# FIELD FORESTER

## VOICES FROM THE FIELD

VOLUME 3, ISSUE 1 | JANUARY - JUNE 2018

Volume 3, Issue 1 (January - June, 2018)

Published by Directorate of Forest Education, MoEF&CC, Dehradun

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# FIELD FORESTER

## VOICES FROM THE FIELD

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

डॉ. हर्ष वर्धन
**Dr. Harsh Vardhan**

भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्री
**GOVERNMENT OF INDIA**
**MINISTER OF ENVIRONMENT, FOREST & CLIMATE CHANGE**

## MESSAGE

The forests of our country, besides maintaining ecological balance and environmental stability, play a great role in subsistence economy of large population of our country, especially of those who live in and around the forest areas.

The Forestry sector has witnessed significant changes during the last few decades both at national and global levels. There has been a gradual transition from Production Forestry to Conservation Forestry. This has brought in necessity to focus on issues related to Sustainable Forest management and Close-to-Nature forestry wherein dissemination of forestry information from field to public at large is obligatory.

It gives me great pleasure to know that the Directorate of Forest Education, Dehradun is bringing out the journal **Field Forester: Voices from the Field** for the third year. I hope that it will arouse much needed consciousness among the readers to conserve forests which constitute a very crucial element of country's inner vitality. I congratulate the Directorate of Forest Education, Dehradun for coming up with this periodical publication.

My best wishes for all the future endeavours of the Directorate of Forest Education!

**Date: 05.07.2018**

**(Dr. Harsh Vardhan)**

डा. महेश शर्मा
Dr. Mahesh Sharma

संस्कृति राज्य मंत्री (स्वतंत्र प्रभार)
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MINISTER OF STATE FOR
ENVIRONMENT, FOREST AND CLIMATE CHANGE
GOVERNMENT OF INDIA

## MESSAGE

It is heartening to note that the Directorate of Forest Education, Dehradun has taken the initiative to publish half yearly Journal "Field Forester" containing information on advancement in forestry technologies, field experiences and views of the renowned professionals and experts, with an objective of sharing the inputs of conservation strategies from the field with different stakeholders. The Journal covers topics like success stories, problems, prospects, opportunities and technological options available in the field of forest and wildlife management.

I am sure this publication will benefit the forestry professionals as well as people having passion for forest and wildlife conservation. I take this opportunity to convey my best wishes to the Directorate of Forest Education, Dehradun for coming up with this periodical publication.

**(Dr. Mahesh Sharma)**

पंचम तल, आकाश विंग, इंदिरा पर्यावरण भवन, जोर बाग रोड़, नई दिल्ली-110 003 फोन: 011-24621921, 24621922, फैक्स: 011-24695313
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सी.के. मिश्रा
C.K. Mishra

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SECRETARY
GOVERNMENT OF INDIA
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## MESSAGE

India is one of the few countries which are known for scientific and people centric forest conservation practices. India is not only home to important biodiversity hotspots, but also blessed with a variety of natural resources. These provide a variety of goods that support the socio-economy of dependent population and an array of ecosystem services much required for the very survival of mankind. The success of conservation and sustainable development is carved by multiple stakeholders like the Forest Department, rural and urban communities and NGOs to mention a few. There is a need to document the efforts and activities of these stakeholders to a wider sphere for dissemination of knowledge in forestry sector.

It gives me immense pleasure to learn that Directorate of Forest Education, Dehradun is publishing the journal "Field Forester: Voices from the Field". This journal is an attempt to document best practices and success stories in forestry and wildlife sector of the country. Case studies varying from Joint Forest Management to Wildlife Management, Forest Protection to Nursery Technology and Plantation Technology to use of modern tools and technology in forestry are being documented and published through the journal for wider circulation. In addition, popular articles written by Officers posted in the field across the country, officer trainees, scientists and experts on forestry and natural resource management will enhance to quality of publication. Truly, Field Forester represents voices from the field.

I extend my best wishes to Directorate of Forest Education.

(C.K. Mishra)

**Dated: 6th July, 2018**
**Place: New Delhi**

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पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
**DIRECTOR GENERAL OF FOREST & SP. SECY.**
**GOVERNMENT OF INDIA**
**MINISTER OF ENVIRONMENT, FOREST AND CLIMATE CHANGE**

## MESSAGE

I congratulate the Directorate of Forest Education for bringing out the latest issue of educational journal **Field Forester: Voices from the Field.** In last two years, this journal has not only documented and published good practices in the field of forestry but has also provided a platform to foresters to document and publish their vital field experiences - at times in the form of success stories or field initiatives aimed at sustainable forest management.

The current issue covers wide spectrum from highly technical to complex sosical ones. A the same time, the simple and lucid language makes it comprehensible for amateur and professional foresters alike.

The importance of communication in general and documentation of field experiences in particular, is one aspect of forestry profession that I have always been emphasizing upon. It gives me immense pleasure to see that not only the forest officers working in the field have contributed the articles based on their experiences in the field but Officer Trainees from various Academies under the Directorate have also done documentation of certain case-studies during the course of their induction training. It will definitely go a long way in boosting their confidence and will have their articulation skills.

I once again congratulate the entire team for this initiative and hope the good practices documented here are replicated or locally adapted to address challenges being faced in the forestry sector.

6/7/18

**(Siddhanta Das)**

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**SAIBAL DASGUPTA**

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**GOVERNMENT OF INDIA**
**MINISTER OF ENVIRONMENT, FOREST AND CLIMATE CHANGE**

## MESSAGE

It is very heartening to know, that the Directorate of Forest Education, Ministry of Environment, Forest and Climate Change, Dehradun is bringing out the half yearly Journal "Field Forester" Volume 3 Issue 1 (January-June), 2018. It is a fact that our forests are facing several threats from various fronts. With the increasing pressure, collective effort and awareness among people for scientific conservation can help sustain this huge forest resource.

I am hopeful that this Journal and its upcoming issues will improve awareness in forestry, reduce information redundancy and create more streamlined flow of knowledge and information amongst the community of forester and also the common man interested in forestry and natural resources.

I applaud the efforts of the Directorate of Forest Education under the Ministry of E,F&CC in bringing out the third volume of Field Forester and look forward to such works which will greatly benefit the forest fraternity. I am hopeful that this journal will bring about a significant awareness amongst people interested in forests & wildlife.

**(Saibal Dasgupta)**

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**Dr. Suneesh Buxy**

**Deputy Inspector General of Forest**
**Environment, Forest & Climate Change**
**Government of India**

## MESSAGE

The Directorate of Forest Education (DFE), Dehradun has been at the centre stage of forestry training in India with its mandate to manage and shape the training needs of the State Forest Service Officers and the frontline staff of Forest Department. Apart from its mandate, the Directorate of Forest Education, Dehradun has made a noteworthy initiative of publishing a periodical Journal "Field Forester: Voices from the Field" to create a platform to encourage reading and writing skills amongst field forest officers. Since the first publication in November 2015, this unique series of periodical is taken as authoritative source for congregating information from the field.

I am happy that the Directorate of Forest Education is publishing this periodical for the benefit of the forest personnel in the management of the forests and also to make the public aware of the happenings in forest sector throughout the country.

The present issue contains articles not only on Biodiversity Conservation, wildlife and forest productivity, but has also highlighted the interaction of people and forest. Thus, making this journal more valuable and worth disseminating.

All those who have an occasion to go through this journal should feel free to send their impressions to the Directorate of Forest Education, Dehradun. This would substantially contribute to improve the coverage and presentation of the future publications.

**(Dr. Suneesh Buxy)**

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# FIELD FORESTER

VOICES FROM THE FIELD

**Volume 3, Issue 1 | January - June 2018**


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**FORESTS AND PEOPLE**

## FOREST PRODUCTIVITY

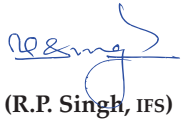
# From the Chief Editor's Desk

The period from January 2018 to June 2018 has several globally recognized important days related to Environment, Forests and Biodiversity. These included World Wetlands day on 2nd February, International Day of Forests on 21st March, World Water Day on 22nd March, International Biodiversity Day on 22nd May and 5th June as World Environment Day. These days highlight the importance of various aspects of our environment and the need to be more sensitive and conservation oriented towards these aspects. Also as we observe these important days in various ways, it has to be ensured that the message of Nature Conservation and Sustainable Living is spread across the stakeholders and general public.

Keeping in line with the above objective, the present issue of Field Forester compiles case studies and success stories in the wider field of Forestry through vividly penned articles submitted by Officer Trainees of the Academies under Directorate of Forest Education, experienced Officers posted in the field and Scientists also. These write-ups have been categorized into four themes viz. Biodiversity Conservation, Wildlife, Forests and People and Forest Productivity. The articles cover a wide spectrum of topics like Socio-ethnic traditions in conservation, species restoration efforts in rare tree species of Karnataka, marine biodiversity, success story of Amur Falcon conservation in Nagaland, re-introduction of Gaurs in Bandhavgarh National Park, successful models of Joint Forest Management and involvement of people in forestry activities, Community Forestry, Grassland Management, Agroforestry and Clonal Forestry and many more…

While going through the pages, one can see new chapters in Forest and Natural Resource Management unfurl in every article presented in this issue of Field Forester.

Best wishes !



**(R.P. Singh, IFS)**

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*Photo: Common Jezebel*
*Credit: Vibhaben Goswami, ACF, GEER Foundation, Gandhinagar, Gujarat*

*Photo: Spotted Deer*
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*Photo: Griffons*
*Credit: Abhilash D., IFS, Lecturer, CASFOS, Dehradun*

# BIODIVERSITY CONSERVATION

BIODIVERSITY CONSERVATION

# Conservation of Biodiversity Following Concepts of Socio-ethnic Traditions: Experience Learnt in *Ekamravan*

**Ashok Kumar Mishra**
*Divisional Forest Officer, City Forest Division, Bhubaneswar*
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***Our endeavour has been to make the people acquainted with the plants and their medicinal properties of the plants associating them with the socio-ethnic traditions so that they would take care of these plants***

*Ekamravan*, a Medicinal Plant Garden situated on west bank of Bindusagar is an initiative of Forest and Environment Department of Odisha. Medicinal plant gardens have been established at many places but the concept of presenting one heritage at the backdrop of another heritage is uniqueness of this garden. This garden, otherwise known as the Heritage Garden has harboured the three heritages of the land. One of the heritages, *i.e.* the healing plants is exhibited in the ambience of another heritage, *i.e.* heritage architecture with a blend and backdrop of folk tales and socio-religious practices prevailing in the land for ages.


**The Famous Bindusagar Lake of the Temple City**

Bindusagar, whose name signifies that each drop (bindu) of its water bears the greatness of sea (sagar) has been described in *Puranas* to be dug by Lord Shiva with his trident to quench the thirst of *Maata Parvati*, after she killed two demons *Kirti* and *Vasa* who were torturing people of this land. As per direction of Lord Shiva, all the rivers of India and all the *tirthas* have contributed their water to this lake to enhance its magnanimity. From historic point of view it has also enormous significance. It is believed it was created by Ashoka-the Great after his victory in the famous Kalinga war. He named it as *Bindusara sarobara* after his father Bindusara,

which gradually became Bindusagar. Some people also believe, it was constructed by Samrat Kharavel in 100 AD, as a people's welfare activity. But a large section of historians say, it is contemporary of the temple itself, so it might have been dug in 11 century. Because of its proximity to famous temples of Lord Lingaraj and Lord Anamta Vasudev and the folk tales associated with its origin, it has been regarded as a very sacred water body of *Ekamrakhetra*, the present day Bhubaneswar.

### Earlier Condition

But with indifferent attitude of people, this holy lake and its surrounding lost its beauty and serenity. Particularly, the west bank of auspicious Bindusagar Lake turned to be an open defecation ground for the people living in nearby habitation and even for passersby. It became full of weeds and debris. Some unauthorised uses were also prevailing over the land. Dumping of garbage added to its misery. This horrible place of stink became a curse for nearby people and even people avoided to use the road nearby.

The initial days of project were marked with unpleasant scuffle to refrain people from using the land as toilet and dumping garbage. During the construction period from 2006 to 2008, toilets were provided in nearby dwellings by Bhubaneswar Municipal Corporation.

### Concept

Seeing the sorry state of affairs, it was decided to establish a medicinal plant garden on the west bank of Bindusagar. This ambitious project was entrusted to Forest Department. Shri B.K. Swain IFS the then Silviculturist, Odisha prepared the concept report and the job of developing the garden was entrusted to City Forest Division, Bhubaneswar. The concept plan was enriched with input of heritage

architecture by Shri Anupam Sah, the Consultant to this project while IFFCO supported this project financially. And the endeavour to transform the land from a stink to a place of serenity began in 2006 and completed in 2008. The garden was inaugurated by Hon'ble Chief Minister, Odisha on 1st January, 2009.

Odisha being a place of excellence in stone masonry, it was decided to showcase this expertise of built heritage of Odisha in this project along with the heritage of healing plants. Additionally, it was decided to blend it with the heritage text *i.e.* the *puranas* and folk tales, just to make it more interesting and develop affinity with local people. The architectural designs adopted here were inspired from nearby famous temple of Lord Lingaraj, which is an 11th century monument. The architecture was designed in such a way it would perfectly merge with the heritage rich ambience of this Temple City of Bhubaneswar.

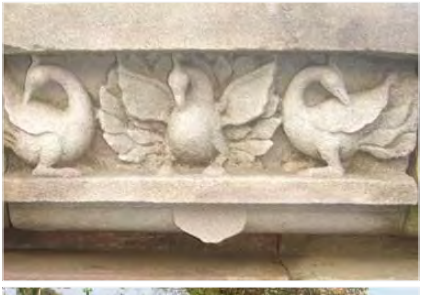
## Theme

To bring the garden close to the heart of local people it has been given a blend of significance of the site relating the spiritual belief and folktales associated with this *Ekamravan* or *Ekamrakhetra,* the ancient name of Bhubaneswar. In *puranas,* like *Shiva Purana, Ekamra Purana, Ekamra Samhita* etc. Bhubaneswar or *Ekamrakhetra* has been described as the most favourite place of Lord Shiva and Mata Parvati. It is described Lord Lingaraj evolved under a huge Mango tree in this vast forest and Mata Parbati was worshiping Lord Shiva in the disguise of a milkmaid. This huge Mango tree denotes this *Eka Amra* means one Mango tree forest. The theme of the garden has been conceptualised to connect this spiritual notion and folktale prevailing in the minds of people. Since *Ekamravan* or *Ekamrakhetra* is believed to be the land of Lord Shiva and Mata Parvati, abodes

made of Sandstone and Laterite stone designated for Lord Shiva and Mata Parvati has been constructed as per *Rudra Yantra* and *Durga Yantra* of *vedic* designs. Since *Lord Ganesh* is the foremost God, one *Ganesh Yantra* has also been constructed in the garden. Whatever flowers, leaves and fruits are offered to these Gods, those have been planted around the specific *Yantras*.

### Architectural Design

All the elements of the garden have been designed with heritage architecture taking inspiration from the nearby temples. The traditional sandstone and laterite stone masonry of Odisha which was once the crowning glory of this region was dwindling due to lack of patronage. Experienced stone masons from the artisan village *Raghurajpur* of



Puri District and from *Lalitgiri* of Kendrapada District near the famous Budhist monuments were hired to train nearly 100 new stone masons during course of making of *Ekamravan*. Now those new stone masons have ample of works in their hands both in private and in public domain. Thus it was a great revival of traditional stone masonry of Odisha.

## Endeavour

In *Ekamravan,* it has been our endeavour to explain people that whatever plants are associated with worship of different Gods and Goddesses are of great medicinal or environmental values. The significance of plants mentioned in folktales or *puranas* in different context, like *Ashok, Kadamba, Tulsi, Shami, Sahada, Pipal, Neem, Amla, Amba* and many others are displayed and explained. To remind this message of our ancient texts, a mini *Ashokvana* (an Ashok groove relating to the *Ramayana*) and *Kadambavana*(a groove of Kadamba relating to the *Mahabharat*) have been created. Visitors are explained the benefits of Ashok and Kadamba tree and their medicated environment. In similar way all the plants found in *Ekamravan* as mentioned in *puranas* have also been planted in this garden along with other medicinal plants. Importances of plants which are associated with the religious and social tradition of people of this land are also described. People are explained that our forefathers had identified these valuable plants and had associated them in their religious and social traditions so that, the latter generations take care of these plants and do not harm these plants, unnecessarily. By this way existence of these plants in the environment was ensured.

In *Ekamravan*, our endeavour has been to make the people acquainted with the plants and their medicinal properties of the plants associating them with the socio-ethnic traditions so that they would take care of these plants. By this way their interest in plants would turn in to a passion and they actively take part in preservation of this precious biodiversity. To promote propagation of these medicinal plants, a nursery has been established in the garden from where saplings of large varieties of plants are being made available at a minimal rate. Since space is a major constraint in urban area.

## Achievement

Ekamravan is a dream-come-true project which has been overwhelmingly been successful in achieving its objectives by transforming a place of stink to place of serenity, but by contributing hugely towards conservation of biodiversity by creating a massive awareness among the public by revalidating our socio-ethnic concepts. Besides this, the traditional built heritage of Odisha, the stone masonry which have been restricted to temple construction only, has also revived with adoptability for a more residential domain. For developing an acquaintance with of plants and their medicinal values it has become the nicest place for its serene and tranquil ambience with complete natural surroundings in the heritage zone of Bhubaneswar. It has been a learning place for practitioners and students of Ayurvada, Forestry, and Agriculture and of common nature lovers. The embedded theme of Biodiversity conservation through Socio-ethnic concepts has been praised by all the visitors. It gives immense pleasure to note the urban visitors after visiting the garden purchasing plants from the nursery attached to the garden and asking the gardeners about the care to be taken for the plants.

BIODIVERSITY CONSERVATION

# Anthropogenic disturbances affected chilgoza pine (*Pinus gerardiana* Wall.) in dry temperate forests of Indian Himalaya

RAJ KUMAR[†], G.S. SHAMET[#] AND SNEHA DOBHAL[#]

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***Enlightenment campaigns to educate the populace on the values of the chilgoza pine and intensify efforts on tree planting as a regular event are needed***

## INTRODUCTION

Chilgoza pine (*Pinus gerardiana* Wall.) has a restricted distribution in India, though it is an important ecological and economic species. This species is restricted in dry temperate region of North-Western Himalaya. There are large numbers of biotic and abiotic factors that affect the regeneration in the pine. Young trees are scarce or entirely lacking, the mature trees predominate in its natural zone. Phytosociological study shows the high endemism of the *Pinus gerardiana* in its natural zone. Therefore, the productivity and sustainability of chilgoza pine has to be ensured.

*Pinus gerardiana* Wall. commonly and commercially known as 'chilgoza' and/ or neoza pine is a small to medium sized evergreen tree of 17 to 27 m in height and 2 to 4 m in girth (1). The species is restricted to dry temperate region of North-western Himalaya between altitudes of 1600 m to 3000 m above mean sea level. A British officer 'Captain Gerard discovered it in the year 1932 in India. The species was subsequently introduced to England in 1939, where it was found to be frost-sensitive (2). Chilgoza pine is the only conifer in India, which provides edible kernels/nuts being rich source in carbo-hydrates (21.6%), proteins (15.9%), fats (49.9%), moisture content (7.5%), fibre (2.2%) and mineral matter (2.90%) (3). Pine nuts are rich in calories, vitamins, antioxidants and packed with numerous health promoting phyto-chemicals. Beside chilgoza pine *(Pinus gerardiana*) four other pine *viz., Pinus sibirica; Pinus koraiensis; Pinus pinea* and *Pinus monophylla* are known worldwide for nut production. *Pinus gerardiana* is also used for fuel and scarcity timber for construction. The present work is an attempt to explore the ecology and natural regeneration of chilgoza pine in Kinnaur district of Himachal Pradesh, where its occurrence has been mostly reported.

A field survey was conducted in Kalpa, Kilba, Moorang and Pooh sites of Kinnaur district in Himahcal Pradesh (Fig. 1). Phytosociologiocal studies on different sites by laying 8 sampling plots of size 25 x 20 m in each site revealed that *Pinus gerardiana* was found to be the dominant species in all the sites and *Cedrus deodara, Pinus wallichiana* and *Quercus ilex* were associated species. The dominance of *P. gerardiana* in different sites ranged from 70-80%. The study showed high endemism of the *P. gerardiana* in its natural zone. It was also observed that in areas where chilgoza pine was dominant, more than 80% area was occupied by it alone. The maximum diversity for tree species occured in Kalpa and Kilba sites. The lowest value of diversity on Moorang and Pooh sites indicated that as the elevation increased from Kalpa (2765 m) to Pooh (2970 m), the diversity of tree species decreased. Overall low diversity of trees was due to xericity and low temperatures in the high mountain. However, trees on high elevations and cooler slopes grew faster. The study revealed that the density of trees per hectare ranged from 110 $ha^{-1}$ to 200 $ha^{-1}$ and distributed in diameter classes from 30-40 cm to 70-80 cm. The volume of growing stock varied from 180 $m^3 ha^{-1}$ to 280 $m^3 ha^{-1}$. It was observed that young classes are scarce or entirely lacking, while the mature trees predominated in its natural zone. Ruthless lopping of branches and twigs while extracting cones for excessive commercial gain, have adversely affected the trees. The canopy cover was estimated between 40-50% and degree of lopping was quite high. Due to degradation of forest resources in the dry temperate Himalayan region, it has been found that fuel wood is not easily available as compared to 20-30 years ago. The soil is loam sand in texture, pH ranged from 6.2 to 6.5, nitrogen was low to medium and potassium and phosphorus was high.

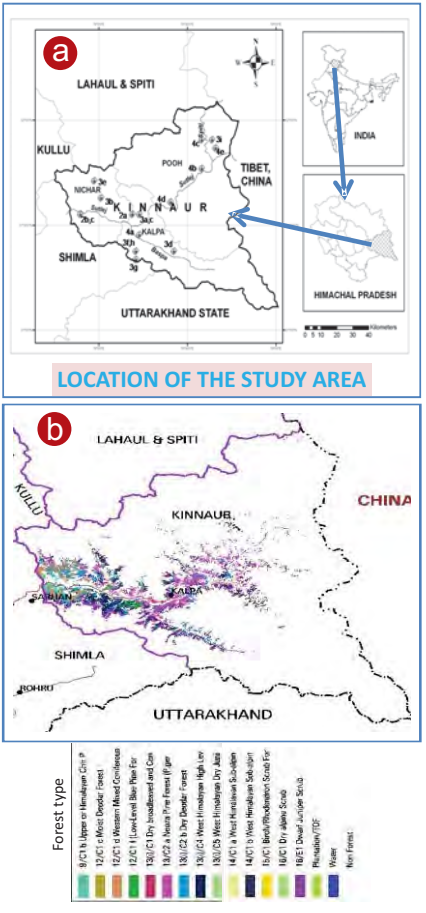


**Fig. 1 (a) Location map of the study area (b) Forest type map of the study area**

The natural regeneration status of

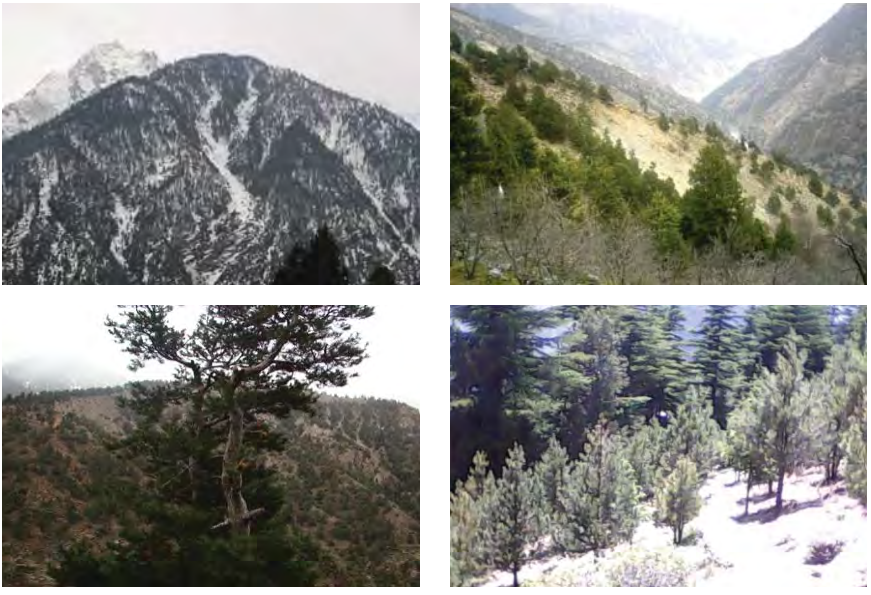

**Fig. 2. (a) Chilgoza pine forests covered with snow (b) Trees growing on eroded steep slopes (c) Excess pruning of tree for nut collection (d) Sapling and pole of chilgoza pine**

chilgoza pine in different sites revealed that number of recruits (current year growth) of chilgoza pine varied from 281.00 $ha^{-1}$ to 593.00 $ha^{-1}$which ranged 5% to 15% of the total tree population. Overall the regeneration of the species is poor due to fact that only 5% of the trees growing in inaccessible places (where the collection of cones was impossible) provided seeds for natural regeneration of the species and rest 95% trees were harvested for edible seeds. Natural regeneration was only observed in cliff rocks and areas where there were plenty of bushes to protect young seedlings from birds and rodents. The damage by birds, goat grazing, intense heat of the sun, desiccating winds and shortage of soil moisture accounted for heavy mortality of seedlings. The species has also erratic seed year and dormancy related problems which also reduced its regeneration in natural habitats. This species has already entered into IUCN Red List of Threatened species. Severe biotic interference and non-scientific procedure for commercial harvesting of cones led to poor regeneration, which may result in the extinction of the species.

The collections of cones as observed was the most important factor responsible for the absence of natural regeneration in chilgoza pine forests. Rotational closures of areas for seed collections would promote regeneration in the pine. It was also observed that where protections were provided by fencing, natural regeneration has

increased. Therefore, areas bearing chilgoza pine should be closed (fenced) for a period of 25-30 years, to promote regeneration and establishment of regenerated individuals. The Himachal government has formulated a 30-year project for the conservation of the fast-depleting reserves of chilgoza pine. Under this project, a park for the conservation of chilgoza has to be established on five hectare area in Kinnaur for the standardization of regeneration techniques and management practices for sustainable production of chilgoza pine. In the first phase of this project a nursery is to be established to provide quality planting material for plantations of chilgoza in 400 ha area of degraded chilgoza forests.

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BIODIVERSITY CONSERVATION

# Master Architects of Termite - Fungus Relationship

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***Fungal stalks appear in groups because their base is on the termite comb. The sight is rare and very beautiful. Believe me you will be lost for a while if you are in the company of this termite-fungal garden***

Termites or white ants! Yes, they are never welcome. This is so because they are a nuisance in plantations, agricultural fields, buildings and so on. But do you know that they are nature's factories for the recycling of nutrients? Well, that is a fact. But for them the wood (*cellulose / lignocelluloses*) will not decompose easily and nature will take lot of time for conversion of wood into humus- the food for plants that contains available nutrients. While feeding upon the wood they create conditions favourable for other organisms for degradation/decomposition of wood and a chain of events starts. What are those organisms like rats, rodents, insects, and fungi that finally decompose the wood and how are birds like wood peckers, barbets and hoopoe etc. are benefitted? Well, that is not the topic for discussion. I just want to paint the positive side of termites. You may treat them as unwelcome guests in forests but they are useful in bamboo forests. You know why? Well, they never attack young and green bamboos but do not spare the dead bamboo stumps. So, termites are welcome in bamboo forest and plantations. So, in a bamboo clump you want the stumps of cut bamboos to rot or removed or eaten so that new bamboos can emerge, never destroy termites. And so, the termites are farmers' friends. They help stubbles of crops like paddy and wheat to rot and help in release of nutrients.

Termites are the only organisms on earth that can digest cellulose- the basic component of their food. But that is a secret as to how do they do so. The fact is that they can't do this on their own. The nature has gifted them with the presence of certain cellulolytic protozoans, bacteria and archaea in their hindgut. These organisms are the champions of cellulose digestions as they produce cellulose breaking enzymes like cellulose, xylanases and glycoside hydrolyses while being in the body of termites. They can make upto one third of the total termite weight. Believe me, that is a fact. Even protozoans, bacteria and archaea live symbiotic life and depend upon each other for their survival. The relationship that has come to be known as obligate symbiosis. Some of these organisms have been

recently named as *Trichomonas, Trichonympha, Pyrsonympha, Microjoenia, Holomastigotes elongatum, Dinenympha fimbriata, Treponema, Bacteroides, Bacteroides termitidis, Desulfovibri, Citrobacter, Citrobacter freundii, Enterobacter, Enterobacter agglomerans, Citrobacter, Citrobacter freundii, Enterobacter agglomerans, Methanobrevibacter etc.*

Now, let us move little away from cellulose digestion. Have you heard of termites in their role as orchardists or gardeners. Yes, they are farmers too. They do their own mushroom farming. And we have to learn a lot from them. Termites are the nature's master architects of '*Mushroom ki Kheti*' (mushroom farming). We are all very well familiar with the termite hills {termitarim(a)}. These are above ground perforated structures especially built for the purpose of air conditioning. The major portion of the termite house lies below the ground and above ground termitarium through galleries, is connected to the below ground royal chamber where egg laying machine termite queen is housed.

Certain ground dwelling termites belonging to sub family microterminae build well aerated swollen combs in the soil and store ligneous and cellulose bearing material on it. These combs are round in shape and are of the size of freshly prepared aerated 'hot phulka' (*gehun ki roti*) as it gets swollen on tawa. This comb looks exactly like comb of Indian Bee (*Apis cerana indica*) except for colour. There are galleries inside it and is excellently perforated. For the purpose of excellent aeration the termites ensure that a gap of more than one inch is left between the termite comb and the neighbouring soil. Until and unless you dig the soil you cannot spot it. They are well connected with outside world through perforated galleries. Well, that is why termites are called nature's master architects (*Yun hi nahin kaha jata unhen kudrat ke master shilpkar*).

Let us now talk about the termite gardens. It sounds awkward that termites create their gardens. But certainly by their master architecture, they do their gardening. They do so by entering into partnership with selective fungi belonging to genus *Termitomyces.* Their relationship is purely symbiotic. It is never opportunistic. It is based on the principle 'let us live together and flourish' (*sath raho aur phalo phulo*).

Let us now know as to how termites create fungal garden and how termite - fungal relation flourishes. Infact termites belonging to Microtermitinae acquire spores of fungi belonging to group '*Termitomyces*' from the fruiting bodies through horizontal or vertical movement of spores. The termites store and protect these spores till the return of next rainy season. Come the rainy season and the termites start the culture / farming of the mushroom. As we all know, mushrooms lack chlorophyll, do not need sunlight and therefore, flourish in air conditioned chamber. The spores germinate, develop into thread like white structures called hyphae. Latter get interwoven and white mass appears. It is called mycelium. Then the fungus enters into reproductive phase.

Long stalks appear. They come out of the loose soil and appear in groups of white *'Atishbaji*' like conical or folded umbrella like shape. This is the only small visible part of a tall fungus mushroom.

The fruiting body comes out of the soil with some purpose. The time when this mushroom comes out in its visible form is rainy season. The air is fully wet. The spores do not dry and do not become air borne. But the reproduction has to take place. So, within two to three days thousand of spores are produced. The presence of above ground part is an indication to termites of other colonies that the spores are available. They come, collect and store the spores till next season.

The fungal stalks appear in groups because their base is on the termite comb. The sight is rare and very beautiful. Believe me you will be lost for a while if you are in the company of this termite-fungal garden.

Well! Let me use language of mycologists (Fungus expert). The mycologists call long stalk or stem like structure of *Termytomyces* mushroom as '*Pseudiorhiza*'. That means false roots. This white clear rod like structure gives this mushroom a beautiful look. If you move to Shiwalik hills towards the end of July when the soil becomes fully saturated with moisture and if you are lucky enough, you will get to see this beautiful scene.

It is more interesting to know as to how termite-fungal relation flourishes. Infact the termite comb contains everything that *Termitomyces* need to grow. The fungus gradually breaks cellulose and lignin bearing substances into the form that are easily assimilated by the termites. So, the mushroom flourishes. But then *Termitomyces* is not a selfish fungus. It too returns its favours without any selfishness. It degrades the lignocellulose present in the termite comb. This makes conditions favourable for the termites to digest lignocellulose and proliferate. What a relationship that does not have even an iota of selfishness and opportunism!

While there occurs symbiosis between termites and *Termitomyces* fungi, symbiosis also occurs inside the body of termites among various organisms. While termites get benefitted as the nutrients that can be assimilated by termites are released by the activity of gut fauna, the gut fauna in turn is benefitted as they meet their nutritional needs from the food.

The benefit sharing is not restricted to the termite-fungus relationship. The relationship has ecological and environment value. Well, the nutrients are released and the soil is kept perforated. This benefits other soil micro and macro flora and fauna.

But the matter does not end there. The benefits of termite-fungus relationships are passed on directly to human beings as well. Have you ever got to taste this mushroom? If you get it, please eat it without hesitation. Believe me it is a delicacy. It is deliciously tasty. The taste is comparable with the tastiest mushroom of the world called Morale/Guchhi (*Morchella esculenta*).

The only word of caution is to consult locals so that you do not pick up anything which is not *Termitomyces* and is poisonous. And you will not have much leisure to collect this delicacy. You will have to take help of locals who have the past experience of locating the mushroom sites and remember, the mushroom does not live for more than ten to twelve hours.

*Termitomyces* serve as stable food in many parts of India. In Chhattisgarh, these mushrooms are sold in vegetable by poor tribal people during rainy season. In Uttrakhand, Himachal Pradesh and Shiwaliks of Haryana, this is a sought after dish during July-August. Morni hills of Haryana are known for this mushroom and the these secrets of *Termitomycetes* were studied in Morni Hills. There were times when people used to collect upto 10 kgs of this mushroom from a single spot. But that is a thing of past. It has now become rare.

What makes it tasty? Well that is a question that still remains unanswered. There is no information available on the nutritional facts of this mushroom. The chemists have to reveal the secrets of its magical taste. The mushroom scientists have to get the clue from this termite-fungus relation as to how this relation flourishes. The electric thunders in the sky and loamy/clayey soils are preconditions for the relationship to flourish. May be the mycologists will be able to culture it as they will reveal many secrets of this amazing relationship. The relationship primarily flourishes in hills but there are reports that the phenomenon happens in Chhattisgarh and Jharkhand forests during rainy season where collection and selling this mushroom is a source of livelihood for the poor. Good thing is that the mushroom can be dried and when soaked in water the mushroom looks as fresh as ever.

Another mushroom which grows on termite mound is small mushroom that also belongs to *Termitomyces*. It is called Bhatoli (cooked rice grain) because of its small size (height less than an inch). Bhatoli means cooked rice grain and it also belongs to genus *Termitomyces*. Infact this mushroom grows in a group of thousand on termitarium. It is time consuming to collect it. But once you collect it, just add little haldi, a chutaki of namak and just boil with rice. Believe me, you will get to taste one of the tastiest recipes of the world.

BIODIVERSITY CONSERVATION

# Discovery to Restoration - A Success Story of *Semecarpus kathalekanensis* from Western Ghats

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***The case of Semecarpus kathalekanensis elucidates the fact that species recovery combined with integrated ecosystem management can only pull back. The critically endangered flora from the edge of extinction***

An intensive botanical survey in Uttara Kannada district of Western Ghats of Karnataka discovered new species of genus *Semecarpus*, member of mango family and cousin of cashew. The species named *Semecarpus kathalekanensis* was introduced to world by Dasappa and Swaminath in 2000.

*Semecarpus kathalekanensis* is found only in Western Ghats. It is a huge gregarious, evergreen tree reaching height of 10-20 metres with large clear bole. The specific name was derived after its predominant occurrence in Kathalekan, a village in Siddapur taluk of Uttara Kannada, a home to the rare rain forest habitat. "Kathalekan" means dark forest in Kannada language. The species is having very restricted range and occurs only in the freshwater Myristica swamps of the Central Western Ghats. It is critically endangered due to very few individuals in the population. The species is also called as 'Marsh nut' as they are found in marshy area.


Freshwater swamps are one of the important swampy habitats classified under Group 'Littoral and Swamp Forests' and within Subgroup 'Tropical Freshwater Swamp Forests by Champion and Seth, 1968. These patches of forest are popularly called Myristica swamps as dominant plant species in swamp are belonging to the family Myristicaceae. They are the source of water to the adjoining areas, acts as channels for the runoff of excess

water, thus controls flood. They are rich in biodiversity.

There were only four known populations of *S. kathalekanensis* (Table 1), which had very few individuals with unbalanced age structures which is a typical character of a critically endangered species (Raghu *et al.*, 2001). A total of 91 individuals were identified from four localities, 40 individuals from Kathalekan I, 34 individuals from Kathalaken II and 12 individuals from Mundgeteggu and 5 from Thorme (Vasudev *et al.*, 2004). Only 91 individuals surviving in four localities with less number of matured individual shows alarming signs of early extinction in near future. How to save it from local extinction was the next question.

To increase the population size above the critical level, restoration of this species has been attempted by joint efforts of group of scientists and Karnataka Forest Department (KFD). A strategy of re-introduction of nursery grown seedlings in to type localities within the central Western Ghats was planned. For this, studies were undertaken to know the biology, breeding systems, genetic structure, working out demographic details, and response of the species for re-introduction.

The seeds of *S. kathalekanesis* have a very short viability period (less than one week) because of their recalcitrant nature. On an average, only 40% of the germinated seedlings successfully became young recruits, with a large proportion of germinating seeds and young recruits predated by porcupines and wild boars because of oily rich cotyledons and young recruits were trampled to death by grazing cattle's. Moreover, the swamps are under heavy anthropogenic pressure which is being converted to Arecanut plantations. The threat is faced by such habitat till today also.

Introduction of species was planned in Siddapur range within its type locality. Seeds were collected, viability, germination were studied and they

***S. kathalekanensis* saplings**

**Table 1: Location, latitude, longitude and size of existing different populations of *S. kathalekanensis***

| Site (Name of the hamlet) | North Latitude | East Longitude | No. of matured individuals in the population |
|---|---|---|---|
| Kathlekan - I | 14°16'N | 74°44'E | 40 |
| Kathlekan - II | 14°16'N | 74°44'E | 34 |
| Mundigetheggu | 14°16'N | 74°46'E | 12 |
| Thorme | 14°16'N | 74°47'E | 5 |

were raised in nursery. One year old seedlings were planted in two localities in January 2000. Total of 37 seedlings were planted, 15 seedlings in Site - I and 22 in Site - II. Observations were taken regularly. Among the introduced seedlings, all the 15 seedlings at Site - I and 85.19% at Site - II (n = 22) survived after 6 months. But after 24 months the survival percentage decreased to 45% (Table 2).

Exact reason of mortality was not known, but most of the seedlings mortality occurred due to anthropogenic interference. Raising the seedlings under controlled conditions can completely minimize anthropogenic disturbance and the risk of predation in the wild.

Karnataka Forest Department had rendered full support for conservation of the species. The Department had declared one of the sites as an *in-situ* conservation spot. Human interference and invasive weeds populations were controlled. Protective fence were constructed around the natural population.

Today, the collective effort by researchers, scientists, NGO's and Karnataka Forest Department has yielded very positive results and the seedlings of many focal swamp species are growing into mature individuals. A species whose only few mature individuals were living in the entire Western Ghats, after a decade and half are surviving successfully with more than hundred mature individuals growing in different swamps. Thus species recovery as a restoration strategy has come to the rescue of vanishing Myristica swamps in the Western Ghats - truly another marvel in the otherwise complex landscape!

As the Myristica swamp forest continues to be degraded and sites of rare plants are lost, reintroduction into sites where the species is likely to survive and/or to replenish existing populations would become a very important and effective tool for conservation. Support by local people is also very important to successfully conserve these rare plant species. Such recovery plans for endangered plants often create new, self-sustaining populations within historic range and characteristic habitat (Vasudeva *et al*., 2001). More restoration works need to be done so as to ensure survival of *Semecarpus kathalekanensis* for posterity. Species recovery combined with integrated ecosystem management can only pull back. The critically endangered flora from the edge of extinction.

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**Table 2: Survival (%) of the re-introduced seedlings of *S. kathalekanensis* in two sites**

| Site | No. of individuals | Per cent survival | |
|---|---|---|---|
| | | After 6 Months of Introduction | After 24 months of Introduction |
| Site - I | 15 | 100% | 46.70% |
| Site - II | 22 | 85% | 45.45% |

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BIODIVERSITY CONSERVATION

# Leading the Way to a Carbon Neutral Campus: The CASFOS Experience

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***The need of the hour is to manage waste at the source itself as far as possible. A major portion of the waste generated in households is organic in nature hence biodegradable. The disposal of solid waste can be done effectively through City Farming at the source itself***

## INTRODUCTION

Central Academy for State Forest Service, (CASFOS), Dehradun is a premier training academy under the aegis of Directorate of Forest Education, Ministry of Environment, Forest and Climate Change, Dehradun. Its prime mandate is to impart two years induction training for freshly recruited State Forest Service (SFS) Officers and organize short term training for in-service SFS officers. Being the fountain head of forestry training, wherein hundreds of personnel are trained each year, it is ideally suited for showing the way to achieve a "carbon neutral campus" through innovative yet simple techniques and practices. The learning of past two years in this regard is documented here for awareness generation for a wider audience.

***Rationale for the carbon neutral vision:*** Forest officers being the guardians of ecological security of the nation it is imperative for them to walk the talk when it comes to adopting eco-friendly life style. CASFOS, Dehradun decided to lead the way in adopting eco-friendly and carbon neutral methods since training academy is the crucial place where knowledge, skills and attitude of forest officers are moulded. The carbon neutral vision encompasses

**Central Academy for State Forest Service, Dehradun**

the spirit of taking responsibility of the waste generated by an individual/ institution and moving towards the 'zero waste' status.

***Strategy and action points:*** The academy has identified and adopted a multipronged strategy to achieve its vision of transforming itself into a carbon neutral campus. Salient features of this strategy are as given in Table 1.

***Organic Waste Management through the innovative City Farming method:*** The organic waste management strategy of CASFOS, Dehradun is based on the following principles:

1) Any waste management strategy begins with identification of the point sources from where waste is generated. Detailed survey in the campus identified four point sources.
2) At each point source segregation of waste was carried out into biodegradable and non-biodegradable. A rough estimate category wise quantity of waste generated was also made. The results are summed up in Table 2.

**Table : 1**

| S.No. | Strategy | Action points |
|---|---|---|
| 1. | Reduce plastic and other non-degradable consumables | i. Identification of waste generation sources and segregation into bio-degradable and non-biodegradable at source itself.<br>ii. Complete ban on the use of plastic disposable cups, plates, glasses, mineral water bottles etc. for trainings and other official programmes.<br>iii. Switching to hand painted cloth banners instead of banners, boards and standees made of flex.<br>iv. Switching back to traditional ways of welcoming and honouring dignitaries through coconut and khadi shawl, gifting plants in small hand painted pots and books instead of bouquets wrapped in polythene sheets and metal wires.<br>v. Distributing/gifting jute or cloth bags to visiting dignitaries and participants of training programmes.<br>vi. CASFOS, Dehradun has switched to e-office platform as a step towards a 'less paper' office. |
| 2. | Reuse and recycle of various materials | i. Milk poly bags from officers' mess are regularly shifted to nursery for growing plants.<br>ii. Old curtains, bed sheets and table cloths have been converted and reused as seat covers, aprons for mess staff and cloth bags for wider distribution.<br>iii. The paper waste generated in the campus is to be recycled into files and file folders through tie-up with Hast Nirmit Kagaz Udhyog Sahkari Samiti Ltd. |
| 3. | Clean and efficient energy use practices | i. Phasing out of CFL and replacing by LED lighting in phased manner.<br>ii. Use of parabolic solar cooker in the officers mess to reduce LPG consumption.<br>iii. Initiated steps for switching to solar energy to meet 100% energy requirement of the academy in the near future. |
| 4. | Managing organic waste | i. Managing organic waste generated in the campus through innovative City Farming technique.<br>ii. Adopting high speed composting method using patented bio-culture Vermi 3G for utilizing leaf litter and garden waste. |

**Table : 2**

| S.No. | Point Source | Type of waste generated | Estimated quantity of waste generated (kg) per month | |
|---|---|---|---|---|
| | | | Biodegradable | Non-Biodegradable |
| 1 | Academy | Papers, plastic-files, folders, pen, stationery, markers etc. | 80 | 0.5 |
| 2 | Library | Papers, plastic covers | 44 | 0.2 |
| 3 | Officers' Mess | Organic Kitchen waste, plastic milk packets and packaging material, empty bottles etc. | 300 | 3.5 |
| 4 | Hostel | Newspaper, papers, plastic | 50 | 5.25 |
| 5 | Staff Quarters | Kitchen waste, plastic bags etc. | 36 | 4.5 |
| | | Total | 510 | 13.95 |
| | | Percentage of total waste generated | 97.33% | 2.67% |

**Visit of Shri Saibal Dasgupta, IFS, ADG (FC) to view the City Farming initiative at CASFOS Dehradunin the presence of Shri R.P. Singh, IFS, Director, Forest Education, Smt. Meera Iyer, IFS, Principal CASFOS Dehradun, Faculty and Officer Trainees**

3) Next step was to manage the organic /biodegradable waste which formed 97.33 percent of the total waste generated.

At this juncture a new method of rapid, odorless organic waste disposal – 'City Farming' was adopted in the Academy and institutionalized in the training system. The initial training was imparted by Dr. R.R. Deshpande, Honorary Director, MGM Clean India Mission, Aurangabad to the SFS Induction Course Officer Trainees in September 2016. The classroom sessions

on City Farming were followed by installation of five drums in the Officers' Mess area by the Officer Trainees themselves thereby ensuring hands-on training to them. In a way it served as 'Training of Trainers' programme for the SFS Officer Trainees. In order to give an emotional connection to staff and their family to Swachch Bharat Abhiyan, the Officer Trainees initiated installation and hands-on training for the mess workers, staff and their family members especially the women and children on 23rd October 2016, the Dhanteras during the festive season of Diwali. Each family residing in the campus installed a City Farming drum in the courtyard of their residence assisted by the Officer Trainees. A group of two Officer Trainees adopted one family each for regular monitoring, guidance, counseling and encouraging the families to continue this method successfully.

It is pertinent to note that prior to the adoption of new innovative method of waste disposal, the entire waste without segregation was sent to the municipality garbage collection. Thus the whole programme of City Farming training has been institutionalized in CASFOS, Dehradun. So far more than 500 Officers/ Officer Trainees from various parts of the country have been trained in this method. The snowballing effect of this initiative can already be seen in the replication by Officers in

City Farming drum with butterfly host plants – Miniature Butterfly Park


Living Waste Bins – Drum with ornamental plants

different parts of the country in their own jurisdictions. To cite few examples, City Farming has been implemented at Darjeeling in West Bengal, Chota-Udepur in Gujrat, Wardha in Maharashtra and by Wildlife Institute of India in Dehradun by Forest Officers who were inspired by the CASFOS initiative.

**City Farming Method**

It is an innovative method for utilizing organic waste for growing plants in a

**Waste to wealth: Organic vegetable growing in City Farming drum**

**Explaining City Farming technique to visiting FRO Trainees from Karnataka Forest Academy, Dharwad**

drum on terraces, balconies, courtyards and gardens especially where there are space constraints. It is scientific method for disposal of organic garbage in the premises where it is generated and simultaneously growing vegetables, fruits, ornamental and medicinal plants. The use of drum for growing plants was designed by Padmashri Dr. R.T. Doshi. This method also uses a patented bio-culture named as "Vermi 3G" developed by Dr. Uday Bhawalkar, a former Research Scholar of IIT Bombay. Dr. R.R. Deshpande, Honorary Director, MGM Clean India Mission combined the drum method of growing plants and addition of Vermi 3G Bioculture in the drum for waste decomposition. Addition of Vermi 3G catalyses and accelerates the process of decomposition of organic waste in the drum in an odourless way.

**Procedure of City Farming**

A discarded 200 litres capacity drum, preferably corrosion resistant metal drum is selected and 12 holes each of 10 cm diameter are cut out on its sides. These holes are placed in a staggered pattern so that the plants can be properly placed in them without causing obstruction to one another. Smaller holes of 1 cm diameter are made on the base of the drum to allow drainage of excess water from the drum. The aesthetically painted drum is placed on an elevated brick platform leaving some space between ground and the base of the drum. A 10-15 cm thick layer of sugarcane bagasse or coconut coir pith is placed at the bottom inside the drum and compressed tightly. Above this layer a 5-10 cm layer of leaf litter is placed followed by a very thin layer of local soil. On top of this layer, four plants along with ball of earth are placed in a slanting manner in such a way that the shoots emerge out of the 10 cm diameter holes. The procedure is repeated two more times till all the twelve holes have plants in them. Finally one plant is placed on top of the filled material in the drum. Thus the drum now holds 13 plants. Lastly, 10 gm of Vermi 3G bioculture is sprinkled on top followed 3-4 litres of water. Allow the City Farming drum to establish for ten days. From eleventh day, the drum is ready to digest

City farming drums placed near Officers' Mess kitchen to manage kitchen waste

Parabolic Solar Cooker installed in Officers' Mess for reduction of LPG consumption

approximately 300-400 gm of organic waste daily by supporting luxuriant growth of the thirteen plants placed in it (Table 3).

## Conclusion

The efforts taken to make CASFOS into a Carbon Neutral and waste free campus has been institutionalized to maintain continuity and intensify the activities to achieve the goals. Additional steps like training the staff across all ranks to adopt eco-friendly techniques in office as well as in their personal lives are a regular feature in the Academy. The staff have also been trained in apiculture to enable installation of one bee box for every City Farming drum which will in turn enhance pollination and biodiversity of the campus. Thus the CASFOS Experience not only aims at reducing plastic and waste, but also at adopting a nature friendly and organic lifestyle. CASFOS Dehradun not only leads the way in this direction but also inspires others to adopt environment friendly models.

**Table 3 : Cost economics of City Farming**

| S.No. | Resource | Cost (₹) |
|---|---|---|
| 1. | Solar energy | Free |
| 2. | Water | Free |
| 3. | Local Soil - 20 kilogram | Free |
| 4. | Sugarcane residue / Coir pith and leaf litter - 180 kilogram | Free |
| 5. | Organic waste generated in the house - daily 300 grams. | Free |
| 6. | Saplings of plants - 13 @ ₹ 30.00 per plant | 390/- |
| 7. | Metal drums with 12 holes | 1000/- |
| 8. | Vermi 3G Bioculture (10 grams) | 1000/- |
| | Total | 2390/- |

*The per day cost for waste disposal per drum (Assuming the drum to last for minimum ten years) works out to ₹ 0.65/- only*

*From September 2016 to April 2018, a whopping 6.63 tonnes of organic waste has been managed through City Farming in CASFOS Dehradun through 37 drums installed in the campus. These drums support 481 perennial plants. Each drum is thus a micro-habitat comprising of plants that attract butterflies, bees, insects, birds and other organisms.*

BIODIVERSITY CONSERVATION

# The Valley of Flower Development Project around the Narmada River Banks

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***Incidence of the forest fires in the country is high. Standing trees and fodder are destroyed on a large scale and natural regeneration annihilated by such fires. Special precautions should be taken during the fire season***

## INTRODUCTION

The Narmada, the largest west flowing river of the Peninsula, rises near Amarkantak range of mountains in Madhya Pradesh. It is the fifth largest river in the country and the largest one in Gujarat. In Gujarat, it flows between Narmada district and Vadodara district and then meanders through the rich plain of Bharuch district.

### Religious Significance

Narmada is one of the sacred rivers of India. Among the people in India, Narmada River is considered as the mother and the giver of peace. The Narmada River finds mention in ancient texts of India as one of the seven most sacred rivers in India. The banks of the Narmada River are dotted with many temples. The importance of the Narmada River as sacred is testified by the fact that the pilgrims perform a holy pilgrimage of a "parikrama" (circumambulation) of the river. The Narmada Parikrama, as it is called, is considered to be a meritorious act that a pilgrim can undertake. There are numerous "thirthas" on the banks of the river; the most important among them are Mahewswar, Omkareshwar and Shoolpaneshwar temples.

### Sardar Sarovar Dam

It is the largest dam and part of the Narmada Valley Project, a large hydraulic engineering project involving the construction of a series of large irrigation and hydroelectric multi-

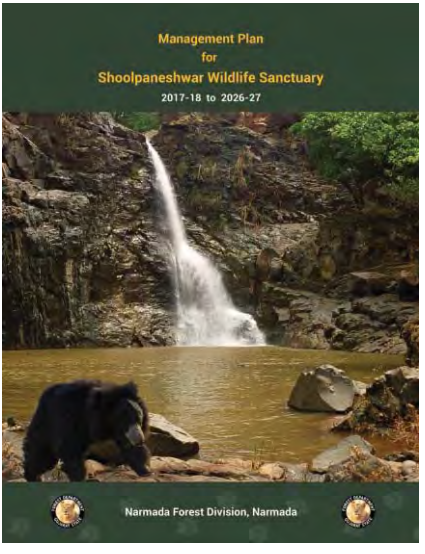
purpose dams on the Narmada River. The project took form in 1979 as part of a development scheme to increase irrigation and produce hydroelectricity. The plan was to meet the water requirement of the people and industries. The dam site area is surrounded by beautiful hillocks of Vindhya and Satpura hill ranges covered with dry deciduous forests of Narmada Forest Division.

**Shoolpaneshwar Wildlife Sanctuary and Ethnic People**

The Shoolpaneshwar Wildlife Sanctuary is marked for its scenic beauty and pristine natural settings. It has vast undulating terrain, ever-pervading greenery, soberly silent rocks, majestic waterfalls, breath-taking landscapes culminating at the convergence of Vindhya and Satpura hill ranges. The Sanctuary preserves a diverse range of wild flora and fauna. The presence of sanctuary in the vicinity of the Statue of Unity adds the significance by adding scenic beauty with pristine natural settings and thereby may lead towards attracting more tourists.

**Statue of Unity**

The Statue of Unity is an iconic 182 meter tall landmark statue dedicated to




Sardar Vallabhbhai Patel, a visionary leader and statesman hailed as the Iron Man of India. It is located in the Narmada district of Gujarat state, India. 182 meters in height, it is to be located facing the Narmada Dam, 3.2 km away on the river island called Sadhu Bet in the middle of sacred river Narmada. It will also be surrounded by an artificial lake spread across 12 km of area. Post completion in 2018, the Statue of Unity will be the world's tallest statue. As a memorial to Sardar Vallabhbhai Patel, the Statue of Unity will provide visitors a meaningful experience that both educates and entertains, by focusing on his personage, life, and accomplishments. Additionally, it will provide visitors a spectacular view of the Sardar Sarovar Dam and its environs.

**Objectives of the Project**

- Landscape development of the Narmada River Banks.
- Beautification of the area will provide recreation opportunity to tourist.
- Control of soil erosion along river bank.
- To provide more aesthetic look to the upcoming statue of unity.
- To conserve and flourish the bio-diversity around the Narmada River.
- To protect the environment quality of the Narmada River banks, including water, soil, air, landscape and environment.

**Details of the site**

The land ownership of the proposed site belongs to Sardar Sarovar Nigam


Ltd. (SSNL). The distance from Gurudeshwar weir dam to Narmada Dam is 12 km. The right and left side river banks are approximately 15 meter in width. Out of total 12 km of left side river bank 7 km area is encroached and rest 5 km area is open. Out of total 8 km right side river bank 3 km is available for planting and rest of the 5 km area is covered by the forest of Gora and Kevadia Ranges of Narmada Forest Division. Approximately 5 Km stretches of forest lies along the bank. As showed in the satellite image the right and left river banks (a total of 8 kilometres in non-forest area and 5 km in forest area) will be developed as the valley of flowers.

**Planning of the Project**

The project will be implemented in two phases, namely:

1. Creation of assets
2. Maintenance and upkeep of those assets.

Chain link Fencing will be done for protection and drip irrigation system will be installed for watering the plants. Land leveling and scaping and bank stabilization along the river will be done above the waterline. Existing structures and trees will be maintained as such or can be modified to fit in the landscape development model to beautify the proposed area.

**Details of the project Works**

The project work can be divided into two main categories; 1. Beautification of Valley of flowers in non-forest area, 2. Habitat improvement in forest area along the Narmada river.

**Beautification of Valley of flowers in non-forest area:** Nearly 8 km. stretch will be beautified through plantation of flowering plants in such a way that round the year flowers of plants bloom. It is estimated that about 3000 flowering trees and an about 30000 shrubs and creepers will have to be planted. To develop the mentioned area as valley of flowers, the details of planting material is given in Table 1.

**Habitat improvement in forest area**

In the vicinity of Statue of Unity, there is 5 km stretch along the river. Its face lifting is also necessary for fulfilling the twin objective of improving the habitat ecologically and at the same time improve its aesthetic sense. The open patch available will be planted with trees while bordering areas and undergrowth of shrubs and creepers will be planted in about 50 ha area. The slope being very high and vulnerable for erosion, it will be stabilities and soil and moisture works will be undertaken to improve the habitat.

**Project Cost:** The total cost of the project is estimated around ₹ 11.88 crore spreading over 6 years as shown in Table 2.

**Outcome of the Project:** The developed valley of flowers will provide the

**Table 1: Plant Details**

| S.No. | Trees | Shrub | Creepers | Bougainvillea |
|---|---|---|---|---|
| 1 | *Tecoma argentea* | *Allemenda violet* | *Allamanda cathartica* | *B. Mary Plamar* |
| 2 | *Tabebuia rosea* | *Allemenda yellow dwarf* | *Antigonon leptopus* | *B. Tourch Glory* |
| 3 | *Cassia fistula* | *Caesalpinia pulcherrima* | *Bignonia venusta* | *B. Red Mahara* |
| 4 | *Cassia javanica* | *Tecoma stance* | *Ipomoea violet* | *B. Orange Mahara* |
| 5 | *Cassia nodosa* | *Cassia alata* | *Jacquemontia species* | *B. Pink Mahara* |
| 6 | *Bauhinia blackae* | *Lagerstroemia lancasteri* | *Petrea volubilis* | *B. Snow White* |
| 7 | *Erythrina Indica* | *Bauhinia Yellow* | *Ipomea batatas* | *B. Formosa* |
| 8 | *Jacaranda mimosifolia* | *Nerium Pink* | *Thunbergia blue* | |
| 9 | *Cordia sebestena* | *Nerium Red* | *Thumbergia white* | |
| 10 | *Lagerstroemia thorelli* | *Nerium White* | *Iresine lindenii* | |
| 11 | *Lagerstroemia flosreginae* | *Nerium Dwarf* | | |
| 12 | *Bombax ceiba* | *Nerium Deep Red* | | |
| 13 | *Agathi species* | *Thevetia Yellow, Pink and White* | | |
| 14 | *Delonix regia* | *Michelia champaca* | | |
| 15 | *Callistemon lanceolatus* | *Croton* | | |
| 16 | *Parkinsonia alata* | *Acalypha* | | |

**Table 2: Project Cost**

| S.No. | Particulars of Work | Financial Requirement (₹ In Lakhs) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | '0' Yr. | 1st yr. | 2nd Yr. | 3rd Yr. | 4th Yr. | 5th Yr. | Total |
| 1 | Land Preparation and creation of water facility (Annex. A) | 452.00 | 0 | 0 | 0 | 0 | 0 | 452.00 |
| 2 | Trees Plantation (Annex. B) | 0.75 | 5.68 | - | - | - | - | 6.43 |
| 3 | Shrubs & Creepers Plantation (Annex. C) | 1.80 | 29.00 | - | - | - | - | 30.80 |
| 4 | Plantation Upkeep (Annex. D) | 0.00 | 22.75 | 22.75 | 22.75 | 22.75 | 22.75 | 113.75 |
| 5 | Habitat Improvement (Annex. E) | 127.00 | 84.00 | 38.50 | 38.50 | 38.50 | 38.50 | 365.00 |
| 6 | Other Activities (Annex. F) | 40.00 | - | - | - | - | - | 40.00 |
| | Total | 621.55 | 141.43 | 61.25 | 61.25 | 61.25 | 61.25 | 1007.98 |
| Cost Escalation @ 10% | | 62.15 | 14.14 | 6.13 | 6.13 | 6.13 | 6.13 | 100.80 |
| Planning and Consultancy @ 1% | | 10.00 | - | - | - | - | - | 10.00 |
| Monitoring and Evaluation @ 2% | | - | - | 5.00 | 5.00 | 5.00 | 5.00 | 20.00 |
| Overheads @ 5% | | 10.00 | 10.00 | 10.00 | 10.00 | 5.00 | 5.00 | 50.00 |
| Grand Total | | 703.70 | 165.57 | 82.38 | 82.38 | 77.38 | 77.38 | 1188.78 |

aesthetic look to the up-coming Statue of Unity. Thereby, may lead to good tourist inflow in the proposed area. Moreover, development of the Valley of Flowers will improve the environmental quality of the surrounding areas. It will also help in reducing the river banks erosion and will lead to the stabilization of the river banks. Additionally, it will help in the conservation of biodiversity of the area. Furthermore, it will also provide insights to the tourists about Narmada River ecosystem including the valley of flowers. It helps in educating the people towards conservation of Nature. Therefore, this ambitious project will not only improve the aesthetic look of the River Narmada and up-coming Statue of Unity but also help in the conservation of biodiversity and environment.

## SUGGESTIONS

- Use of indigenous species rather than exotic species may reduce the impact of exotic species on plant community structure, higher tropic levels of eco system as well as hydrology so indigenous species must be introduced for better ecological sustainable management.
- Local people should be given employment in tourism activity so that it may improve their socio-economic significance and uplift their livelihood.

## ACKNOWLEDGMENTS

DFO, Narmada Forest Division, Gujarat.

Gujarat Forest Department.

*Photo: Elephant in Bandipur Tiger Reserve*
*Credit: Abhilash D. VS, Lecturer, CAREDS, Dehradun*

# WILDLIFE

WILDLIFE

# Rise of Nagaland to the Amur Falcon Capital of the World

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***The community and government agencies responded within a short time to make the Amur Falcon conservation initiative in Nagaland a phenomenal success***

The fact that a small state in the remote corner of the country has been affirmed as 'the Amur Falcon Capital of the World' might sound bit of an exaggeration. To comprehend the rise of Nagaland to be the Amur Falcon capital of the world from being a death trap for the raptors, one needs to study an analogy that Asad R. Rahmani, the then Director of Bombay Natural History Society makes. In the editorial notes of the Amur Falcon commemorative issue "the Mistnet", he compares Amur Falcon conservation initiative in Nagaland to events like successful organisation of *Kumbh Mela* at Allahabad or eradication of Polio across the country. There is some sense in comparison. The sight of mass harvesting of the migratory raptors in Nagaland was as agonising as a stampede at a pilgrimage or an epidemic. But the way the community and government agencies responded within a short time is what makes the Amur Falcon conservation initiative in Nagaland a phenomenon similar to some of the best managed events across the globe. Such is the significance of the conservation initiative that Shri Prakash Jawdekar, the then Hon'ble Minister for Environment, Forest and Climate Change in his new year greeting to the forest officers across the country, quoted it as an example and model worth emulation.

**A pair of Amur Falcons**

Amur Falcon (*Falco amurensis*) is a small raptor belonging to the falcon family (*Falconidae*). It breeds in south-eastern Siberia and Northern China before migrating in large flocks across India and over the Arabian Sea to winter in Southern Africa. It was earlier treated

as a subspecies of the red-footed falcon (*Falco vespertinus*) and known as the eastern red-footed falcon. Males are dark grey with reddish brown thighs and undertail coverts; reddish orange eye-ring, cere and feet. Females are duller above, with dark scaly markings on white underparts, an orange eye ring, cere and legs. Only a pale wash of rufous is visible on their thighs and undertail coverts. Their diet consists mainly of insects, such as termites; during migration over the sea, they are thought to feed on migrating dragonflies. Every October, a large number of Amur falcons arrive in Northeast India especially Nagaland, from Siberia en route to their final destination - Somalia, Kenya and South Africa.

Though Amur Falcon is not an endangered species of bird, there has been a huge interest for the majestic bird species because of its migratory behaviour. During summer the raptor breeds in parts of south-eastern Siberia & Northern China. It undertakes a migration journey from this region all the way to Southern Africa where they spend the winter and then returns to Siberia. Amur falcons travel up to 22,000 km in a year, this being one of the longest migration routes of all birds. In the process the raptor is known to fly non-stop for three days over Indian Ocean covering a distance of over 3000 km. The congregation of millions of falcons at their communal roosting sites in southern Africa is said to be one of the most spectacular bird of prey phenomena in the world.

The wide breeding range and large population size of the Amur falcon have led to the species being assessed as being of least concern. However, the flocking behaviour during migration and the density at which they occur, expose them to hunting and other threats. During their migration from their breeding area to the winter quarters, they are plump and are hunted for food in parts of north-eastern India as well as in eastern Africa. The raptor spends its day in search of food and settles on the trees for roosting during the night. This particular behavioural pattern of Amur Falcon was being exploited by the hunters by setting up huge fishing nets all over the roosting sites. It was reported in the past that around 15,000 birds were captured every day in some parts of Nagaland. This unpleasant aspect of mass harvest

**Congregation of Amur Falcons at Doyang Valley, Nagaland**

of Amur Falcons at various roosting sites across the state during the year 2012 was highlighted by the National and International media.

It is to be understood here that the State of Nagaland is administered under the special provisions of Article 371 (A) of the constitution. By virtue of this provision the land and the recourses there in belong to the community, unless specifically acquired by the Government. Unfortunately, this constitutional provision has been misinterpreted at times to authenticate the traditional practice of hunting of wild animals and birds in community owned forest areas in the state. Furthermore, arrival of Amur Falcons in celestial numbers in remote areas was being interpreted as the divine intervention by the almighty to provide livelihood opportunity to the rural mass. Under these pretexts trapping of raptors was happening for over a decade without much of reporting and thus had become a livelihood option for few individuals within the community. Given this scenario it was difficult task for the Department to put an end to the harvesting of birds.

Before the Department could contemplate as to what grave things were happening around during the roosting season of 2012, the fortunate Falcons flew away to Africa. This did not deter the Department and Government machinery to resolve to take care of the visiting raptors in the true Naga Tradition, the next time around. To make this happen, the Department of Environment, Forests and Climate Change, Government of Nagaland with ample co-operation from administration, police, village authorities, churches, schools, NGOs, etc. undertook multiple initiatives for protection of Amur Falcons during the year 2013. Mass awareness programmes at villages across the State, deployment of Forest Protection Force in the falcon roosting sites, regular patrolling along the highways, inspection of vehicle ferrying public and goods from the roosting site, market raids, etc. are some of such initiatives. Involvement of youth organisations, educational institutions and the institution of church proved very decisive in bringing in requisite change in the attitude of the general public. Such was the impact of these measures undertaken by the



**Marathon and Signature campaigns organised as part of mass awareness programmes**


**An awareness campaign organised at Wokha, Nagaland**

**Protection measures taken up by Department**

Department and the community, that not even a single bird was reported to be killed during the roosting season in the year 2013. This was a colossal turn-around not just in the fortunes of the Falcons but also for the global image of Nagaland.

The conservationists and the media from across the world were eagerly looking at the government agencies of Nagaland, as to how they would manage to arrest the mass harvesting of raptors. By the time the birds arrived during the month of October, 2013 the Department not only put several preventive measures in place but also had discussions with concerned scientific organisations led by the Wildlife Institute of India to facilitate quality research. This was needed to have an understanding of the enigmatic fact as to why the raptors had chosen certain roosting sites in Nagaland over all other places.

Wildlife Institute of India, Dehradun in association with the CMS (Raptors MoU), Bombay Natural History Society, etc. managed to tag three birds (Naga, Wokha and Pangti) with satellite tracking devices. This enabled us monitor the said raptors on day-to-day basis. Further, twenty seven birds were tagged with rings provided by Bombay Natural History Society. The outcome of these scientific interventions facilitated during 2013 has helped us understand the migratory route and behaviour of Amur Falcons. The

scientific community is better aware of the migratory pattern of the raptors than ever before. Initial studies are being followed up keenly with new initiatives and interventions. Another batch of birds was tagged with satellite tracking devices during the roosting season in 2016. Dr R. Suresh Kumar of Wildlife Institute of India is the humble scientist who has been co-ordinating the highly technical satellite tracking programme for Amur Falcons in Nagaland and other parts of the North-east India. He was indeed acknowledged profucely by Shri Prakash Jawdekar, the then Hon'ble Minister for Environment, Forests and Climate Change for taking such an interest in working on the enigmatic raptors particularly under such a challenging circumstances.

Amur Falcon conservation initiative taken up by the Department of Environment, Forest and Climate Change, Government of Nagaland and local community in co-ordination with various other Government and Non-Government organisation has been amply highlighted by the print and electronic media. This has negated the negative publicity the state had during initial years and has assisted in creating a niche for Nagaland in the realm of

**Amur Falcons being released after tagging with Satellite tracking devices**


**A map showing the initial flight by the three birds tagged with tracking devices**

wildlife conservation. Organisations like UNEP-CMS, BNHS and Birdlife International have appreciated the efforts of Government of Nagaland and the local community for their efforts in protecting the falcons and providing them safe passage. The Department and the village communities involved have been honoured with many awards and honours, significant amongst them being the citations and cash prize by Royal Bank of Scotland, Balipara Foundation, Tigerland Biodiversity Conservation Award, etc.

The Department on its part has been relentless in formulating and initiating conservation efforts. New roosting sites emerging every season are being accorded similar conservation status the Doyang Valley is accorded since 2013.



**Summarisation of the series of events related to Amur Falcon Conservation**

Department of Environment, Forest and Climate Change, Government of Nagaland in association with the Indian Postal Department has brought out commemorative postal stamp and envelops. Ecotourism in the region has received a boost and the communities involved have started getting the reaping the benefit in terms of alternate livelihood options.

The above two cartoons comprehensively sum up the Amur Conservation Saga and its outcome in the state of Nagaland. The falcons were being massacred by the villagers for short sighted economic benefits. Department of Environment, Forest and Climate Change, Government of Nagaland has been successful in communicating to the public that, as a society we were failing to foresee this congregation of Amur Falcons as a livelihood opportunity in terms of eco-tourism and other income generating activities. Initial efforts of the Department and the community were expected to bring in laurels and resources necessary for overall development of the community. The stakeholders of mass conservation initiative have had ample recognition but a lot is yet to be achieved in terms of communicating the actual benefits of conservation to the communities around the roosting sites involved in conservation. Nevertheless, the unprecedented Amur Falcon conservation initiative in Nagaland has rendered the otherwise mystique state of Nagaland, to be the Amur Falcon Capital of the World.

WILDLIFE

# Ray of Hope

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***Captive breeding has provided a ray of hope the critically endangered Northern river terrapin***

**ABSTRACT**

Captive breeding is defined as "the process of breeding animals outside of their natural environment in restricted conditions in farms, zoos or other closed facilities" (WWF, 2007). It is one of the most important tool for conservation of wildlife. The aim of this article is to provide a brief overview of the efforts taken by the West Bengal Forest Department to conserve the largest river turtle found in Asia *i.e. Batagur baska* (Northern River Terrapin) through conservation breeding. This species of turtle is almost on the verge of extinction. IUCN has categorized the species as critically endangered while it finds place in Appendix 1 of CITES.

Northern River Terrapin is the largest river turtle having hard-shell and found in Sunderbans of India, Bangladesh, Myanmar, Cambodia, Indonesia and Malaysia. It's characteristic features includes four clawed forelimbs and pointed, upward tilting nose. The male exhibits striking colour differences during breeding season here in male: Neck and head

**Striking colour of male during breeding season**

show dark brown colour. Forelimbs and base of neck show reddish colour.

Earlier Northern River Terrapin (NRT) was common in rivers of East India, Odisha, Bangladesh and Myanmar. But now, it is considered one of the most endangered freshwater turtle, as it is heavily or overexploited for flesh and egg in recent few decades.

**Threats that face conservation of the species are categorized below:**

***Poaching***

- Hunting of adults for flesh.
- Removal of eggs.

This resulted into little or no recruitment into breeding populations.

***Habitat destruction***

- The fruits of Keora tree (*Sonnertia apetala*) - a mangrove tree forms a staple part in the diet of river Terrapin. The population of *S. apetala* has dwindled due to illicit felling, epidemics borer insect (*Zeuzera conferta*) attack and cyclones.
- Conversion of mangrove forests to shrimp farms.

The construction of dams causes an alteration in riverine habitats. The upstream dam project accelerates erosion of nesting beaches as large amounts of water released periodically from them. Similarly, the downstream dam restricts the movement of the and nesting sites.

**Unregulated sand mining causes**:

- Destruction of nesting places (these species are obligatory to nest on high sandy beaches).
- Alteration in structures of riverbank.
- Changes in water flow.
- Increase in water turbidity (loss of submerged aquatic flora).
- Reduction in levels of dissolved oxygen (few aquatic animals *i.e.* reduction in prey base).

Gold mining causes mercury contamination of river water to higher levels. This higher level of mercury is the main cause of many developmental abnormalities.

The combination of all these factors result into the alteration of aquatic

**Northern River Terrapins fitted with sonic transmitters**

ecosystem to an extent that it becomes incapable of supporting or sustaining a viable population of river terrapins.

**Initiative by forest department**

Several research expeditions in the recent years had failed to estimate the population of NRT in the wild. As it is apparent or believed that terrapins have been nearly wiped out in wild in much of its former range. Keeping in view the critical nature of the problem being faced by this fast dwindling NRT, West Bengal Forest Department decided to undertake a captive breeding programme for conservation of this species in the year 2006. The brooder stock consisted of 11 individuals of terrapins rescued from fishermen's net, houses and ponds. The initial brooder stock included 8 females, 2 males and a juvenile. They were kept in a pond at the interpretation center in Sajnekhali at STR. The initial efforts of breeding were not successful as the facilities for egg laying were not proper as required by the species.

In the year 2008, Forest Department obtained technical assistance from Turtle Survival Alliance (TSA) for improving egg laying facilities. Accordingly activities like Building of nesting sites with sand; Basking platforms and protection/fencing with wire mesh for protection from predators were established.

These efforts paid off in June 2012 when 25 hatchlings of Northern river terrapin emerged out of eggs in captivity at Sajnekhali. Similarly in 2013, 56 hatchlings were obtained at the breeding centre. As the captive population is performing better and growing at rapid rates the enlargement of the existing facilities was inevitable. So the department created separate enclosures for adult and mature females. Each enclosure is having a large pond and nesting beaches. Natural environmental conditions were provided in every enclosure with its own natural stock of fishes, crustaceans and mollusks and surrounded by mangrove tree species.

**Current status**

Currently, there are about 154 individuals of northern river terrapin in the captive breeding facility at Sajnekhali interpretation center. This is also the largest *B. baska* colony in the world. Now the department is planning for the soft release of turtles and monitoring them by use of acoustic telemetry. For monitoring developmental change Passive Integrated

**The provision of mesh protection for the translocated *B. baska* clutch on the sand beach. The improved cage protects the eggs against predators like mongoose and monitor lizards**

Transponder (PIT) tags were used for tagging juveniles. Similar efforts have been tried out in adjoining Bhawal National Park, Bangladesh and Vienna Zoo, Austria.

**Future plan**

In future department has planned to reintroduce NRT into the wild. Therefore, they are conducting a survey to find out suitable habitat where these turtles can survive. These shall be primarily those areas where nesting was recorded earlier or were known to be habitat of NRT. Habitat suitability analysis is being carried out on the basis of certain parameters such as level of salinity, depth and tidal creeks. The officials have identified 3 suitable release sites which are having a low level of salinity, considerable depth, easy for post-release monitoring and patrolling.

## Conclusion

The efforts of West Bengal Forest Department to revive the Northern River terrapin population through captive breeding highlights the importance of captive breeding as a technique in reviving the critically endangered population back to the ecological main stream from the verge of extinction. Truly, captive breeding has provided a ray of hope for the critically endangered NRT.

## Acknowledgments

Field Director, Dy. Field Director and Staff of STR.

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WILDLIFE

# Gaur Re-introduction in Bandhavgarh National Park, Central India

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***Bandhavgarh Tiger Reserve successfully, opened the floodgates to address the issues related to local extinction, enriching the species composition as well as maintaining the ecological balance of the protected areas***

## Introduction

Gaur (*Bos gaurus gaurus*) is one of the large wild ungulates of Asian jungles belonging to family Bovidae. Gaur is an endangered animal included in Schedule – I of Wildlife (Protection) Act 1972 of India. It is categorized as vulnerable by IUCN and included in Appendix - I of CITES. Gaur is the tallest living ox and one of the four heaviest land mammals. The estimated population of the Gaur is 23000-34000, and declining alarmingly. Gaurs were once distributed through out the forested tracts of India, South Nepal, south to Malaya and east to Vietnam but today they are confined to just over a hundred existing and 27 proposed protected areas in India. Gaurs are distributed to the major mountain systems of the Western Ghats in more or less isolated pockets, the Central Indian highlands and the North-Eastern Himalayas, including the hills south of Brahmaputra. Gaur plays an important role in the moist and dry deciduous forest in India, as ecosystem landscapers. Gaurs have a major impact on the physical structure of habitats, rates of ecosystem processes and the diversity of community. Mega-herbivores like gaur can trigger tropic cascades, increase spatial heterogeneity, accelerate succession processes and influence nutrient cycling and primary productivity resulting in modification of ecosystem structure and function. In Bandhavgarh Tiger Reserve gaur went locally extinct in the late 1990s. This population of Gaur was considered to be the only population to north of the Narmada River, in Central India. Gaur has reportedly vanished from three protected areas - Kanger Valley National Park (Madhya Pradesh), Thattekad Wildlife Sanctuary (Kerala) and Bhandhavgarh (Madhya Pradesh)- which indicates the urgent need for measures to stop further losses. There are many reasons for such local extinctions, right from hunting (for meat), competition with livestock, loss of habitat and habitat fragmentation to the managerial issues like protection and inadequacy of human resource and infrastructure in the last two decades. Gaurs higher niche overlaps with domestic cattle than by the other

wild animals (chiefly deer). Dwindling populations and local extinction need urgent conservation oriented interventions to maintain the holistic ecological processes intact.

**Study Area**

Bandhavgarh National Park is one of the popular national parks in India located in the Umaria district of Madhya Pradesh (declared in 1968). Tala, Magdhi, Khitauli and Panpatta are the four main zones of the national park which together forms the Core of the Bandhavgarh Tiger Reserve (694 $km^2$). Among these zones Tala is the richest zone in terms of biodiversity, mainly tigers. The Umaria and Katni forest divisions (437 $km^2$) together form the buffer zone. According to biogeographic classification, the area lies in Zone 6A - Deccan Peninsula, Central Highlands. There are five categories of Vegetation under BTR: northern dry mixed deciduous forest (5B/C2), moist peninsular low level sal (*Shorea robusta*) forest (3C/C2e), dry deciduous scrub (DS1), West Gangetic moist mixed deciduous forest (3C/C3a) and dry grassland (5/DS4).The vegetation is chiefly of Sal forest in the valleys and on the lower slopes which gradually change to mixed deciduous forest on the hills and in the drier areas of the park in the west and south. Long linear grasslands are flanked by Sal forests in the wide valleys along the streams. These together provide Bandhavgarh its rich biodiversity and suitable habitat for Gaur.

**Re-introduction Programme**

A joint collaborative re-introduction program of Madhya Pradesh Forest Department and Wildlife Institute of India was started to rebuild the gaur population in BTR, both to enhance the long-term survival of the species and restoring the natural biodiversity by post release scientific monitoring. Based on population viability analysis, the project aimed to capture and release of fifty gaurs from Kanha to Bandhavgarh Tiger Reserve. The project also envisaged support from Taj Safaris and Conservation Corporation of Africa (CC-Africa).

CC-Africa trained three forest officers and two veterinarians in capture and transport of large herbivores while tranquilizers and the sedatives were imported from South Africa. The animals were captured with the help of capture and translocation experts of CC Africa. A holding Boma (enclosure for large herbivores) was designed to release the immobilized animal before eventually being loaded in the transport truck. Design of the *boma* was adopted from the South African designs. The Boma was constructed of steel sections 3 m long and 2.5 m high made out of 50 x 75 x 3 mm rectangular hollow tubes. The *boma* had three sliding gates 2.5 m high and 1.5 m wide sliding on a 3 m rail. The *boma* had a loading ramp of 3 m section made up of solid pressed steel at 2.5 m height. The steel sections of the *boma* beyond the sliding gate were covered all the way up to the entrance of the truck covered with green mesh as camouflage. This would bring a feel of the natural forest to the captured animals and help them to enter into the truck. By using

bamboo mats and sliding gate the *boma* was divided into two compartments, where in the last compartment food, water and salt is provided. A specially designed stretcher was made for carrying immobilized animals from the site of capture to the vehicle for this complicated process. Taj Safaris had donated two specially modified large vehicles for transportation of animals.

After re-introduction, the home range, habitat use and food habits of re-introduced gaurs were using radio collars (GPS/Argos/VHF) enabling the park managers for suitable habitat management intervention. In addition to bringing gaur back to Bandhavgarh this project will also train and equip the forest department, and WII to undertake translocation and reintroduction of other endangered wild animals to repopulate depleted areas.

**Result**

Gaurs were captured by immobilizing them chemically from Kanha Tiger Reserve located at a distance of nearly 300 kms from the site of release (BTR). The primary immobilizing drugs such as Etorphine HCl (10 mg/ml) with the short-acting tranquilizer Azaperone (40 mg/ml) were used. Subsequently during transportation to maintain a desired level of tranquilization and stay in the release site, medium to long-acting tranquilizers like Haloperidol (5 mg/ml) and Perphenazine enanthate (100 mg/ml) were administered. Intravenous antidote Naltrexone (50 mg/ml) was used in the ratio of 20:1 of Etorphine HCl. The necessary clearances were obtained from the Narcotic Commissioner (Ministry of Finance, Central Bureau of Narcotics), Drug Controller General of India and the Ministry of Agriculture (Department of Animal Husbandry and Dairying).

The operation was carried out in 2 phases. In a joint collaborative initiative 19 gaur (14 females, 5 males) were captured from Kanha Tiger Reserve (from two different herds) and translocated to Bandhavgarh Tiger Reserve in January 2011. Though there were apprehensions about the capturing process, the meticulous steps taken helped to achieve the goals. For the soft release of gaur at the borders of Tala and Magdhi ranges at BTR a suitable site with good vegetation, cover and water was selected. The captured gaurs were released in BTR in a power-fenced 50 hectare plot. The re-introduced gaurs were released into the wild on 20th March 2011. Thirty one additional gaurs (22 females and 9 males) were translocated (from six different herds) in March 2012 with absolute nil mortality. The mortality rate was brought down to an internationally accepted rate of 2%. Every tranquilization was followed by a close monitoring of the animal by the veterinary doctors.

Among the initial re-introduced stock there were two natural deaths (both adult females), three mortalities and one sub-adult female was predated by tiger. There were three natalities, two from the first reintroduced stock and one from the second stock of animals taking the stock to about 50 gaurs in

BTR. The sex ratio was 60% female and 40% male.

27 gaurs (6 males and 21 females) were fitted with radio collars. Till March 2012 the re-introduced gaurs had ranged over an area of 268.7 $km^2$. The annual home ranges of the males were 254.4 $km^2$ and females were 200.4 $km^2$, respectively. The home ranges in summer (April 2011-June 2011) for males and females were 231.5 $km^2$ and 161.2 $km^2$, respectively. The home ranges of males were 110.6 $km^2$ and females were 135.7 $km^2$, respectively in monsoon and post-monsoon (July to October 2011). The home ranges in winter (November 2011 to February 2012) of males were 98.5 $km^2$ and

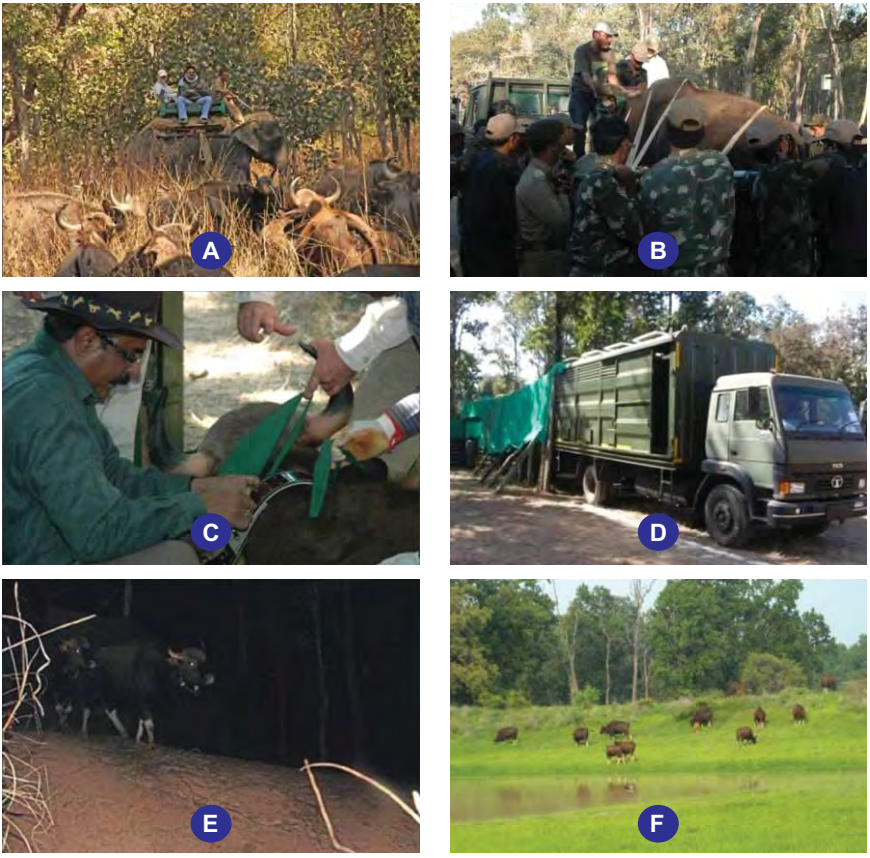


**Fig. (A) Gaur Capture in Kanha Tiger Reserve (B) Gaur shifting into a small truck in Kanha Tiger Reserve (C) Fitting of radiocollar on gaur at Kanha Tiger Reserve (D) Truck used to transport gaur from Kanha TR to Bandhavgarh TR (E) Gaur released in an enclosure at Bandhavgarh Tiger Reserve (F) A herd of free ranging gaur in Bandhavgarh TR.**

***Photo Credits: Dr K Shankar, Scientist (WII)***

females were 152.5 $km^2$, respectively. The group size was found to be fluid ranging from 1 to 19 individuals. Gaur mostly used flat terrain (65%) as compared to gentle slope (28%) and steep slope (7%). In monsoon and winter compared to summer the use of undulating terrain by gaur increased. In total 68 plant species were recorded as food plants of gaur which includes 28 trees, 6 shrubs, 10 herbs, 21 grasses and 3 climbers.

Relocation of two villages in Kallwah range (Kallwah and Kumuruwah) in June 2011 from the National Park helped in reducing anthropogenic pressures on forest. It was observed that Gaurs were using these relocated village sites and hence creation of more such habitats is essential for conservation of this species.

## Conclusion

Re-introduction of gaurs to Bandhavgarh Tiger Reserve successfully, opened the floodgates to address the issues related to local extinction, enriching the species composition as well as maintaining the ecological balance of the protected areas. The field staffs of Kanha Tiger Reserve have also become experts in handling the large ungulates. Now they are transferring these techniques to other PAs in the state and as well as outside the state. This success of BTR has added another chapter to Wildlife Conservator efforts being done in India.

## Acknowledgments

Field Director and Dy. Director Bandhavgarh Tiger Reserve.

Madhya Pradesh Forest Department.

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WILDLIFE

# Threats to Marine National Park in Jamnagar (Gujarat)

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***Exploitation of the environment for a purpose can alter the environment's ability to provide other goods and services. So this is also a way of understanding what we stand to gain and lose by exploitation of certain aspects of the environment***

## INTRODUCTION

Marine ecosystems are among the largest of Earth's aquatic ecosystems. A marine ecosystem is one that occurs in or near salt water, which means that marine ecosystems can be found from sandy beach to the deepest parts of the ocean. The ocean covers 71% of the planet, so marine ecosystems make up most of the Earth.

India has a long coast line of about 7520 km and Gujarat state has a coast line measuring more than 1650 km which is the longest amongst the maritime states of India. In 1978 marine areas of Point Calimere were declared as a Sanctuary in India. The first Marine National Park was declared in 1982 in the Gulf of Kutch.

The Gulf of Kutch is located between $22^0$15' to $23^0$40' N latitude and $68^0$20' to $70^0$40' E longitude. The total area of the Gulf of Kutch is 7350 $km^2$ having approximate length of around 170 km and maximum width of about 75 km at the mouth.

**Statement of significance at various levels**

**Global:**

- Located on the west coast near international border and in the close


**Fig. 1. Location Map of the Gulf of Kutch**

proximity of Pakistan and Gulf countries.

- It acts as a barrier for the Gulf in the time of heavy cyclone.
- It supports many internationally endangered species of marine fauna.
- Fossils of molluscs provide opportunity to study the geology and biology of the origin of the formation and diversity of species in the area.

**National:**

- One of the 4 major coral reefs of the Country.
- Northern most in location just below the tropic of Cancer.
- First area in the country to be declared as Marine protected area.
- Jamnagar is a district headquarters connected by air, road and rail link.
- Important area that provide ample opportunity for research.

**Local:**

- It acts as a barrier to cyclone for Jamnagar district.
- Mangrove forests and coral reef ecosystem provides excellent fishing ground.
- Ideal site for nature education camp and awareness camp.

**Threats**

Looking at ecosystems in terms of the goods and services they provide allows us to realize their full value and our dependence on those systems in the broadcast sense. Exploitation of the environment for a purpose can alter the environment's ability to provide other goods and services. So this is also a way of understanding what we stand to gain and lose by exploitation of certain aspects of the environment.

**Floral resources**

The following mangrove species are found in the Marine National Park:

| | |
|---|---|
| 1. Khari cher | *Avicennia marina* |
| 2. Mithi cher | *Avicennia officinalis* |
| 3. Patt cheradi | *Avicennia alba* |
| 4. Karod | *Rhizophora mucronata* |
| 5. Kunnari | *Ceriops tagal* |
| 6. Chavario | *Aegiceras corniculatum* |

**Fig. 2. *Avicennia marina***

**Faunal resources**

The major faunal species found in the Gulf of Kutch are:

| Category | No. of species |
|---|---|
| Sponges | 74 |
| Hydrozoan | 5 |
| Jelly fish | 3 |
| Echinoderm | 8 |
| Crabs | 22 |
| Gastropod | 145 |
| Bivalve | 58 |

## Natural Factors

**1) Cyclone and storms:** The cyclone causes very heavy damage to marine


**Fig. 3. Faunal Diversity**

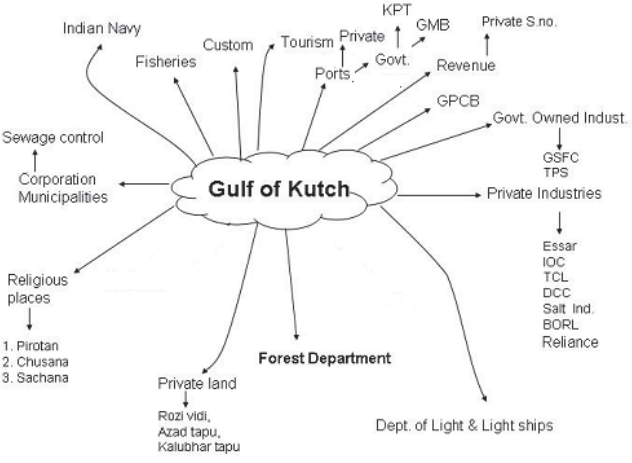


**Fig. 4. Diagram representing pressure on the Gulf of Kutch**

flora and fauna also. Large scale of uprooting of huge mangrove trees, debarking and twisting of mangroves resulted in the mass drying of mangrove forest in the Gulf area. Gujarat has witnessed two major cyclones in last decades *i.e.* 1998 and 2015.

**2 ) Sedimentation:** The most important physical phenomenon which affects the coral and other marine life in the National Park area is high degree of sedimentation.

The sediments are brought by the material resulted out of the cutting of trees on the land and clearance on the land. The industrial activity like dredging, laying of pipelines, port activity are also responsible for increasing silt load in the Gulf.

**Fig. 5. Sedimentatiom on coral reef**

From 1945 onwards, some of the areas were leased for manufacture of salt. Today there are about 21 salt units in the area. All these salt works were laid after clearing good mangrove forests.

The clearance of mangroves from such a large area has resulted in very heavy soil erosion and resultant sedimentation has affected the coral reefs in a significant way.

The increases in ship traffic and their anchorage also creates disturbance in the ocean floor and results in the sedimentation.

The high degree of cover created by silt, sediment and mud on the reefs is a major detrimental physical factor which affects the growth of corals as well as many other filter feeding marine animals.

**3) Changes in salinity:** There is hardly any fresh water flow in the Gulf of Kutch. There are 7 seasonal rivers flowing into the southern part of the Gulf but most of the rivers dry in the month of September. The salinity remains low during July, August and September, but increases afterwards. The increasing salinity has adverse affect on mangrove as well as marine life.

**4) Temperature:** The water temperature varies in all seasons in the Gulf of Kutch. The high average temperature affects the growth of coral.

The Gulf of Kutch is very near to the Tropic of Cancer and therefore, temperature rises very high during summer month, which result in the rise of water temperature.

The corals thrive best between $20^0$C to $30^0$C. The *Zoo xanthalaie* which live inside the coral are infact an algal associate. It has symbiotic relationship with the coral and is responsible for variation of colour in the corals.

Most of the time, the water temperature rises more than $32^0$C the *Zoo xanthalaie* leaves the coral and because of that the corals gets bleached and sometimes die also.

**5) Tidal variation:** Most of the coral reefs in the Gulf of Kutch are located in the inter tidal area. The type of reef is a fringing reef found in the continental shelf. A very heavy tidal amplitude is noticed in the Gulf of Kutch. So when low tide occurs during day time in summer season the corals gets exposed to the bright sun light and temperature. Exposure to the sunlight for a longer duration kills the corals.

**6) Drought:** The Jamnagar district is a drought prone area. Almost every third year is a drought year. The coastal region in the Gulf of Kucth experiences repeated and consecutive droughts. It increases the salinity of the sea water and affect the growth of the coral as well as mangrove plantations and mangrove forest.

## Anthropogenic Factors

**1) Sewage pollution:** On the southern part of the Jamnagar district on sea coast area the towns like Navlakhi, Jodiya, Balachadi, Sikka, Salaya are located. None of the above mentioned towns and cities have a solid waste management and sewage management system. In the absence of the sewage treatment plant, the polluted water and other waste of all these towns and cities flows into the Gulf of Kutch. The sewage pollutes the sea water in the Gulf. It adds nutrient and causes eutrophication.

**2) Thermal and Chemical pollution:** A 120 Megawatt Thermal Power plant is located at Sikka. This plant releases fly ash and bottom ash into ash pond which is located in the Gulf of Kutch. They are also releasing their effluent as well as water used for cooling the plant into the Gulf of Kutch through a channel. The ash as well as effluent causes heavy pollution near Sikka.

The Gujarat State Fertilizer Company located at Khavadi, imports Phosphorous, Ammonia and other hazardous chemicals. Some times due to accidents and subsequent leakage of these chemicals harms the marine flora and fauna.

The brine pipeline of Tata Chemicals Limited, passes through Marine sanctuary. The brine is a highly concentrated sea water, which is very highly dietrimental and by no means amicable for all biological growth.

**3) Oil pollution:** The Gulf of Kutch is in the close proximity of oil producing countries. Besides, it is safe to establish mooring systems and sub-sea pipelines.

Therefore, a number of oil industries have come up in this area and some more industries are planning to establish their refinery and oil importing station in the area. Oil spilled into the sea undergoes a number of physical and chemical changes such as spreading, evaporation, dispersion, emulsification, dissolution, oxidation, sedimentation and biodegradation.

**4) Drawal of sea water :** There are about 21 salt industries located in the Gulf of Kutch. Besides, there are big industries like Tata chemicals, Sikka GSFC and Mega industries like RPL and Essar. All these industries are drawing sea water regularly.

The sea water that flows in the creeks is diverted to their industrial units. Most of the industries have huge

**Fig. 6. Eutrophication**

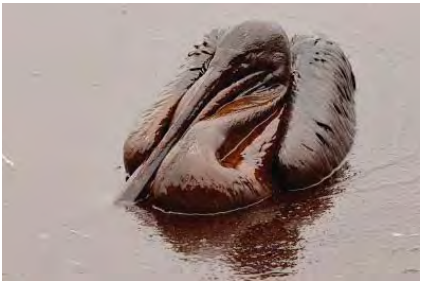

**Fig. 7. Brown Pelican covered with spilled Oil**

pumps for drawing sea water from the creeks.

All these industries have not taken desirable precautionary measures to prevent the entry of marine animals along with the sea water in their inflow. Thus a large number of marine animals particularly small fishes, crabs, molluscs *etc.* are subjected to the risk of getting killed.

**5) Biotic interference:** Lot of human interference for shell collection, collection of pearl oyster, sand mining and pedestal fishing are also found in this area.

This sand is generally used for mixing in the poultry feed after due process.

The shells are collected for the purpose of preparing pure Calcium Carbonate (CaCo3) for mixing it into PVC pipes and other industries as well as for medicinal purpose also.

The fishermen generally use hand net, hook and line, stack net, gill net etc. Which also causes localized damage to the faunal population.

**6) Pilgrimage :** A number of religious places, shrines are located on islands and some are located on the coast also.

There are famous Dargah on the Pirotan island; people offer a goat is sacrifice to their god and leave behind lot of wastes, plastics etc. Their movement also causes lot of damage to the mangrove forest.

**7) Maritime activity:** The Gulf of Kutch is always having a heavy traffic of ships as the Kandla port receives number of cargos which comes to West Coast. In fact the Kandla port was created to lessen the burden of traffic on the Bombay port. Now in fact the Gulf of Kutch is having very heavy movement of large ships.

As a result of the heavy movement of ships, the maritime activity like Surveillance, Patrolling, other watch and ward in the port limit increases. Very often the dredging is carried out near the harbour.

**8) Ship breaking:** The Government of Gujarat has declared an area near Sachana as a Ship breaking yard. The area was handed over to the Gujarat Maritime Board from the Department of port and Gujarat Maritime Board have issued lease to nine parties for ship breaking purposes.

**9) Export & import of coal:** The Gujarat

**Fig. 8. Traffic of ships**

Maritime Board imports coal at Navlakhi port. Besides, this coal is also imported by Shreeji Shipping Company at Jamnagar and Thermal Power Station at Sikka. The Tata chemicals are importing coal at Okha port.

As most of the area near Bedi port, New port and Sikka is very shallow; the ships cannot come and anchor on the jetties of above port. Therefore, loading and unloading is carried out through barges. While the coal is being loaded and unloaded the small dust particles remains embedded in the air and it falls on mangroves and in the water.

## Conclusion

For a long time the significance of biological diversity in the world's ocean was unclear. It is now known to play a vital role in maintaining the functionality and productivity of marine ecosystem. The conservation measures to mitigate the threat to the MNP are as follows:

- People awareness programs should be arranged.
- Make safe and sustainable sea food choices.
- Proper law enforcement at every level.
- Minimize the impacts on the coast.
- Install waste treatment plants at nearby industries.

WILDLIFE

# Man Animal (Langur) Conflict at Kumathe in Vaduj Range

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***Illegal encroachment of forest land for housing and agricultural purpose and extensive cutting of forest trees and plantation of exotic tree species in place of natural food plants forced the langurs to invade the crop fields in human habitat***

## Introduction

The case study is carried out at Kumathe village in Vaduj range which comes under Satara division of Maharashtra. The study is carried out between 2nd to 8th October, 2017.

### About the Menace

When a species constructs its niche in human habitat - urban area or village areas, it's aggressive behavior is likely to increase due to competition for food and space. This is evident in case of langurs which become commensals and competitors of human being in and around villages, towns and cities.

The rapid increase in the number of langur population in recent time has led to increased competition mostly for food and space between human and langurs. In urban areas, langurs are mostly found in temples and in frequent contact with people as they are fed as a form of worship by local people. Rhesus macaques are aggressive and cause injury to humans and damage properties in many parts of India. Indians have many religious and traditional beliefs about langurs but frequent conflicts have affected the traditional bond between man and langur.

Langurs came to Kumathe village some time during 2011. Due to regular rains they got their food easily till recently. But due to insufficient rains and scarcity of food in recent times they come to human habitats. Since 2011 population of these langurs in human habitats also increased. There are 3-4 troups with 30-40 langurs in each troup. These langurs frequently cause damage to human properties and their crops.

Kumathe village is situated in Satara district under Vaduj forest range. The village has some forest area and having population of around 5000 which is scattered in their fields. Hence, one can expect the problem from these animals in such areas.

### Problem Dynamics

This village has forest area which is dry thorn forest and tropical dry deciduous forest. This area mostly depends on monsoon for agricultural activity restricted irrigation by

wells.

Census has been conducted to find out the population of langurs in the village and by interacting with the people of the village.

The views of village people were obtained to know about the problem of langur *i.e.* why langurs comes to human habitat and how to manage problems caused by langurs. From the interaction, it was found that langur directly do not harm any person and plants but they damage and destroy their crops. Langurs damages their field crops like potato, tomato, groundnut, pea, sugarcane, guava, banana, tamarind etc. The plants and their parts eaten by langurs are given in Table 1.

It was also found that langurs not only destroy fruit and agricultural crops but also damage property. The properties damaged generally are roof of houses, fruit trees near the houses and TV Antenna. Though economic estimate was not done during the study, it is a necessary to find out the economic loss.

**Causes of the Man-langur conflict in study area:**

**1) Habitat destruction-** Illegal encroachment of forest lands for housing and agricultural purpose, extensive cutting of forest trees and plantation of exotic tree species in place of natural food plants force the langurs to invade the crop fields in human habitat.

**2) Irregular rains** - Irregular rains leads to scarcity of food and therefore langurs come to fields of farmer to fulfill their requirement.

**3) Overpopulation** - The population of langur in that area has increased in last few years from 30-40 to 230. In recent times, human population also increased which lead to encroachment which caused scarcity of food and shelter for the langurs, thus increasing the conflict.

**Table 1: Comprehensive list of food plant species and its parts eaten by Rhesus langur in Kumathe village**

| English name | Scientific name | Parts eaten |
|---|---|---|
| Mango | *Mangifera indica* | Fruits, Folwers |
| Banayan tree | *Ficus bengalensis* | Leaf, Fruit |
| Mulberry | *Moras alba Buds* | New leaf, Fruit |
| Ber | *Zizipus mauritiana* | Fruit |
| Black cutch | *Acacia catechu* | Seed |
| Tamarind | *Tamarindus indica* | Buds, New leaf, Fruit |
| Jamun | *Syzigium cumini* | Fruit |
| Guava | *Psidium guajava* | Leaf and Fruit |
| Banana | *Musa paradisica* | Fruit |
| Subabul | *Acacia nilotica* | Pods, Flowers, Leaves |

**4) Food provisioning by villagers** - Due to traditional belief, people worship langurs as Lord Hanuman. Near the temple, they provide banana and other eatables to langurs in the form of *Prasad*. This attracts most of the langurs in the area there by increasing the conflict.

## Recommendations

Damages caused by langurs in Kumathe village is very high and therefore, detailed study on their habitat and monitoring of population is necessary. To understand the extend of damage caused by langurs in Kumathe and surrounding villages, we need to conduct a long comprehensive study with specific focus on the level of langur abudance in different geographical and agro-climatic regions. Most importantly programme for the langur management and habitat conservation programme in areas with high economic damage is a necessity.

Both short and long term measures can be adopted to control the man-langur conflict in study area as below:

**Short-term measures** - These interventions provide immediate relief to the people:

1. Ban on providing eatable to langurs.
2. Capture and translocation of the langurs to the nearly wildlife sanctuaries and zoos. Monkey *Chacha* who is an expert in capturing langurs are to be involved to temporally minimize the problem.
3. Mass driving of langurs out of the area physically by using drums and crackers etc.

**Long term measures**- It aims at removing the factors responsible for the langur depredation and at creating ideal living conditions for the langurs within the forests *viz.*:

1. Eviction of illegal encroachment of forest land and restoring the evicted land to forest ecosystem.
2. Extensive cutting trees must be minimized.
3. Construction of water conservation structures.
4. Promoting conservation education and public awareness programmes among the fringe villages.
5. Planting more fruit and fodder plants in forest area which fulfill the need of food and shelter for the langurs and creating a reserve for them.

## Conclusion

During the interaction with the villagers it is known that people accept the fact of protecting langurs and conserving their habitat and also accept that humans are responsible for presence of langurs in human habitat. The basic reason for man-langur conflict is rapid increase in population of langurs during last seven years. Also habitat improvement, planting of fruit trees and construction of water conservation structures with help of Forest Department and local people may minimize the langur attacks. The villagers invite a person called Monkey *Chacha* who is an expert

in capturing langur and sending them in forest area to manage the problem temporarily in presence of forest officials. Educating the people about the problems and pre-cautions to be taken to minimize sudden encounters would at least help people to avoid such conflicts.

WILDLIFE

# Leopards in Conflict

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***There is need for further research and studies on leopard rehabilitation whenever new river valley projects are made; the terms of reference for Environmental Impact Assessment (EIA) should also include impact of project on man animal conflicts***

## Introduction

Junnar is a small place in Maharashtra and very well known for its historical significance. It is the Birthplace of great Indian warrior Chhatrapati Shivaji. There is also a cluster of ancient Buddhist caves in this place. Junnar came in to limelight during the recent years because of frequent leopard animal conflict. The area under this division comprises of Reserved Forest (547.45 sq. km) and 27.23 sq. km of Unclassed Forest. The forest area of this division spreads over part of Pune district, and surrounded by Ahmednagar district on North and Eastern sides where as on the Western side there is Thane district. The forest areas are quite scattered and distributed in seven ranges, namely Otur, Junnar, Ghodegaon, Rajgurunagar, Shirur, Chakan and Manchar.

Though the forest areas are found fragmented in patches the population of leopard has probably increased leading to man-animal conflict.

The common reasons like fragmentation of natural habitat and decline in natural prey population are quoted but in Junnar Forest Division (which lies parallel to Western Ghats, being seat of origin of various rivers and about seven dams) the change in cropping pattern is supposed to be one of the root causes of this man beast conflict. Initially crops like Jowar, Bajra and Ragi were cultivated by farmers but later on due to availability of irrigation facilities the cropping pattern shifted to cultivation of Onion, Potato, Sugarcane and Banana. Especially Sugarcane became next safest place for leopards' habitat. Sugarcane field provides shelter, water and mainly secure place to raise their cubs. Generally it is said that the mortality percentage in case of leopard is 50% but because of sugarcane fields it has grown upto 100%. Another reason for increasing conflict is movement of leopard to unusual places. Translocation is the common strategy to reduce man animal conflict. However this strategy is not supposed to be scientific for managing problem animals. The leopard belongs to family *Felidae* and it is territorial animal having strong homing instinct. So whenever a leopard is released in a distant place it is unable to find out source of food and water which leads to confrontation with human being in the

new site. Also because of its homing instinct it tries to come to its home range and while coming back it has more chances of confrontation with humans especially when it crosses human habitats.

## Mitigation Strategies Followed by Forest Department

***Awareness among people:*** Forest department is mainly focusing on the people living in sensitive areas of conflict to make them aware and alert about the existence of leopard. Posters, pamphlets, wall paintings are used to alert and educate people. Also workshops, training programmes are arranged particularly for village people and school, college students.

***Village rescue team:*** The forest department in collaboration with NGO trains people in rescue operation living in sensitive villages. Team of six people is formed which plays the role of first aid. They also control the mob till the experts reach the site.

***Leopard ambassadors:*** These are the school going children living in the areas affected by man animal conflicts. These children are trained in communication skills and act as awareness creators among the people in and around the villages.

***Initiatives taken by forest department:*** Forest department has increased the patrolling hours and also the number of staff working in conflict areas and the vans for patrolling and easy accessibility have been provided. Training is also being provided to local people as well as forest staff.

***Compensation by forest department:*** In Maharashtra, the compensation for the human death is ₹ 8 lakhs, whereas for any serious injury it is about ₹ 4 lakh. In case of cattle death compensation is 75% of the amount of the market price of cattle or ₹ 25000 whichever is less. In case of sheep, goat and any other animal it is 75% of the amount of its market price or ₹ 3000 whichever is less.

***Manikdoh Leopard Rescue Centre (MLRC):*** It was established in the year 2001 by Forest Department. But due to lack of funds and technical expertise it could not operate at its full potential. In the year 2007 the forest department signed MoU with Wildlife SOS, a Non Government Organization. This arrangement has solved the problem of expertise and enhanced the performance of the rescue centre.

The rescue centre is spread over an area of 4.05 ha and department is willing to extend that area which is now under the possession of Irrigation department. It works under the direction and guidelines of Central Zoo Authority.

## Objectives of MLRC

- ✓ **Conducting Rescue operations in situation where the :-**
  - Leopard is trapped in well having water.
  - Leopard is trapped in the well having no water.
  - Leopard has entered a house.
  - Reunion of cubs and mother leopard.
- ✓ **Providing Veterinary Aid :-**
  - Healths check up and keeping record of leopards rescued.

- Vaccination of rescued leopards.

✓ **Conducting Awareness Programmes in Schools, Colleges, Gram panchayats :-**

- Extension Programme by means of audio visual methods.


**Dr. Deshmukh with a Rescued Leopard Cub at MLRC**

- Involvement of local people.
- Training and workshops.

✓ **Maintenance of Rescue Centre :-**

- There are about 36 leopards rescued from various places. Most of them are over aged and cannot be released back into the wilderness and others are cubs which were abandoned by their mothers. For the maintenance of rescue centre NGO raises funds from sponsors and through donations.

**Achievements of MLRC**

Till now MLRC has released more than 100 rescued leopards' successfully in wilderness and contributed in the reunion of about 42 cubs with their mother since 2009. They are playing major role in the rescue operations of leopard and also in providing technical support to the forest department. The NGO has lions' share in awareness programs held by Forest Department.

**Animal Enclosure at MLRC**

**Squeeze Trap at MLRC**

## Discussion and Conclusion

The main causes for Leopard Man Conflict in Junnar is habitat fragmentation, translocation and release of leopards in new habitats without study of consequences, changes in cropping pattern due to development of irrigation facilities, lack of awareness among the people, inadequate technical expertise, funds and trained man power in forest department. Many of these issues can be addressed by collaboration with NGOs who are engaged in wildlife conservation. In the present case study Wildlife SOS enhanced funding and also provided expertise. Success rate indicates such collaborations are the need of the hour in the Forest Department.

There is need for further research and studies on leopard rehabilitation whenever new river valley projects are made; the terms of reference for Environmental Impact Assessment (EIA) should also include impact of project on man animal conflicts.

WILDLIFE

# Analysis of Artificial Salt Feeding to Wildlife in India, Its Impact and Consequences

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***Feeding artificial salt makes animal habitual and their natural instinct for finding salt and material will be lost after sometime***

## Introduction

Human has brought many unprece-dented effects on the nature and ecosystem. Overpopulation, manipulation of habitat has resulted in altered behavioral response for the wildlife. Altered response condition in wild affects number of animals and bringing undesirable changes. Impact may be so severe that can check evolution rate of animals. The forest department personnel are providing salt artificially to the wild animals in National Parks, Tiger Reserve, and WLS etc.

**Common salt kept on cut Trunk at Buxa Tiger Reserve**

### Why animals take salt

The mineral contents of these licking sites usually contains elements like calcium (Ca), magnesium (Mg), sulfur (S) phosphorus (P), potassium (K), and sodium (Na). Such licks are helping hands for the ecosystems with poor general availability of nutrients. It is believed that certain animals can detect calcium and other salts in salt licks. Many essential minerals are required for muscles, bone development. These elements are integral part of osmo-regulation, nervous system, circulatory system and synthesis of various components at cellular level. Some animals require the minerals at these sites not for nutrition, but just to neutralize the secondary compounds that are synthesized by the plants against herbivory.

### Salt feeding analysis

Feeding wild animals artificially may quickly cause problem. Feeding wildlife

**Natural Salt lick site (*Image source: Wikipedia*)**

may cause the spread of certain contagious diseases among the animals as they get crowded near artificial salt licking sites.

An over abundance of individuals in particular place result in habitat degradation and they will be concentrated into only one point and this may increase pressure on that particular site.

***The response due to artificial feeding are described below:***

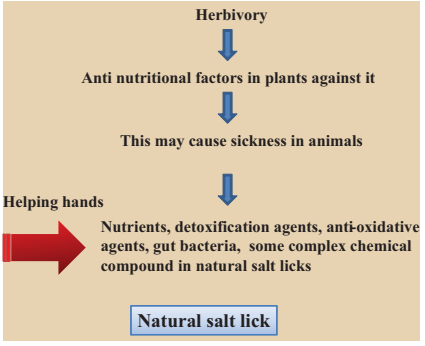
**1. Effect on Population dynamics:** Lubow and Smith (2004) said that density dependence may be reduced with consequences for population dynamics. Consequently, we expect that feeding would lead to a reduction in variance in population size.

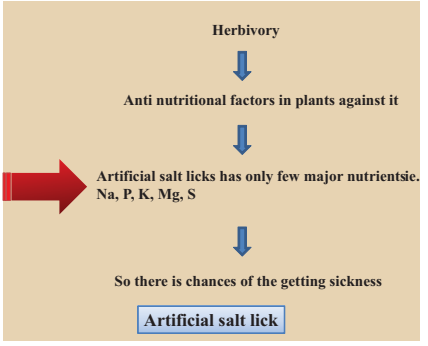
**2. Genetic composition of population and response to artificial selection:** Blanchong *et al*. (2006) found that feeding may affect the genetic structure of populations. Spatial homogeneity of allele frequencies was increased in supplementary fed white tailed deer with the loss of micro-geographic genetic structure normally associated with kin-structured social groups. Schmidt and Hoi (2002) suggested that feeding may also reduce selection pressures on nutrition-mediated traits such as overwinter mortality and reproductive success (Rodriguez-Hidalgo *et al.,* 2010) by buffering individuals against the effects of environmental variation.

**3. Reduced generalized health:** Wild animals need varied, natural foods as a part of their normal diet. Their digestive systems are adapted to extract energy from a variety of foods available throughout the seasons but it may go due to artificial feeding.

**4. Affect sexual selection:** Increased variance in male mating success affecting sexual selection.

**5. Altered behavior of animals:** As feeding leads to crowding and




crowding may causes stress in some animals ultimately generalized health of animals reduces. As feeding artificial salt makes animal habitual and their natural instinct for finding salt and material will be lost after sometime. Information goes on passing from one generation to others via communication and in turn this will change the habit of animals of finding natural salt licking sites.

**6. Impacts on vegetation and habitats:** Sustained heavy browsing or grazing, reduction in habitat or niche heterogeneity, species replacement may occur.

**7. Impacts on other taxa:** Feeding stations often attract non-target species.

## Conclusions

Natural system of salt feeding may be followed and the natural salt liking sites which are dead or dying should be revived. Salt licking sites should be away from the camps and human settlement.

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*Photo: Ladies with Fodder collected from Forest in Garhwal Himalaya*
*Credit: Abhilash D., IFS, Lecturer, CASFOS, Dehradun*

# FORESTS AND PEOPLE

FORESTS AND PEOPLE

# Gondwana Herb: From Forest to Market

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***Gondwana Herb is an attempt to take value added medicinal herbs to the market through branding of tribal knowledge related to health***

## Introduction

Gondwana as the name explains is the land of *gonds*. It is full of biodiversity where abundant medicinal herbs are present. Not only the medicinal herbs but many traditional health healers who know the value of this are there on this very land. This gives the scope for the birth of this project named Gondwana Herb.

**How Gondwana Herb came into to existence?**

Shri T.S.K. Reddy, IFS is the navigator of Project Gondwana Herb. He along with Mrs. Shrilakshmi Annabatulla, DCF started this project. Dr Prashant Bharne, with Forest Department through Gondwana Herb has registered 280 *vaids* (traditional healers) in the district to leverage their traditional knowledge and promote sustainable harvest through them. *Zillah Vanaushadhi Vaidya Mandal*, a federation of these *vaids* and local ayurvedic doctors is seeking support from various agencies for identification, sustainable harvesting, processing, storage and cultivation of important of NTFPs. District Industries Corporation (DIC) has conducted training in herbal products (processing of herbs to make *churnas*, cosmetics, etc.) in the district in collaboration with the above agencies. The current project will also help feed into the supply side for these production units.

**Gondwana Herb – Present scenario**

Forest Department has started the project of Gondwana Herb with the purpose of conservation of medicinal plants and to know its traditional utility.

The following activities are conducted here:

1) Total identification of flora of Gadchiroli district.
2) Development of Biodiversity Park.

3) Organization of *Vaidu* Sammelan.
4) Establishment of Medicinal plant processing centre.

**How they are doing it?**

JFMCs in various ranges are given the task of collecting these medicinal herbs under the guidance of *vaidus*. When they go for collection, another purpose of conserving the forest is also taken care of.

**Research and development component:**

- It is becoming a demonstration unit to find livelihood through different means.
- Model is getting developed for sustainable harvest of NTFPs, collecting and storing samples, dissemination of this knowledge and harvest technologies to the tribes.
- It is emerging as a knowledge sharing centre. Linkages are getting formed with S&T / R&D Institutes / NGOs / Industry for technical backup. IIT Bombay is a mentoring partner with the Forest Department of Gadchiroli.

**The global scenario of medicinal herbs**

In this age of technology where everything is being possible, medicinal

**Processing for product making**

Collection
↓
Drying
↓
Grading
↓
Processing (pulverizing/boiling/oil extraction)
↓
Packing and labeling
↓
Forwarding it to outlets

**Final material for selling**

system is not behind. Many new medicines and technologies are getting introduced everyday but still Ayurveda have its own place. Demand for herbal products worldwide has increased at an annual rate of 8% during the period of 1994-2001. According to WHO forecast, the global herbal market would be worth $5 trillion by the year 2050.

According to a research published in International Journal of Business and Management Invention, it is estimated that the annual total market for the product of Indian systems of medicine


**Gondwana herb storage and machineries**

is of the order of ₹ 5000 cores in the domestic market and around ₹ 500 cores in exports.

**The National Market demand**

The market for Ayurvedic medicines is estimated to be expanding at 20% annually. Sales of medicinal plants have grown by nearly 25% in India in past ten years, the highest rate of growth in the world.

To meet this global and national market demands and being competitive at par with the multinational and national companies Gondwana herb needs more analysis and some strategies need to be planned out.

**Problems faced with the solution obtained**

› **Problem:** The scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest rights) Act, 2006 created problem during collection of medical herbs by vaidus.

**Solution:** Identity card given to each *vaids*.

› **Problem:** Licensing of Gondwana herb project to manufacture the product.

**Solution:** All efforts are being taken from CCF level to the ground level with B.A.M.S doctor involved in it.

## Enhancement Strategies

1. Gondwana herb can work as a facilitator in marketing linkage. For this current demand, possible supply needs to be surveyed. It can provide hints for economic circulation of medicinal species in the preparation of scheme.
2. Growing, processing, value addition and all aspects of marketing need to be taken care of. Brand positioning is important realizing the consumer behavior.
3. Online availing of products can work as online shopping is on boom.

**SWOT Analysis of Gondwana Herb Project**

| Strengths | Weaknesses |
|---|---|
| 1) Raw material available.<br>2) The government is promoting medicinal plant cultivation under National Medicinal Plant Board.<br>3) Huge traditional knowledge available with *voids*.<br>4) Existence of small scale machinery.<br>5) Great market demand for herbal product.<br>6) Marketing outlet at 6 places in Maharashtra and online website.<br>7) Proximity to Nagpur (centre of the country) | 1) Very narrow band of value added products mostly churna and oil are given attention.<br>2) Licensing work is not completed.<br>3) Market linkage is not adequate.<br>4) Lack of knowledge about Quality Control. |
| **Opportunities** | **Threats** |
| 1) Better utilisation of traditional knowledge.<br>2) Employment generation.<br>3) More value added product can be prepared.<br>4) New national and international market can be identified.<br>5) Sustainable use of forest resources. | 1) Improper harvesting of medicinal herbs.<br>2) Lack of testing facility may affect the quality of products.<br>3) Great competition by other herbal companies like Patanjali, Dabur, Himalaya etc. |

4. From the already available data of herbs, a list of rare, endangered and threatened species if created can make future task easy in conservation and propagation work.
5. Mobile testing unit for keeping standard raw material would need lot of involvement from scientists in the field of Agriculture, Pharmacy, Botany and older folk from the traditional collectors, community and farmers.
6. Laboratory can be set up for testing of products at various levels.
7. Linkages with Traditional Knowledge Digital Library (TKDL) and Botanical Survey of India can make it more authenticated.
8. Monitoring mechanism right from collection of raw material to value addition and packaging and labeling can make it more qualitative and competitive product.
9. National Expert Agencies can be invited for partnership for more expertise.
10. To make the project more sustainable special purpose vehicle can be formed under Company Act where company will have right to facilitate, mentor, produce or manufacture any product.
11. Profiling of local diseases and drug demand analysis should be taken up.
12. The healers can be assessed and accredited through Indira Gandhi National Open University (IGNOU) for reliability.

## ACKNOWLEDGEMENTS

DFO, Gadchiroli.
Maharashtra Forest Department.

FORESTS AND PEOPLE

# Ramling Forest: Eco-tourism on the Trail of Success

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***Co-operation of the people in right perspective and analyzing the point of contention between forest management and villagers right from the beginning, addressing and resolving their issues can go a long way in the success of people centric Eco-tourism***

## Introduction

Success of any scheme concerning conservation and education in relation to wildlife and forest needs people participation. But it is very difficult to achieve it especially when the villagers are poor and dependent on forest. Especially when they are not sure of constant source of income as their main livelihood is on rainfed agriculture. One has to see the problem in right perspective and make a ground for implementation of any new project.

In this case study, the inception of eco-tourism in Shree Ramling Forest and its implementation with the help of Joint Forest Management Committees is discussed with an overall assessment of its success in prevailing conditions.

## Shree Ramling Forest Profile

Shree Ramling Devalay is situated at eastern part of Kolhapur district. The Ramling forest is 20 to 25 kms from Kolhapur. The Dewalay lies on 16$^0$73'06'' N latitudes and 74$^0$43'56''E longitude at an elevation of 591 meters above mean sea level. It consists of 207 hectare of reserved forest. The Ramling Dewalay is under administrative control of Territorial Range Karveer of Kolhapur Forest Division. The target is to implement the nature tourist plan during 2015 to 2020.

The forest area of Shri Ramling Dewalay is one of the oldest reserved forests, which is scientifically managed. The forest has a diverse habitat and is also very rich in fauna. The area is home to Teak (*Tectona grandis*), Saja (*Terminalia tomentosa*), Tendu (*Diosphyros melanoxylon*), Baheda (*Terminalia belerica*), Bamboo (*Dendrocalamus strictus*), Neem, Palash, Hirada, Arjuna (*Terminalia arjuna*), Mango (*Mangiferra indica*), Ficus spp. and other miscellaneous species.

The major non timber forest produce includes Tendu leaves, Mahua (*Madhuca indica*), Aonla (*Embelica officinalis*), Char (*Buchanania latifolia*), Honey, Medicinal plants, Sal seeds, Grasses, Mahua leaves (*Bauhinia vahilii*), Kulu gum (*Sterculia urens*), etc. The area is well known for wild animals like bovids, carnivores and avian fauna. The species found in the Ramling forests are Wolf, Hyna,

Porcupine, Monkey, Wild Ass, Cobra (*Naja naja),* Peafowl (*Pavo cristatus),* Peacock, Parrot, Bulbul, Eagle, Vultures, Rafters etc. This has been a most popular resort for wild life viewers in this region. The area is geographically very conveniently located, and has immense potential for wildlife tourism, conservation and education.

### Socio-economic status of forest dwellers

There is one forest village inside the Ramling forest. Villagers residing inside the Ramling forest depend to some extent on the forests though human pressure is comparatively low. These villagers were settled inside the reserve forest long ago as there was demand for laborers for forest workings (extraction of timber). Today each of the family who was settled has on an average 0.5 ha of agricultural land.

People are mainly farmers, they cultivate paddy as main crop, and some also grow wheat and vegetables as per their needs. Excess quantity of crop, if any, is sold in the market. The land holding is not sufficient for their needs, so they work as laborer. Few people are involved in bamboo basket making and brooms from grass.

People living inside and outside on the periphery of forest mostly depend on the forest for fuel wood, small timber, fodder etc. Thus the life support system directly revolves around the forest. In lean periods people are solely dependent on forestry works like collection of *Mahua* flowers, *Tendu* leaves, *Mahul* leaves, Aonla collection etc.

### The activities that threaten the flora and fauna are:

1. Grazing inside the forest area.
2. Illicit felling of trees and bamboos for sale.
3. Fire (during mahua flower collection).
4. Poaching for sale of skin, bones and meat of wild animals.

The above said activities of people can be traced to the following socio-economic and policy issues:

1. Poor agricultural productivity
2. Small land holdings
3. Lack of irrigation facility
4. Lack of electricity
5. Practicing inefficient animal husbandry methods
6. Lack of communication
7. Lack of income generating activities
8. Ban on timber, bamboo, firewood harvesting

### Establishment of eco-tourism network

The year 2002 was declared as the International Year of Eco-tourism (IYE). Tourism with nature is the fastest growing segment. The idea of nature tourism or Eco-tourism in Ramling forest was concieved from 2012. Kolhapur known as Dakshin Kashi has precious areas of forest and is the nearest tourist spot.

Taking into account the status of the reserved forest and considering the need of the people living inside it, the forest officials initiated talks with the JFM society of Ramling Forest for promoting Eco-tourism. This activity

had potential to generate revenue, which can benefit the rural communities of the area for upgrading their livelihood, which in due course help in forest conservation and education. Keeping their points in mind the forest department properly planned the Eco-tourism networking and active involvement of local people was sought.

**Selection of route**

The selection of spots for eco-tourism was such that it covered not only the forest areas and wildlife but cultural heritage and archeological sites were also included. Details of route and sites covered are given below:

Kolhapur - Karveer - Alate - Shree Ramling - Shree Dhuleswar - Kunthagiri - Kunthasagar.

## Description and importance of the places of visit

***Khidrapur:***

The village is situated inside natural forest. Khidrapur hill is 61 kms from Kolhapur. Kopeswar temple is a good nature trail.

***Nrusinhwadi:***

This place is situated at a distance of 47 km from Kolhapur. The Nrusinhwadi is famous for the Dattatreya temple.

***Ramling:***

Ancient Temple of Lord Shankar, Ramling is situated near Kolhapur. There is a stream flowing down the hill with *tur tur* sound. This place is of religious importance. There is also a small cave in the Ramling forest hill.

***Bahubali:***

There is an ancient temple of Jain religion called Bahubali temple. It is situated at a distance of 25 kms from Kolhapur. It was an important center of Jainism in 6$^{th}$ century

## Challenges & How they were Tackled

Before initiating tourism there was a need to build infrastructure and seek villager's cooperation. For this first a tourism route was identified and developed. For this money was sought from Government of Maharashtra and people of nearby city were given the work of upgrading roads.

This has generated employment to the local people. Then the State Government provided funds for repairing and furnishing the tourist huts which were actually old government buildings. This activity again provided employment to the villagers. A fund from District Administration was provided for development of water holes. In this way money was pooled for development of the Ramling as tourism spot.

Employment generation through above activities motivated the JFM

Main Entrance of Ramling Devalaya

committee members for providing co-operation. They came forward to take responsibility of managing tourist's transportation. Selected members were trained for undertaking above activities at local level. Some local youngsters were trained as tourist guides for Ramling forest.

### Tours and Facilities

The JFM committee members provide accommodation and camp arrangements. At Alate, Ramling there is an eco-center where there is infrastructure for training villagers in forestry and other income generation activities. The facilities available are utilized for sensitizing tourists about forest department's work. Then the tourists are taken to Ramling Forest hilltop through reserve forest and night halt is made in tourist huts. The tourist huts are now maintained by the JFM committee members.

In the evening, tourists engage in discussion on their wildlife sightings with forest officials. Also tourists enjoy

Eco-hut and Resting Place

Children Playing Area under Construction

Walkways under Construction

cultural activities and participate in Karma and meditation at Kunthugiri and Bahubali temples.

In this eco-tour the tourist get the feel of natural forest, reserve areas and cultural heritage sites. They are sensitized to the diverse values of nature and are motivated towards conservation.

## Achievements

Today tourism has started generating revenue to the common people, which earlier was going to outside people. Villagers get market for sale of handicrafts, honey, bamboo articles, grass articles etc at their doorstep. Local youngster get employment as guide, driver, cook, caretaker etc.

It has been seen that incidents of fire, timber theft and cases of poaching have come down since the tourism started. Upgradation of forest roads has aided in frequent movement. Information network and monitoring of waterhole and wildlife has become more effective after introduction of feedback information, which is collected from the visitors. The guides are acting as effective tool in conservation education. Littering inside the sanctuary is checked by them. Thus the eco-tourism has started giving fruitful results.

## Future Plans for Sustaining and Improving the Eco-tourism

For making the tourism and conservation sustainable there is a need for assessment of present situation and planning for future depending on the needs. Some of the future requirements are as follows:

1. Guides and caretakers should be trained to take care of foreign tourists.
2. Accommodation and other facilities need to be upgraded for promoting international tourists.
3. Wildlife sightings can be increased by habitat development.
4. An Interpretation Center and a Natures Trail are planned in near future.
5. Marketing of more of local handicrafts is being ensured.

6. Establishment of facilities like post office, telephone facility, primary health Center, increase in bus service etc. can uplift the region.
7. Studies on habitat, waterhole utilization are being planned.
8. Villages are still largely dependent on the forest for meeting their basic requirements of fuel wood. Therefore providing alternatives is a priority.

If such management concept is to be successfully adopted as major conservation strategy for the future, it is necessary to re orient and train villagers and forest staff in the right direction. This will make the difference between success and failure.

## Conclusion

The concept of eco- tourism has taken roots in the Ramling Forest. It is expected to give good results. This article attempts to present an overview of efforts done by Forest Department, in implementation of eco-tourism in the Ramling Forest. The objective of this initiative is not only to enable the local people but also to motivate visitors to learn about the local environment and culture. This process will create employment, improve standards of living, by stimulating the local economy and provides incentive for conservation.

## Summary

Implementation of any such scheme concerning tourism, education and conservation of forests and wildlife with the people is very difficult. It is necessary to identify right people for this type of specialized work. This paper provides information that how inception of Eco-tourism in the Ramling Forest took place. There is a need to take cooperation of the people in right prospective and analyze the point of contention between forest management and villagers right from the beginning, addressing and resolving their issues can go a long way in the success of people centric Eco-tourism.

## Acknowledgements

DFO and Field Staff.

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FORESTS AND PEOPLE

# Trekking for Forest Conservation

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***The benefit to local forest dwellers and nature conservation should be our prime objective and not the mere offshoots of trekking***

## Introduction

Conservation through people's participation is a need of today's era. In this view, eco-tourism is playing a vital role through its two important stakeholder's *viz.*, local people and common civilians. Local people get benefited in financial terms via eco-tourism and their dependence on forest decreases to a large extent. While on the other hand common civilians become sensitized towards nature conservation when they become part of eco-tourism as a tourist. Forest Department is needed to act as a connector between these two communities.

In view of above mentioned facts, a trekking event was organized by Vyara Forest Division (Gujarat), which was named as Trekking Festival-2017 during the monsoon months in 2017. The event had various objectives like spreading awareness on environment, floral and faunal diversity, importance of conservation of natural resources, strengthening the activities of JFMC and providing adventure opportunities to participants.

A total of 10 treks (on 10 Sundays) constituting various forest types were finalized. A cumulative of 8 falls, 6 temples, 33 mountains, 13 river crossings were incorporated to make the excursion exploratory. A comprehensive appreciation was accredited from the participants, especially nature lovers, print and electronic media and NGOs.

### Trekking Festival-2017 Campaign

A registration form was created using the Google form and registration link was shared via WhatsApp. The whole campaign process was paperless with Zero budget.

In the link, all the information and instructions about Trekking Festival-2017 were provided and required personal details were collected.

### A Digital Initiative for Registration Process

The main aspect of this initiative was that the whole process was paperless. In addition to this, Google maps and GPS location services were used accordingly. Registration process was made available via mobile / smart phone / computer / laptop with help of Google Form

service. A copy of the registration was acknowledged via e-mail too. Approximately 60,000 people received the details of the event through social media as a part of advertising campaign with zero budget. More than 7000 registrations were received.

**Use of Digital Technology - Salient features**

1. Registration link was created by using Google forms.
2. Use of social media - WhatsApp, Facebook for promotion.
3. Digital photo competition was organized using G-mail facility.
4. Attractive digital certificates were prepared using CorelDraw and delivered to participants through e-mail.
5. Photo sharing facility was provided in Google drive.
6. Feedback was received through Google forms.
7. Videos on Vyara Trekking Festival-2017 were uploaded on Youtube by participants.
8. Experiences were shared on Facebook by participants.
9. Blogs on Vyara Trekking Festival-2017 were created by participants.
10. Vyara Trekking Festival registration link was uploaded by Gujarat Forest Department on its website.

The uniqueness of this event was that people of diverse age group participated and no fees were charged. An assemblage of like-minded people who participated in the event formed an organization to extent aid to the local tribal people which was later named "*Helping Humanity Club*".

**Other aspects of Trekking Festival-2017**

Alongwith enjoying the beauty of forest, the trekkers shared the knowledge that they gained from the


**Digital Certificate**

Forest Department personnel and resource persons experts in varied fields like in medicinal plants, birds, herpetofauna, *etc.* on various social networking sites which contributed to mass awareness. The youth were motivated for forest conservation and thereby contributing to nation development, not to mention the personal health benefits. Simultaneously, local people were benefited with the income generated through the JFMC activities during this festival. The relation between villagers and Forest Department got strengthened, which lead to significant positive impact on protection measures. As these treks were organized on Sundays only, the holiday was transformed into a celebration. A total of 2740 people participated in 10 different routes.

**Success of Trekking Festival-2017**

1. Total 2740 Trekkers from entire Gujarat State gained benefits from this event.

**Trekkers were given attractive T-shirts with attractive logo**

2. More than 7000 people had registered, which can be a very good data bank for the upcoming programmes of Forest Department and for promotion of conservation activities, using digital / social networking platforms.
3. More than 500 people joined the '*Helping Humanity Club*' for the development of forests and helping tribals residing in forest areas.
4. A platform (a folder) was created on Google Drive, so that participant can share their Forest/trekking photographs.

**Feedback System**

A feedback link had been created using Google Forms which was sent through WhatsApp and Gmail. Trekkers shared their good experiences on Facebook also. Many positive feedbacks were received from Trekkers. Majority of trekkers were satisfied regarding trekking festival, especially the selection of trekking routes, digital registration process, attitude of forest staff, nature education initiatives, digital certificates, support of JFMC, *etc.*

**A New Dimension to Serve People - *"Helping Humanity Club"***

Through the sensitisation received during the Trekking Festival-2017, the Trekkers, with the usage of varied professional backgrounds, ameliorated to mold into a cluster group for the upliftment of the needy local inhabitants, mostly tribal. More than 500 participants became members in this club, which was later named '*Helping Humanity Club*'. Following campaigns, in order to employ the locals in mainstream conservation and to decrease their dependency on forest resources, are under pipeline with regard to this club:

1. School Result / Education Improvement Programme
2. Career Counselling Programme
3. Teacher's Training Workshop
4. Youth Skill Development Programme.


5. Medical Camp
6. Counselling Programme related to Pregnancy Issues
7. Livelihood Enhancement Programme
8. Counselling Programme for improvement in lifestyle of Villagers
9. Agriculture Improvement Camp
10. Documentation of the Traditional Knowledge of Villagers
11. Small Village Adoptation Programme
12. Enhancement of Tourism and Hospitality Management ability among villagers

**Future Strategies of the Department**

Based on suggestions provided by Trekkers, the following activities will be undertaken by the Vyara Forest Division in future:

1. Night Camping (2 days, 1 night)
2. Forest Awareness Camp
3. Plantation of 1 lakh saplings by trekkers in next festival

**Positive Outcomes**

Lunch was arranged by the local JFMC and thus the employment opportunities were created for the villagers. Members of JFMC availed the opportunity to sell some agricultural products like maize and some artifacts made from bamboo, *etc.*

Trekkers were given forest conservation lessons by the Forest Department and they were committed to contribute for this purpose. Participants were given information regarding various aspects including animals, insects, birds, medicinal plants, importance of forests, conservation of water, use of minimum plastic, its recycle, *etc.*

With the grand success of the Trekking Festival here in Vyara, and seeing the outcomes in terms of Nature Conservation and its potential to generate alternate livelihood amongst locals, other Forest Divisions have also replicated the model.

**Overcoming the Intimidations**

In spite of utmost care taken during the event, there are potential threats that cannot be denied. As reserve forest cannot be labeled as tourism destination,

highest degree of precautions need to be undertaken in order to prevent the damage to nature and wildlife. There should be a cap on intensity of such activity by adopting a controlled tourism module in future endeavors. The benefit to local forest dwellers and nature conservation should be our prime objective and not the mere off shoots of trekking.

## Acknowledgements

Sh. D.K. Sasikumar, IFS.
DCF Vyara Forest Division.

FORESTS AND PEOPLE

# Evicting the Encroachments: A Friendly Approach to Conserve Forest Land

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***Implementation of law and order is not an easy task especially in the protection and conservation of forests***

## Introduction

Kalamba village is situated in Sakri taluka of Dhule district. This village lies on boundary of Dhule, Nandurbar and Gujrat. Most of people are tribal having agriculture as their primary occupation. The literacy rate is very less in this village. The total forest area of Pimpalner Range is around 26000 ha out of which Kalamba village has 200 ha of forest area. The forest type is of dry tropical forest. Many tribal people are engaged in MFP collection like honey and Mahua. A successful removal of illegal encroachment from Kalamba village was done by the Forest Department. The core part of this removal was awareness created among people of that village and successful participation of villagers in patrolling. No legal case was filed against the encroachers to avoid unnecessary conflicts. The forest officials gained the trust of encroachers which helped to stop such activities.

### History of Encroachment

Forest department received a complaint from some educated villagers about encroachment being done by a group of villagers in forest area by felling trees, clearing shrubs and grasses. Those villagers were doing encroachment in groups and they were also encouraging others to do so. These people were resorting in such activity because they were told that if they encroach such land then they will be getting an ownership right over that encroached land. They were clearing the forest land by removing trees, shrubs, grasses with axe, sickle etc. These people were clearing the forest land in square shape and practicing ploughing, harrowing for crop production. Whenever forest official resisted such activity, they used to say that they were tribals and believed to have an ownership right on forest land since many generations.

Upon detailed enquiry, it was learnt that one particular person in the village was influencing the people to encroach the forest land, assuring them ownership of such encroached land in future. Under his influence the villagers in spite of having their own agricultural land resorted to encroachment for getting additional piece of land.

**Measures by Forest Department:** Once the forest department came to know that the people were influenced by a person, Mrs. Minakshi Jogadande, RFO decided to deal with this problem in a different manner. She persuaded the illiterate villagers in a positive way and made them aware about laws and importance of forest.

Steps taken by RFO are enumerated below:

1. Mrs. Minakshi Jogdande RFO held a meeting with Sarpanch of Kalamba village and arranged for conducting awareness programmes in the village about environment and forests.
2. In sensitive areas patrolling was started with the help of Round staff, Range staff and retired army persons.
3. The awareness was also created with assistance from Joint Forest Management Committee members of other nearby villages.
4. A legal offence case was also filed against the fresh encroachment.
5. RFO also participated in awareness programme. She explained to the people about general laws governing forests, procedure for land ownership and penalties for encroachment offences.
6. She successfully convinced the people doing such illegal activities and also assured that a JFM Committee will be formed in the village for their welfare.
7. Subsequent to the initiatives taken by the RFO, the Grampanchayat held meetings to create awareness among people about protection of forest.

## Discussion

This case study of Kalamba village highlights that the forest department can protect and conserve forests in a better way by a combination of involvement of people in forest conservation and enforcing the forest laws. The case study shows that the RFO instead of directly resorting to prosecute the encrochers adopted a

**RFO addressing the people about encroachment**

**Villagers and forest officials removing encroachment**

**Villagers doing plantation in encroached land**

innovative approach of educating and persuating people to resist from illegal activities. She had diagnosed the root cause, which is vested interest, who were misguiding the illiterate villagers and realized that such vested interests have to be countered by positive propaganda. The results were astonishing. Instead of legal confrontation between the department and the villagers, a situation was created wherein the villagers abandoned their illegal activities and got convinced about the importance of forests. They started participating in forest conservation. This case study emphasizes that a

combination of persuasion and enforcement can achieve greater results than resorting to enforcement only.

## ACKNOWLEDGEMENT

I am heartily thankful to Shri Anarase, DFO, Dhule Forest Division and Mrs. Kulkarni, ACF, Dhule Sub Division for their kind support and guidance. Special thanks to Mrs. Minakshi Jogdande, RFO, Pimpalner Range for her assistance throughout the case study.

FORESTS AND PEOPLE

# People for Forest: Rampuri JFMC

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***Rampuri JFMC of Gujarat shows that it is possible to involve the local communities as primary stakeholders in natural resource management***

## INTRODUCTION

In the largest democracy of the world that is India, Joint Forest Management (JFM) is one of the extension of democratic way of functioning in the sphere of judicious utilization of forest resource. JFM is an approach and program initiated in the context of the National Forest Policy of 1988 wherein state forest departments facilitate local forest dwellers and forest fringe communities in protecting and managing forests and in the process share the costs and benefits from the forests.

Communities organize themselves into a JFM Committee to protect and manage nearby forests, guided by locally prepared bye-laws and micro plans. The key element in JFM is that communities have the power to manage the use of forests by members and also exclude non-members. The benefits to them is direct access and control on the use and sale of most NTFPs and a share in the income from timber as well as other intangible benefits from local ecosystem services-like water recharge, pollination, wildlife habitat *etc.* Thus involvement of communities in conservation of forests and wildlife is of paramount interest. It is the platform on which Forest department and local villagers stand together and take decisions as to how the forest resources can be managed in a sustainable manner.

The National Forest Policy of 1988 spelts out clearly that communities are central to forest protection and management. The policy led to the JFM Circular of June 1st 1990, and the subsequent 2000 and 2002 Guidelines, which provided the framework for state level rules, resolutions, and guidelines for JFM. The Panchayati Raj Act, PESA, and the FRA of 2006 further expanded the rights and responsibilities of local communities.

Gujarat has a long tradition of involvement of people in the protection of forests. Joint Forest Management is being implemented in the Gujarat State vide Resolution of Forest and Environment Department, Govt. of Gujarat No FCA-1090-125-V (3) dated 13/3/1991 and Resolution of Forest and Environment Department, Govt. of Gujarat No. FCA-1090-125-K (Part-3) dated 27/6/1994. The first Resolution highlighted the responsibility of the village

organization in the protection of forest land from unauthorized encroachment, illicit cutting and grazing. This resulted in very good results in raising forests and conservation and has been accepted widely by the people. For further extension and consolidation, it was decided vide Resolution of Forest and Environment Department, Govt. of Gujarat No. JFM-1005-191-G dated 17/12/2005 that, JFM would be extended to good forest areas having tree densities above 0.40 in addition to degraded forest areas.

**JFM in Aravalli Division, Gujarat**

Aravalli division is situated Northern most part of the Gujarat at 24'083"N to 73'0414"E Latitude. It shares borders with Rajasthan in North. The Aravalli mountain range passes through it and extends towards Rajasthan. Total geographical area of Aravalli district is 3308 sq km while 587.71 sq km area is under forest. It is a hilly region and tribal villages are pre-dominant. In this division, a total of 291 JFMCs have been formed and a total of 21351 ha. forest land is managed by these committees. In Gujarat Forest Department the arrangements to work are provided in Gujarat Forestry Development Project (GFDP) and Forest Development Agency (FDA). The institutional arrangements have been setup in Aravalli division.

**An Exemplary JFMC Village**

**Rampuri:** The village Rampuri situated in Aravalli District of Gujarat, comes under Bhiloda Range of Aravalli Forest Division. The village is 7 km from Bhiloda. It is a 100% tribal village. The village has 103 families with a population of 430. Among them, 170 are male, 146 are female and 114 are children. The percentage of literacy is only 24%.

The total area of the village is 655.79 ha. out of which 50.60 ha is Waste Land, 300.93 ha is Irrigated Land , 304.26 ha is forest area which contain 46.40% of total area of village, so mostly area of this village comes under forest.

Forest area on the fringes of the village is Dry Deciduous Forest where the species like Timru (*Diospyros melanoxylon*), Dudhikada (*Wrightia tinctoria*), Dhavada (*Anogeissus latifolia*), Sag (*Tectona grandis*), Kada/Indrjav (*Holarrhena antidysenterica*), Khakharo (*Butea monosperma*) are dominant tree species and in many species of grasses like *Sorghum halpense, Apluda mutica, Themada triandra etc.* occur naturally in this forest area.

On February 12, 1999 Mr B.D. Makwana, Forester, conducted a meeting of villagers of Rampuri and explained the importance of JFM as well as encouraged them to establish the JFMC (Joint Forest Management Committee). After much persuasion and follow-up by the forester, the villagers established JFMC and elected and executive body on 29th March 1999. In the 11 member executive body among them there is one Chairman, one Vice-chairman, four male members, three female members along with Forester as Member-Secretary. Gram Sevak of the Gram Panchayat also acts as a member of the Executive Body.

The area of forest survey number 220 is 304.26 ha, out of which 210 ha is handed over to the JFMC for protection purposes. The villagers decided to start the work of plantation in rainy season of 1999. As preparation, in April 1999, the villagers dug 15000 pits. The rate of pit digging was 3.02/pit, but the villagers gave this work to JFMC at the rate of ₹ 1/pit and on 30th May 1999, JFMC opened the account in the Bank and deposited ₹ 15000. From voluntary work time to time they deposited money in the Bank account. Which uses earned from the projects like cement nala bund, loose boulder structure, Gabian structure, vermi-compost, Vanbandu - Kalyan Yojana *etc.*

The Rampuri Dharihor Dungar Vriksh Uchher Committee and Samvardhan Mandali was registered on 13th June 2001 under Society registration Act. This village was included in the Forest Development Committee, Aravalli division, Modasa in 2007-08. Memorandum of Understanding (MoU) was made between Forest Department and Van mandali was

**Grass collection by JFMC members**

**Soil and water conservation structure built by JFMC**

allotted 210 ha of Forest land for the purpose of livelihood activities. Mandali's members have got the different rights in this area such as, Collection of firewood, NTFP, small Timber and Grass.

Mandali Members are harvesting grass from a Forest Area of 127 ha in a Sustainable manner, Mostly the grass is used for domestic cattle the population of which is around 1200. This Mandali has collected 314000 kg of grass in the

**Vermi-compost unit of JFMC**

**Dhav-collection**

**Fuel Wood collection**

**Agarbatti work**

**Tailoring work**

year 2015-16, which valued approximately 15,70,000. Milk production of this village has increased due to increase in supply of grasses from forests.

**Soil moisture conservation:** Four cement nala bunds, 34 loose boulder structures as well as 13 loose boulder bunds were built in the last 2 years (2015-16). Because of this work, soil erosion decreased visibly and according to the farmers, water level of their farm wells increased.

**Vermi-compost production:** Villagers used vermi-compost for organic farming and collected ₹ 25,000 by selling surplus vermi-compost. In local market the retail price of 1 kg vermi-compost is ₹ 12. The bed size of vermi-compost is 12x4x2 meter. One bed vermi-compost contain 800 to 900 kg.

**The financial position of the JFMC-Rampuri**: The saving account of JFMC had an amount of ₹ 3,50,580 as on Feb 2012, out of this they deposited ₹ 2,00,000 as Fixed deposit With the accrual of interest, the total amount of fixed deposit on 31st March, 2016 was ₹ 2,49,976. Again, the JFMC put the amount in fixed deposit and the interest is being earned on a continuous basis.

**Self Help Group**: In this village, seven women SHGs and one men SHG are working. Forest Department provides them ₹ 30000 as revolving fund under Gujarat Forest Development Project from which ₹ 15,000 is the lending money and remaining ₹ 15,000 is in the form of Grant to each SHG. Every SHG collects monthly pre-fixed amount from their members and this goes to extra revolving fund from which they lend money to the needy to carry out small scale business activities like vermi-composting, Sericulture, Mahua (*Madhuca indica*) doli oil extraction, purchase of cattle, Purchase of seeds for agriculture etc. In another sense it is the Micro Finance unit of the village and which has very effectively released the marginal farmers from the clutches of 'SHAHUKAR' system and has great impact on socio-economic aspects of the local community.

**Some of the special developmental activities carried out by the Rampuri JFMC**: Ericulture is a technique of Nursing Eri Silkworm on the leaves of Castor, which is a major crop of this Tribal area. A total of 30 members of JFMC were trained in Ericulture. The Trainees were paid ₹ 45000/- as stipend. After training the one cycle of Ericulture, the average production of Coshato of silk was 20 kg/beneficiary and they could sell the produce at the rate of ₹ 50/kg.

Under the 'Project Sunshine' of Van Bandhu Kalyan Yojana during the monsoon of 20012-13, agriculture kits were distributed to 147 beneficiaries at the rate of ₹ 500/-. The kit was containing 50 kg urea, 50 kg DAP, 50 kg Potash and 10 kg Hybrid Seeds of Maize. During the winter of 2013-14, agriculture kits were distributed to 50 beneficiaries at the rate of ₹ 500/-. The kit was containing 50 kg urea, 50 kg DAP and 10 kg Hybrid Seeds of Maize.

Similarly during the winter of 2010-11, 80 kg Vermi Compost was distributed

Decoration set, Utensils set and Watertanker

Milch cattle

Mahuda oil (seed) Extracting Unit and Masonary work kit

to 50 beneficiaries. Due to this project, agricultural production has increased by 100% in the area. Previously the normal production of Maize was 2500 kg/ha. The productivity increased to 4800 to 5000 kg/ha after the implementation of the project.

### Eye-catching features of JFMC

**Protection system:** Initially the women of JFMC appointed two watchmen for the protection of forests. The salary of these watchmen was being paid by collecting ₹ 10/family/month. After two years they found it more practical to do

**Exposure trip to Chhota Udepur JFMCs**

the protection job themselves. They formed small groups of 4 to 5 women and started protecting the forests regularly. They found that illicit felling was taking place during night and therefore they requested the male members to accompany them for night patrolling.

**Entry Point Activity and Economic Support Activity:** Under GFDP, Decoration sets, Utensil sets and Water tanker were provided to JFMC under entry point activities. These sets were given on rent to other local people. These activities have earned ₹ 45,000 during current year to the JFMC. ₹ 5,00,000/- was provided to 35 SHG members. They purchased 35 Milch Cattle, They get 15 litre milk/day/cattle and earn about ₹ 450/day *i.e.* ₹ 13,500/ month/domestic cattle (₹ 1,62,000/year).

Mahuda seed oil extraction Machine was provided to JFMC. The Rampuri Forest areas and private lands have large number of Mahuda trees (*Madhuca indica*). Processing of the Mahuda seed and flowers require this type of Machine to generate more income to local people. Masonary Kits provide employment to land less people. 11 beneficiaries were provided masonry kits under Vanbandu Kalyan Yojana.

**Training and Exposure Tour:** Under GFDP, and Vanbandhu project local JFMCs and SHGs members were given Training for economical support activities and exposed to successful JFMCs and SHGs through tours.

**Condition of forest area handed over to JFMC:** The forest area is protected by the JFMC. The number of forest fire incidences are rare now. Because of controlled grazing, natural regeneration is good. At the district level, the village was awarded ₹ 25000/- for being the best JFMC in the district.

**Limitations:** The literacy rate is very low and there is lack of interest in education in the community. There are many instances of conflicts among committees as well as within the committee. Some members of JFMC lack responsible attitude towards their duty of forest conservation and only concerned about their own business. Forest conservation and Ecological benefits of the forest is not well

understand by the people and material benefits areal ways given importance. Therefore, the JFMCs are not yet able to fully discharge their responsibilities towards conservation of forests.

## Conclusion

However, at a broader view the case study of JFMC of Rampuri shows that it is possible to involve the local communities as primary stakeholders in the natural resource management. The future depends on overcoming the limitations and constantly evolving towards sustainability of resource use.

## Acknowledgement

I wish to express my heartfelt thanks to the DFO and the staff of Aravalli forest division of Gujarat state for rendering help and guidance during the case study.

FORESTS AND PEOPLE

# Van Gram : Forests for Water and Prosperity

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***Hivare village showed a dramatic change in water availability from being a water scarce village to water surplus village through efficient water management and afforestation activities over a period of time***

## Introduction

Hivare village is known for being the first ***"Van Gram"*** of Maharashtra where the ownership of forest land was given to villagers as per section - 28 of the Indian Forest Act, 1927. It is located in the rain shadow area; the average annual rainfall of last 5 years was around 700 mm in tehsil Koregaon. Hivare has a total of 875 ha farm land out of which around 600 ha is arable. The population of Hivare is around 2500 and the prime source of income is farming.

Hivare is now reaping economic harvests of water conservation, forest conservation and pasture land development. The land under irrigation and the ground water level in the vicinity has increased which has in turn increased the average income of villagers. Diversity of plants found in the forest area of Hivare attracts the researchers. Village development and villager's empowerment activity are being carried out. Special area of focus is education through development of school facilities.

Village's Custard Apple plantation project was the unique project which grows 5500 Custard Apple trees in 33 acre Pasture land, with modern drip irrigation equipment. In future, villagers are planning to start Food Processing Industry and get into AGRO tourism business.

Visionary Sarpanch Ajit Khatal and his young team has the basic agenda of development which would enlighten the village in the path of self-sustainability.

**1) Afforestation:** In the year 2013-14, plantation was carried out with 33030 trees on a 30 ha land and during 2015-16 plantation of 27525 trees on a 25 ha forest area was done. This was done by People's Contribution which was 10% and the remaining 90% of cost of plantation contributed by forest department. The success rate of plantation was more than 85%.

**2) Soil and Water harvesting works:** To increase the ground water table, *in-situ* soil and water harvesting structures were constructed from top to bottom in the hills around the village under different government schemes. The structures like cement check dams, wells and earthen embankments were

**The following table shows the seven important aspects in which the people of the village worked with the support from the Forest Department:**

| | |
|---|---|
| Afforestation program (JFMC) | 55 ha area |
| Soil and water harvesting structures (National Watershed Program, peoples participation) | 1) Earthen bunds 2) Forest pond 3) Check dam 4) Series of percolation dams 5) Staggered trenches 6) Compartment bunding 7) Deep continuous contour trenches |
| Fire protection (youth participation) | Fire line |
| Protection of wild animals | Water hole |
| Substitute for fuel wood | Free gas connections |
| Awareness program | Visits to successful sites |
| Awareness through student participation | Vruksha dindi / ralley |
| Grazing measures | Trench cum mount structures |

also constructed with substantive contribution and involvements of NGOs and village people.

**Deep continuous contour trenches:** During March to June, 2013, a total of 13500 metre length deep continuous contour trenches were constructed.

**Earthen Check Dam:** A series of seven big check dams were constructed by Forest Department upto the year 2017 in the village forest.

In watershed program, the village first focused on drinking water requirement. The watershed program helped to improve the water level in the

**Custard apple plantation**

**Series of percolation dams constructed (February 2009 to March 2016)**

**Well constructed by people participation**

**Water hole for wild animals**

wells and also in farms to provide 12 months water for cattle. Similarly several small cement dams in series helped to store water at each level. Staggered trenches helped to reduce velocity of runoff water, increased percolation of water and checked soil erosion in the area.

The participation of people through Joint Forest Management Committee, voluntary participation, soil and water conservation measures under taken have yielded good results. The forest department played a vital role as a facilitator, partner and supporter. This village was selected under Sant Tukaram Vangram Yojana and secured 98 marks out of 100 points.

The Hivare village was given ownership of the forest land by the forest department based on following parameters:

1) Successful plantation activities on forest land with higher survival percentage.
2) No grazing of cattle on forest land.
3) No encroachment on forest land.
4) Effective measures on to check spreading of fire.
5) Good participation in Joint Forest Management Committees.

In June 2014, Kolhapur Circle started the process of giving full ownership of forest land to this village. Hivare village got honour of first village forest in Maharashtra. Maharashtra State Forest Department gave the ownership of 216.88 ha forest land to the village under the provision of Maharashtra State Village Forest Rule, 2014.

As a result, the villagers got full right over the income and products from these forests. The performance of the village in managing the forest has been satisfactory. Maharashtra is one of the first states in the country to handover the ownership of piece of forest completely to a village, in this manner.

Hivare village was selected as residential training centre for the participants of Amir Khan's "Paani Foundation" and hosted training of the participant's village in 'Satymev Jayate Water Cup". More than 50 participant

**Plantation done by villagers**

**Check dams storing water in the village**

Grampanchayats and more than 250 individual participants got training in Hivare's training centre from Paani Foundation team.

## Discussions

Although there is provision in the Indian Forest Act, 1927 for formation of village forest, there are not many examples of successful village forests in the country as on today. The Hivare village forest is an exception.

The works carried out by the people of the village in protection of forests and in conservation of soil and water through participatory mode is exemplary. The responsibilities shown by the people was rewarded by the forest department by transferring the complete ownership rights to the villagers. Hivare village is an example of absolute trust between the forest department and the forest ecosystem people. The supporting and facilitator roles played by the NGOs is also praise worthy.

This village is not directly depending on forest for their livelihood, but they protect forest as it serves as a source of water for their agriculture production. The Van Gram concept inculcated a sense of responsibility, sensitivity among the villagers towards the forest conservation.

FORESTS AND PEOPLE

# Success of Jalyukt Shivar Yojana work in Barshi Range of Solapur Forest Division

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***Jalyukt Shivar Yojana aims at initiating permanent measures to make the state drought free by 2019 and to harvest rain water within the village boundary thereby increasing ground water levels***

Water is important because it is essential to life on the earth. In Maharashtra state nearly 82% area of state falls in Rainfed sector and 50% area is drought prone, uncertain, insufficient and irregular rainfall pattern adversely affects human life, development activity. The state government's project 'Jalyukta Shivar Abhiyan' started on January 26, 2015 setting targeting 25 lakh hectares of land under irrigation in three phases between 2015 to 2018. The objective was to look into long term measures to mitigate drought with help of integration and convergence of various schemes implemented by various departments and pulling funds from all resources like Central, State, NGO, People's participation etc. under the programme. It is found that due to Jalyukt Shivar Abhiyan in Barshi range of Solapur forest division rainfall runoff, soil erosion declined and recharge of ground water level and water storage capacity also increased under irrigation area.

## Introduction

Maharashtra is the third largest State in Union of India considering population as well as area. The rainfall varies from 400-6000 mm. Nearly 148 tahsils are drought prone and incidents of farmer's suicide have become very common in these regions. Solapur lies in the rain shadow region of western Maharashtra and average rainfall 300-400 mm. Solapur is known as scarcity zone of Maharashtra. The state government of Maharashtra has launched a new programme named 'Jalyukta Shivar Abhiyan' in a state on January 26, 2015. The programme aim to make 5000 villages free of water scarcity every year. This scheme aims at initiating permanent measures to make the state drought free by 2019 and to harvest rain water within the village boundary thereby increasing groundwater levels. Therefore, the government focused on issue of development and strengthening of existing water sources for that Jalyukt Shivar Yojana implemented. Forest

department, agriculture department, revenue department and local people under voluntary activity involved in soil moisture conservation work. Different types of work carried out under Solapur forest division in Barshi range such as loose boulder structure, earthen bund, gabion structure, continues contour trenches etc.

**Necessity and Main Objectives of Programme:** There is a need to recharge ground water and create decentralized water bodies to overcome the water scarcity problem in rainfed area of Barshi range.

**Main Objectives of Programme**

I) To arrest maximum runoff in the village area.

ii) To create decentralized water bodies.

iii) To increase groundwater level in drought prone areas.

iv) To encourage people for tree plantation.

v) To create new structures of water conservation in the State.

**Jalyukt Shivar Abhiyan work in Barshi range of Solapur Forest Division:** Solapur comes under Pune circle and in this region around 903 villages Jalyukt Shivar Abhiyan work started and number of works started are 34026. In these work includes soil moisture conservation structure such as Continuous contour trenches, deep continuous contour trenches, loose boulder structure, gabion structure, deepening and widening of streams, construction of cement and earthern bunds, work on Nallas and digging of farm pond. This project is carried out by various agencies like forest department in forest lands, revenue department in revenue land and agriculture department in the agriculture land.

In the Barshi range of Solapur forest divisions activities done by forest department under Jalyukt Shivar Yojana such as: 1. Soil moisture conservation works and 2. Tree plantation.

Plantation work carried out under Jalyukt Shivar Yojana includes species such as *Acacia catechu, Azadiracta indica, Gliricidia maculate, Hardwickia binnata, Tamarindus indica, Samania saman* etc. Plantation is done on barren land, road side, forest land by forest department and also scattered plantaion done in some villages of Barshi range such as Chikharde, Chincholi, Tandalwadi, Pandhari, Ukkadgaon etc.

**Impact of Jalyukta Shivar Abhiyan in Barshi range:**

**1) Increase in ground water level**: The water harvesting structures play a key role in storing water and allow sufficient time for water to percolate into ground. Increase in ground water table in Barshi range it is a measurable

**Table showing Jalyukt Shivar Yojana SMC work in 2015-2016 in Barshi range**

| S.No. | Soil Moisture Conservation Structure | No. of Work |
|---|---|---|
| 1. | Loose boulder structure | 9 |
| 2. | Continuous contour trenches | 3 |
| 3. | Deep CCT | 5 |
| 4. | Earthen bunds | 12 |
| 5. | Gabion structure | 1 |
| 6. | Kolhapur type bandhara | 8 |


Deep CCT


Earthen Bund


Loose Boulder Struture


Grass Land

**Photos of SMC work and plantation in Barshi range of Solapur division under Jalyukt Shivar Yojana**


Agave Plantation on bunds of CCT

**Table Showing Work under Jalyukt Shivar Yojana in Barshi Range (2016-2018)**

| S.No. | Village name | Deep CCT (Area in ha and volume in $m^3$) | LBS (in $m^3$) | Earthen bund (in numbers) | Actual expenditure (₹) |
|---|---|---|---|---|---|
| 1 | Khandvi | 10 - 2400 | | | 2,02,818 |
| 2 | Valvad | 10 - 2400 | 1500 | | 2,77,734 |
| 3 | Nari | 10 - 2400 | | 1 | 5,02,734 |
| 4 | Upalai | 5 - 1200 | | 1 | 4,02,221 |
| 5 | Ghanegaon | 5 - 1200 | | | 1,02,221 |
| 6 | Kari | 5 - 1200 | | | 1,02,221 |

*Note: Cultivation of 'Anjan' grass , 'Stylo' grass 'Khus' and agave plant on bunds of soil moisture conservation structure*

**Table showing plantation area under Jalyukt Shivar Yojana**

| S.No. | Village name | Plantation area in ha |
|---|---|---|
| 1. | Pangari | 2500 |
| 2. | Korphale | 500 |
| 3. | Jahanpur | 300 |
| 4. | Chincholi | 1500 |
| 5. | Pandhari | 400 |
| 6. | Ukkadgaon | 50 |
| 7. | Pangaon | 40 |

indicator of successful of Jalyukt Shivar Yojana.

**2) Soil Erosion and runoff reduction**: The Soil Erosion was reduced more than 50% in the Jalyukta Shivar Yojana implemented area because of compartment bunding, continuous contour trenches and deep continuous contour trenches and graded bund. Run-off in project area also reduced which indicates the success of the programme to the greater extent.

**3) Increase in agriculture productivity:** Result of Jalyukt Shivar Yojana increased the agricultural productivity and also the fodder production which ultimately increased milk Production.

**4) Employment generation**: Additional employment is generated due to Jalyukt Shivar Yojana. Which can be measured by the increased mandays in various works.

**5)** Wild life population benefited tremendously due to continuous contour trenches, earthen bank, and other water conservation work which gave water sources to fulfill their water requirement.

## Conclusion

Jalyukta Shivar Yojana is one of the most popular development programme implemented across the Maharashtra State. This scheme has achieved the promotion of overall economic and agricultural development and also improved socio-economic status of the farmers in the drought-prone area.

## Acknowledgments

DFO Solapur Forest Division.
Maharashtra Forest Department.

FORESTS AND PEOPLE

# A Forester and First Lady Foot Soldier in the Treacherous Pangi Valley

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***Scientific extraction of fuel wood from local forests which was through harvesting of Killar (Parrotia jacquemontiana) - a coppicing under storey plant in conifer forests in Pangi***

The Indian Forest Service (IFS) is not just an All India Service but is also one of the toughest field services amongst them, which was dominated by male officers till late 70s. The arduousness emanates from the range of duties the IFS officers perform, which includes regular inspection of the forest areas from different management perspectives entailing posting in the remote areas. I, a 1986 batch IFS officer who was not only amongst one of the early entrants into the service but is also among the first women IFS officers to be posted in one of the remotest tribal areas in the Himalayas *i.e.* at Pangi Sub division of Chamba district in Himachal Pradesh and that too by volunteering for it. I would like to share some of my career highlights during three decades long journey.

Climbing Himalayan range and patrolling the forest in the Himalayan range on foot during the months of December and January when the temperature of the region is below minus 20$^0$C still sends shivers to many officers in their wildest dreams. The onerous task of patrolling and conserving forests in the difficult Himalayan terrain was happily accepted by me as a young dynamic lady IFS officer of 1986 batch. I volunteered for my posting at Pangi Sub division of Chamba district in 1990 and worked hard to conserve forests as well as ensuring there were no hurdles on the path of development to the remote tribal area. At the time when I was selected for the service, the Indian Forest Service was not a preferred career choice for many ladies due to the tough task involved in it, but I opted for the service as a challenge.

Indian Forest Services was earlier a male dominated service. There were very few lady officers during 80s. In 1988 three ladies joined the Himachal Pradesh Cadre and I opted for my posting to the most remote tribal area of Himachal Pradesh as I was aware that an employee should be posted in any one of the tribal/difficult areas once throughout the career. Further, I volunteered for the challenging assignment at the beginning of my career and the enriching experience has

greatly influenced my thinking and approach towards problems.

I was the first lady IFS to be posted in the Pangi sub division of Chamba district as Divisional Forest Officer and even after 25 years no woman IFS officer has taken up this daunting assignment although Pangi valley has now been connected with a road, electricity and communication network. This tough posting early in my career helped me to get first hand experience of the aspirations and the difficulties faced by the tribal population. It proved to be a turning point in my career as it brought about mental and physical resilience in me. The medal which I won for obtaining the first position in the women's cross country race at Lal Bahadur Shastri National Academy of Administration stood me in good stead as I was able to cover almost the entire Pangi Forest Division on foot.

Reminiscing the early chapter of my achievements as a lady officer elicits many memories. The area of Pangi was very backward during 90s. Even now it remains backward despite a road connectivity and means of communication. The entire Pangi region, lying between Pir Panjal and Zanskar ranges comes in the path of westerly winds in winters which cause freezing temperatures and heavy snowfall. Back then, there were no communication systems except a rudimentary wireless, which operated intermittently; no newspapers, no television, radio connectivity limited to evening times when due to cooling effect the cold air got heavy and dense permitting some shortwave transmission catching a radio-station or two, rumors often took the shape of news into and out of the valley; no roads, one had to walk at least 52 kms from nearest road-head to reach the headquarter at Killar and on the way cross 14,500 feet (above mean sea level) high Sach Pass, other routes took longer - one via Lahaul crossing Rohtang Pass and the other via Kishtwar involving trekking along

**DFO Pangi Office**

Chenab through terrorist infested territory; no electricity except a summer period evening time limited supply through diesel based generator barely sufficient to merely light-up a bulb or two that too less than 60 watts supplemented with a small individual solar power panel able to sustain a mini - tubelight for four hours in summers, which reduced to one or two hours in winters if there was enough sunlight to charge the batteries otherwise one went back to stone-ages dependent on oil lit lamps; no milk supply, no fruits and vegetable market or supply, cooking was purely on fuelwood as there was no LPG, no kerosene or hard coal supply. In such difficult circumstances even ordinary task seemed impossible. To perform arduous duties as a forest officer who was required to inspect and patrol forest areas, one had no other option but to walk on foot along unbeaten paths often taking considerable risk to one's life and limb, trekking through treacherous routes and negotiating glaciers. It took me at least three days time to reach the district headquarters at Chamba. During 90s the insurgency in Jammu and Kashmir was at its peak. Since during winters the other two routes through Rohtang Pass and Sach Pass were closed due to heavy snowfall, trekking through the only open route via Kishtwar was unavoidable starting on foot from Killar to Shashio (later to Atholi/Gulabgarh) in Jammu and Kashmir at great personal risk with no provision for any security.

Extreme conditions were encountered during inspection of the region. There were number of engineers kidnapped during the 90s in Jammu and Kashmir. Due to such incidents I had to carry out my work with anonymity and keep a very low profile. To travel through the remote areas of Jammu and Kashmir, we dispensed the facility of using government vehicles, in order to avoid being identified and

**Sach Pass**

tracked. We were compelled by circumstances to avoid staying in the Government Rest Houses, as the militant groups kept a vigilant eye on the officers posted in the area. The road signages, milestones and all other important information at that time were written in Urdu. So I had to learn Urdu for my survival.

I got an opportunity to represent my service and present my experiences to the Fifth Pay Commission headed by former Judge Mr. Justice Pandian. I spoke extempore discussing the problems faced by the forest officers under extreme conditions. I pleaded for the case of introduction of paternity leave and enhancement of maternity leave for Government employees which were accepted and are now being implemented. I also represented Forest Services (along with others) for getting parity with the police forces which was accepted by the Government.

I also worked hard for preparing the forest clearance case under the Forest Conservation Act for the strategic Sansari–Killar–Tandi (SKT) road being built by the Border Road Organization (BRO) for approval by the Government of India. This road was also important for the developmental aspirations of the Pangwal tribal people and their connectivity with the outside world. The proposal for the SKT road was hanging fire for a decade before my posting. I took up the project of the link road with the BRO, the Revenue Department, the Resident Commissioner who was the head of the Administration in Pangi Valley and the Conservator of Forests at Chamba. I held meetings

**Shour Rest House**

between the various implementing agencies to manage conflict and dispel mistrust. Due to my sincere efforts, forest clearance for the SKT road was approved by the Government of India.

I dealt with the challenge of minimal effect of the development projects on the forest and environment and ensured that the road project caused the least environmental impact. All through the process, I ensured avoiding dense and valuable forests by insisting its alignment to be kept on the right-bank of Chandrabhaga (further downstream, in Jammu and Kashmir, it is called Chenab) despite being a hardrock cliff resisting the BRO pressure to take it on the easy slopes of left bank hosting very good and vital forests (Kasloon, Chakmanda and Kulal forests), thus protecting the critical resource of the local people (on which till date they depend so heavily) even at the cost of great annoyance to BRO officers and some locals who wanted a quicker road connectivity. Further, I endeavoured to protect the most pristine forests of Bara Bambal and Chhota Bambal and ensured that the road alignment even on the right bank (of Chandrabhaga), caused the least harm to the natural forests. It takes a long time for the trees in the region to grow and mature. It was a challenge for me to save all those forests and trees along with the development of road. Tremendous pressure was exerted on me in this effort, including from higher forest officers. My singular effort for environmental management and development is still remembered and recognised by the tribal people of the area and was also acknowledged by the Forest Minister of Himachal Pradesh even after 25 years of my posting in Pangi area.

During my tenure, I insisted and ensured scientific extraction of fuel wood from local forests which was through harvesting of Killar (*Parrotia jacquemontiana*) - a coppicing under storey plant in conifer forests in Pangi. Contractors were interested to extract maximum quantity from nearest forests but jeopardizing the future crops. My efforts then are still remembered even now for having successfully ensured sustainable harvesting as the Killar (*Parrotia* Spp.) forests which were worked during my tenure there, have now coppiced well and have regenerated to a very good density. Nothing is professionally more satisfying to a forest officer than successful regeneration of forests which were harvested during their charge because no good forest officer would like to be blemished for having left the forests in a shape worse than inherited - unregenerated forests make foresters squirm in their graves.

I am currently posted as Additional Principal Chief Conservator of Forests in Green India Mission at Shimla, the officer also wrote a project on forest fire management under the Indo-Australia Training and Capacity Building Project. I have worked for devolution of financial powers directly to the village community by framing the Grant-in-Aid Rules. I possesses a Masters degree in Environmental Management and

Development from the Australian National University, Canberra.

However, my journey has not been smooth, since I am a stickler of rules, I has been transferred frequently. I am considered to be one of the most straight forward and transparent officers in our department. It is heartening to know that even after two and a half decades the people of Pangi still remember my contribution to the Pangi region.

FORESTS AND PEOPLE

# Success of Community based Eco-tourism: A case of Dhanolti Eco-park "*Amber*" and "*Dhara*", Uttarakhand

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***Eco-park was intensively studied for collection of data on the yearly tourist influx, sources of income generation, facilities provided to visitors***

## Introduction

The study was carried out in Dhanolti Eco-park, Uttarakhand from 13th-24th January 2016. Dhanolti is a small tourist hill station on Mussoorie-Chamba state highway in Tehri Garhwal district of Uttarakhand.

Natural areas with rich biodiversity and scenic beauty, such as the Himalayas, have been the major destination centers for nature lovers from historical time. With the passage of time, the heavy influx of unregulated tourism and its activities, however, have mounted exceptional pressures on such areas of tourist's attractions in terms of loss of native biodiversity and degradation of ecosystems and environment. The continuous degradation of such ecosystems and the loss of services provided by them remind the need of sustainable development of tourism centric places all over the world. Here the concept of sustainable tourism has given birth, which indicates the responsible travel to natural areas that conserves the environment and improves well-being of local inhabitants. The practice of ecotourism or sustainable tourism is known to have the potential of helping the conservation of natural areas in such a way so that the local communities may be benefited by improving their living standards without slowing down their age-old traditions and cultures.

Uttarakhand is one of the Indian states, well known for its rich biodiversity, scenic beauty and tourist destination. To minimize the degradation of ecosystems and environment the state has developed ecotourism areas in the national parks, sanctuaries and in forest areas. Dhanolti Eco-park is a unique model of Community Based Natural Resource Management (CBNRM) in Uttarakhand. The Eco-park has two segments named as Dhara (the Earth) and Ambar (the Sky above) Eco-park. These parks spread over an area of 15 ha and it is a unique model of CBNRM. This eco-park has been selected for studying the system of Community Based ecotourism and the possibilities

of developing suitable strategies for promotion of Community Based Ecotourism in other States.

The eco-park was intensively studied for collection of data on the yearly tourist influx, sources of income generation, facilities provided to visitors. Data also collected through interviewing the local small to medium shopkeeper's and official records.

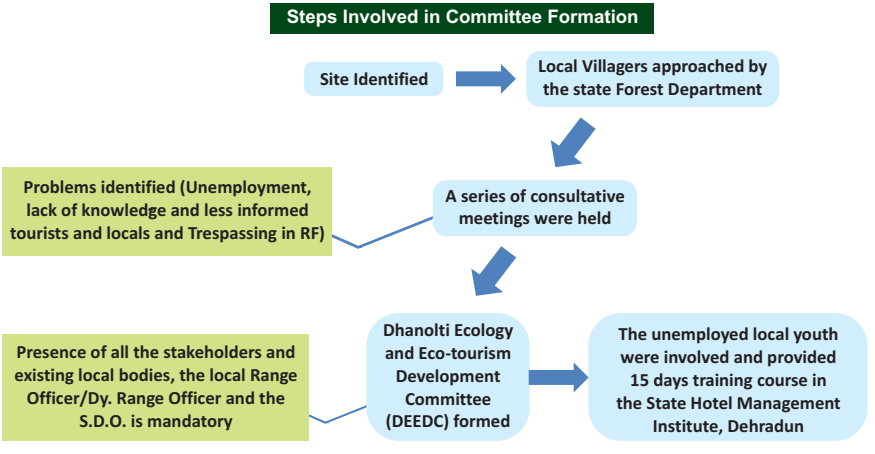
**Formation of DEEDC**

A Committee was formed with the participation of all the stakeholders and existing local bodies with mandatory involvement of the local Range Officer/Dy. Range Officer and the S.D.O. of Forest Division. DEEDC is to manage the eco-park, conserve forest and ecosystem, dispose off and recycle garbage, and fee collection for various amenities, as provided to the tourists.

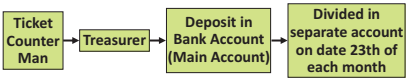
**Management of Eco-park**

Eco-park is managed by 25 DEEDC members (1 Secretary, 1 Treasurer, 1 lady in Van Shilp Kuteer , 2 lady in Ticket counter, 5 in Eco-hut and Eco canteen, 3 Mali , 3 Flying fox, 2 Burma bridge, 7 Other) and Two official persons (Forester as President and Forest Guards and Joint Secretary). For smooth working this committee performs:

1. General body meeting done once in three years for choosing new members.
2. DEEDC members meeting: once in a month For Management and Maintenance of Eco-parks.
3. Maintain Bank Account: 1 main common Current Account of Treasure and Joint Secretary; 3 separate Account for honorarium, maintenance and development and Corpus.
4. Account is Audited once in three years by a Chartered Account.
5. Maintain Register: Van Shilp Kuteer, Entry Fee (each gate), Eco-hut and Eco canteen, Flying fox, Burma bridge and Suggestion Registers are separately maintained.



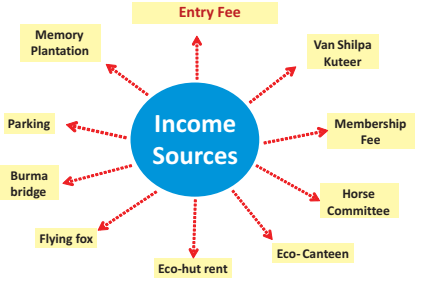
6. Money collection and deposit in following manner:




Keeping the objective in view, to ensure the conservation of local biodiversity artificial constructions are not created inside the park; however, rainwater harvesting structure has been created to arrest the rain water and an Interpretation centre has been developed to generate awareness on the conservation and management of the Himalayan ecosystem and biodiversity. Beside these, to make the entire track free from mule dung a Horse stand and two permanent members are appointed only for plastic collection.

For the visitor's, accommodation facility in eco-huts and eco canteen; amusement facilities like flying fox and burma bridge, plantation of memorial saplings and nature trails with yoga centre has been developed.

***Income Sources of Eco-park:*** There are different sources of income. The visitors pay some nominal entry fees, ₹ 25/- per adult and ₹ 10/- per kid for visiting. Eco-huts (4 no.) per night stay charge ₹ 1513/- (₹ 1313 as revenue and ₹ 200/- goes to DEEDC). The charge for enjoying a walk over the Burma Bridge is ₹ 30/- for sliding on the flying fox is ₹ 120/- per person. The cost of memory sapling plantation is ₹ 350/- per plant. Horse stand charge ₹ 20/horse. DEEDC gets 10% of the sale proceeds as handling and service charges from *Van Shilp Kuteer* - an outlet of handmade products




by villagers. Membership fee also collected from small to large hoteliers, restaurants owner's ranges from ₹ 300/- to ₹ 1500/- collected annually.

**Benefit Sharing Mechanism**

Out of the total income generated, 40% is provided as honorarium to the local people, 30% is used for the maintenance and development of eco-park, 20% is allotted as revenue to State Forest Department and remaining 10% is deposited in the corpus fund.

## Impact of the Work

***Perpetrators become protector and conserving the biodiversity:*** The entire park area is now managed by the local committee members. Earlier these very people were engaged in encroaching on government land for cultivation of off-season vegetables and illicit felling of trees. But now they have become the protector of this precious asset. As per the official record about 22 ha of encroached land has been removed voluntarily from the area and in the past three years there is no case of any fire incidence and encroachment/illicit felling.

***Ecosystem and environment:*** The approach of participatory conservation through DEEDC has improved the

ecosystem and environment conditions of Dhanolti. The area which was once degraded due to dumping of non-degradable plastic waste is now almost free from such non-biodegradable substances. This helped the local flora to revive.

To maintain the greenery till now over 1400 saplings of deodar have been planted as memory plantations in the eco-park area. Above 5000 of Rhododendron and 4000 Deodar trees were planted by committee and school children (inside and in the neighboring areas of the park). These saplings flourish well, as they all are under intensive care of the DEEDC.

***Livelihood opportunity and income:*** The eco-park provides regular employment to 25 local youths, including 3 women. Various park activities and increase in tourist influx have enhanced livelihood opportunities to many other local people (vendors, photographers etc). The eco-park income has continuously increased since its inception in 2008. Over the period of seven years the eco-park has generated a total ₹ 25541978 (Table 1). Out of all the sources maximum income has been raised from the entry fee of the eco-park.

***Expenditure details:*** Upto November 2015 an amount of ₹ 25541978/- has been generated since June 2008. Out of this amount ₹ 7741962/- as honorarium and ₹ 5076035/- for maintenance was spent and ₹ 4333578/- was deposited as revenue to Government. At present during the study balance amount in

**Pre-project condition**

**Present condition**

Table 1: Income generated by DEEDC

| YEAR | Total income from different sources | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Entry Fee | Parking | Horse Committee | Memory Plantation | Membership Fee | Eco-hut Fare | Eco- Canteen | Eco-hut Service tax | Van Shilpa Kuteer | Other | Flying fox | Burma bridge | Luxury Tax | Total |
| 2008-09 | 530490 | - | - | - | 7150 | - | - | - | - | 1020 | - | - | - | 538660 |
| 2009-10 | 1383465 | 77190 | 13071 | 46250 | 23400 | 128188 | - | - | - | 31360 | - | - | - | 1702924 |
| 2010-11 | 1309520 | 65320 | 8579 | 121500 | 24855 | 751196 | - | - | - | 46082 | 256590 | 120760 | 30158 | 2734560 |
| 2011-12 | 1462995 | 44320 | 625 | 74400 | 12000 | 900166 | - | - | - | 36050 | 631680 | 130740 | 21722 | 3314698 |
| 2012-13 | 2461710 | 58930 | 30 | 52850 | 11150 | 758438 | 239996 | 212800 | 97090 | 23300 | 1169500 | 168720 | 22802 | 5277316 |
| 2013-14 | 1754445 | 17400 | 4227 | 25200 | 18300 | 507195 | 66356 | 141000 | 62077 | 18200 | 442750 | 77440 | 20392 | 3154982 |
| 2014-15 | 3139280 | 26650 | - | 5250 | 26300 | 580495 | 127075 | 168600 | 81478 | 10700 | 579850 | 119620 | 17054 | 4882352 |
| 2015-16 (Upto November 2015) | 14667665 | 319560 | 26532 | 329300 | 130755 | 4090874 | 538738 | 640200 | 283856 | 174212 | 3532090 | 680340 | 127856 | 25541978 |

honorarium Account is ₹ 925194/-, in maintenance account ₹ 1424332 and in Corpus fund account ₹ 2166789/- .

***Problems:*** No major problems so far faced by this committee. Some minor problems like Excess Snow Fall, Electricity shortage, Conflict with Animal (Leopard), No computer Facilities, Miss behavior among tourist etc. are faced occasionally.

## CONCLUSION

From the study it is found that this is one of the successful examples of Community Based Eco-tourism which worked as a tool for sustainable development of communities alongwith nature and natural resources. If the geography of any region found suitable for this kind of project we should try to develop such parks through involving the local community and the Government for a better future of Communities along with its natural Bio-resources.

## ACKNOWLEDGEMENTS

DFO Mussoorie Forest Department.

DEEDC, Dhanolti, Uttarakhand Forest Department.

FORESTS AND PEOPLE

# Alternative Livelihood through Joint Forest Management (JFM)

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***Absence of humus is conspicuous throughout the forest which is the result of excessive grazing, fires and continuous soil erosion due to less vegetation covers***

## Introduction

The Chhotaudepur forest division is situated between 72$^0$50'17"E and 74$^0$16'17"E longitude and 20$^0$ 52'20"N and 22$^0$33'0" N latitude. The forest in this area mainly is confined to the eastern and southern hilly regions of the district. The forest tract is undulating with broken ranges of hills of heights ranging from 105 to 633.67 meters above the mean sea level. Narmada, Mali, Heran and Orsang are the four main rivers flowing through the tract. There are a number of tributaries and sub-tributaries of these river which form a network of drainage system. Soil in general is sandy with varying proportions of loam, colour, texture, structure and composition. In the hilly areas, it is generally very shallow and poor in nutrient status. The absence of humus is conspicuous throughout the forest which is the result of excessive grazing, fires and continuous soil erosion due to less vegetation covers. Most of the people belong to the tribal communities. Almost 86% of the forest area of the Division is now being protected by the JFMCs. At present in the Chhotaudepur Division 324 JFMCs are managing 57639.60 ha of the forest area and are actively working. NWFP species are being encouraged for deriving annual sustained benefits and collection of Custard Apple is the major activity of the Division.

### Collection and Marketing of Custard Apple

Custard apple is one of the prime MFP in the villages of Rangpur, Panvad, Kawant and Naswadi Ranges of Chhotaudepur Division of Vadodara Circle.

**Scenario before the intervention:** In the year 2011 there were 6 villages involved in collection and the net output of Custard Apple was 13 tonnes. The fruit was sold to traders or at a local market. Many a times the fruit used to rot due to over ripening, lack of storage facilities and no market linkages. JFMC members used to get price of ₹ 4-5 $kg^{-1}$. With this amount it was difficult to meet the labour cost involved in plucking the fruits. The villagers were not trained in collection and subsequent grading the fruits. The market linkage existed only up to Chhotaudepur and middlemen traders.

**Intervention:** With the help of local staff, base line survey of selected villages was carried out followed by the grass root level meetings with JFMC and SHGs. After the market survey and linkages done with the help of the district co-ordinator and Livelihood Enhancement Team (LET) training was imparted for collecting and grading custard apples. Plastic crates have been provided to JFMC and SHGs. The outlets of this custard apples are at the Reliance Fresh, Spencer's Mega Mall and local vendors in Vadodara and Surat. The collection of custard apple was initiated in 6 villages and the number has increased to 35 in the year 2016.

Due to collaboration with the Gujarat Forest Department, JFMC and SHGs are able to sell custard apples to Reliance fresh at price of ₹ 35 $kg^{-1}$ in 2012 and ₹ 40

**Trend in Custard Apple Collection and Marketing (2012-2017)**

| S.No. | Year | No. of JFMC Involved | No. of Beneficiaries | Total Income | Expenditure | Net Income |
|---|---|---|---|---|---|---|
| 1 | 2012-13 | 25 | 1488 | 9,39,906/- | 1,30,700/- | 8,09,206/- |
| 2 | 2013-14 | 19 | 1418 | 16,58,174.5/- | 1,15,885/- | 15,42,289.5/- |
| 3 | 2014-15 | 30 | 1590 | 9,10,260/- | 37,725/- | 8,72,535/- |
| 4 | 2015-16 | 30 | 1672 | 21,28,670/- | 3,66,320/- | 17,62,350/- |
| 5 | 2016-17 | 35 | 1672 | 51,08,164/- | 4,65,610/- | 46,42,554/- |

$kg^{-1}$ in 2013. Net output of custard apples from 6 villages was 13 t in the year 2011 which increased to 86 t due to the intervention of Gujarat Forest Department in 2012.

For value addition and to achieve reasonable rates of product, market analysis was carried out by the Forest Department, with the help of JFMC and SHGs.

## Conclusion

Finally in the conclusion it could be mentioned that this approach helped in resource conservation through Public Private Partnership (PPP). It enhanced goodwill within the local people towards the Forest Department. This programme strengthened JFMC and SHGs for independent decision matching. Due to involvement of 30 villages in the collection of custard apples, this number is expected to rise in coming years due to benefit sharing in a transparent way. Gram Van Vikas Mandal Rajavant got Organic Certificate issued By CGCERT Raipur for Custard Apple.

FORESTS AND PEOPLE

# Community Forest Rights and Forest Management in Thane Forest Division

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***Women empowerment is necessary through the Self Help Group and if this issue is identified and channelized then it become first step to improve the livelihood through CFR***

## Introduction

The preamble of the Scheduled Tribes and Other Traditional Forest Dwellers (OTFDs) (Recognition of Forest Rights) Act, 2006 recognizes the historical injustice meted out to Scheduled Tribes (ST) and OTFDs. The Forest Rights Act (FRA) seeks to secure traditional rights over forest land and Community Forest Resources (CFRs), and establish democratic community-based forest governance.

FRA emerged as a legislative response to a national grassroots movement to record the rights of forest dwelling communities whose rights were not recorded during the consolidation of state forests in the colonial regime and in the post-Independence period. Many of these forest dwellers have been displaced for industrial and conservation projects without rehabilitation being labeled as 'encroachers' on forest land. Section 4(5) of the Act requires that no member of the forest dwelling ST or OTFDs shall be evicted or removed from forest land under his occupation till the recognition and verification process is complete.

The process of recognition and verification laid out in FRA is currently the only legal process for determining the genuine forest rights holders; it recognizes 14 pre-existing rights of forest dwellers on all categories of forest land, including Protected Areas. The major rights are:

- Individual Forest Rights (IFRs) and Community Rights (CRs) of use and access to forest land and resources;
- Community Forest Resource (CFR) Rights to use, manage and govern forests within the traditional boundaries of villages; and
- Empowerment of right-holders, and the Gram Sabha, for the conservation and protection of forests, wildlife and biodiversity, and their natural and cultural heritage (Section 5, FRA).

### Scenario of CFR in Maharashtra

Maharashtra emerges as a leading state in recognizing CFRs in the country

*i.e.* 12% of the maximum potential, 14% of the mid-range potential and 20% of the minimal potential. By November 2016, a total of 5741 CFR rights claims had been recognised over an area of 7260.58 sq km in the state.

There are many reasons for Maharashtra's comparatively higher implementation of FRA, of these, the important ones are:

1. Strong grassroots mass movement.
2. Presence of civil society groups and committed individuals involved with the implementation of the Act.
3. Periodic push from responsive and proactive individuals within the government agencies at all levels, including District Collectors, Secretaries of the Tribal Department, and the Governor's office.

The success, however, has been varying in different districts depending on local factors, socio-political histories and other circumstances.

The study conducted in the villages (PESA villages) where, CFR right is recognized under Forest right Act, 2006 *i.e.* Tokawade North and Tokawade South Ranges of Thane division.

**The study has the following broad objectives:**

1. Review of management of forest areas where community rights have been recognized.
2. Prescription for future management so as to enhance livelihood potential of the forest

The study was conducted through questionnaires, discussion with village people and personal observations.

**Livelihood pattern of the villages in the study area**

The villagers are mostly dependent on the forest for the livelihood *i.e.* non-timber forest produce. Other than forest dependence they are mostly working as agricultural labourers in the field of farmers located in nearby villages. Daily and seasonal migration as agricultural labourers to the other district is also observed. Average land holding is less in the area and Education is also less. Awareness about the CFR and other rights were given by NGO (Vanniketan). Forest department is connected to the people to enhance the livelihood through entry point activity and other schemes. Government work is seasonal and wages are less than the private work wages. Scarcity of water in the summer is one of the reasons for under development of the people. Self Help Groups are not active; women are not employed and most of the women are involved in collecting forest produce and selling it to the local market.

Some of the villagers are dependent on bamboo based work as they are making tokari, kanga, fishing net, other bamboo article like lamp, hats, flower pots etc. They are collecting flowers of Moha (*Madhuca indica*) and honey and selling it to traders and local known people. Forest Department has provided machinery for making of plates from Palas leaves (*Butea monosperma*). Some of the villages are

provided with machinery for the extraction of seed oil from Moha by Forest Department. Seasonally they are collecting Mango, Jamun, Karonda, other fruits, vegetables, rhizomes etc. and selling it to the local market.

**Management of Forest areas:** No scientific management was done previously by the local people. They were also not aware about importance of forest even though their livelihood depended on it. Previously, they used to cut the trees for sale, fuel etc. and fishing in forest for their livelihood.

After recognising CFR, Villagers willingly started protecting the forest after awareness about the importance of forest and started conserving the forest area. Few CFR committees have done plantation of mixed plants, bamboo and watchers are employed for the protection. They are conserving soil and water by soil and moisture conservation structures. Monitoring and managing the forest area as well as recognised CFR area and protecting it from fire, illegal felling mixed plantation in the CFR area have also begun.

It is observed from the study that with the help of an NGO, they had prepared plan for the management of forest resources in CFR area and timely suggestions given to them by the NGO. They are also planning to conserve, protect and manage forest area with the help of Forest Department.

**Prescription for the future management**

The villagers have started protecting and conserving the forest. For future livelihood, they are planning for the value addition to the Moha flowers and seeds for making different products, with the intervention of Forest Department. Also, planning to make different bamboo articles and selling it through community shop.

The core livelihood pattern of the people has to be identified and channelized appropriately to improve the livelihood. Agriculture and allied livelihood is needed to be enhanced. Value addition and marketing of product through proper channel is to be ensured. Eco-shop concept needs to be developed under the brand name of the tribal people. Conservation and management of the forest through people's participation for the sustainable management of the forest there by improving the bio-diversity is the need of the hour. Detailed research and study is needed to identify the reasons for poverty and backwardness of these areas for policy formulations and development of a livelihood model. Irrigation projects need to be implemented to increase water table, as water scarcity is the main problem in the area. Women empowerment should be addressed appropriately and the Self Help Groups should be activated to improve the livelihood.

FORESTS AND PEOPLE

# Timber Harvesting in South Dangs Forest Division of Gujarat State through Forest Laborers Cooperative Societies

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***Coupe harvesting through Forest Labours Co-oprative Societies has empowered tribal and local people to the extent that in the near future they can shoulder the responsibilities for the management of such societies all by themselves***

## INTRODUCTION

Forests of dangs are being managed scientifically as per the prescription of the Working plan. This management involves protection, regeneration and sustainable harvest of mature trees. In order to exploit the mature crop, annual coupes are laid in the forest as per the working plan prescriptions. These coupes due for exploitation are annually harvested through the Forest Laborers Cooperative Societies (FLCS).

Under Gujarat Cooperatives Act 1970, around 30 FLCSs were established to provide and improve livelihood opportunities and to minimize their migration from Dang. The FLCS help to implement the working plan prescriptions of Dang Forest Division. Every year 18000-19000 families are benefited by the financial assistance provided from the revenue generated by selling of timber by e-auction. At present 10 FLCS in North Division and 11 FLCS in South Division are in good working condition. Around 18599 member families (about 10% of total Dang population) are getting livelihood benefits from coupe working.

### 1. The Working plan prescriptions for working of Forests (South Dang Forest Division)

The prescriptions of working plan especially with respect to marking rules, felling regulations and other precautions to be taken are summarized below:

#### 1.1 Demarcation of Coupe

Coupes due for selection-cum-improvement working circle are laid out two years in advance to prepare treatment map and carry out total enumeration of trees to be felled subsequently. Treatment maps are prepared by RFO under the guidance of concerned ACF.

#### 1.2 Marking rules

Marking is done immediately after demarcation.

#### 1.2.1 Marking for Protection area

A. No trees shall be marked for felling

except dead decayed trees of following area:

i) Steep slopes of more than $45^0$.

ii) 20 m wide strip on either side of rivers and major nalas and also trees standing in rivers beds.

iii) Areas having exposed rocks.

B. Dead, dying (1/2 dead crown) trees will be removed from coupe.

**1.2.2 Marking for other than protection areas**

1. First priority shall be given to dead, decaying trees.
2. Second shall be given to dying trees which can't survive till next felling cycle.
3. Over mature trees having profuse natural regeneration in that area. Order of preference will be from higher to lower girth.
4. Over mature trees having no natural regeneration but having provisions for artificial regeneration of natural species in that area.
5. Inferior species like Kakad, Modad, Kilai etc. interfering with the growth of Valuable species.
6. Fruit bearing, MFP yielding and Ficus trees should not be marked.
7. Endangered species should not be marked.
8. One tree of highest girth for each species should be retained as a future specimen.

**1.3 Method of marking and felling regulations**

Boundary trees are marked with double tar bands (3 to 4 cm wide and 20 cm apart) at breast height and the number shall be given in tar. Other trees are marked with single tar band at breast height and serial number is provided above tar band. The number given at breast height should be chiseled at the base of tree and "X" mark is given above the chiseled number.

**1.4 Working regulations**

Working agency is required to go over the boundary of the coupes and mark a red band on each boundary tree in between the tar bands (as a token of having known limits of coupe). Felling, logging and extraction should be done in orderly manner so as to cause minimum damage. All harvesting should be proceeded by sub coupe. Bamboos of exploitable age should be extracted before the tree is felled to minimize damage (in cases of clumps closer to tree marked for felling). All climbers and creepers to be cut. Damaged trees due to felling of marked trees should be separately enumerated and marked for felling after the coupe working.

The steps involved from coupe lay out to issue of work order is shown in Fig. 1. The harvested timber is classified as per guidelines given in working plan (Table 1).

**2. Silvicultural Terms and Conditions prescribed for FLCS for working of the coupes**

Fifty feet wide fire lines are to be made by FLCS. One person should be there day-night for protection against fire and grazing. Felling should start from sub coupe one. Then sub coupe two in

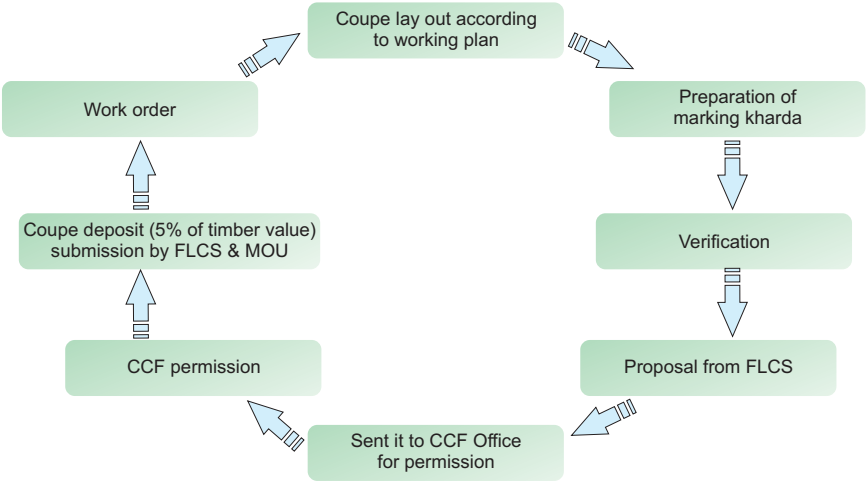


**Fig. 1. The Flow chart showing steps involved in the issue of works orders to FLCS**

**Table 1: Classification of harvested timber**

| S.No. | Class | Girth (cm) | Length (m) |
|---|---|---|---|
| 1 | Log | 90 and above | 1.82 and above |
| 2 | Rafter class 1 | 60 to 90 | 3.65 to 9.14 |
| 3 | Rafter call 2 | 45 to 60 | 3.65 to 9.14 |
| 4 | Rafter class 3 | 23 to 45 | 3.65 to 9.14 |
| 5 | Post class 1 | 45 to 90 | 1.82 to 3.65 |
| 6 | Post class 2 | 23 to 45 | 1.82 to 3.65 |
| 7 | Butt | 23 above | 0.91 to 1.82 |
| 8 | Lopping | 16 to 23 | 0.91 and above |

direction to sub coupe one. Compensation towards loss may be recovered from FLCS in case of injury to the reserve tree by felling activity. After felling, climbers and creepers from the base of tree, soft stems over trees, other to be removed. Trees of more than 15 cm girth and less than 15 cm girth should be placed separate.

### 2.1 Revenue Sharing

Twenty percent share from the net revenue obtained from e-auction of the harvested timber will be provided to respective FLCS. Figures of revenue sharing of last 10 years (2005-06 to 2014-15) shows that approximately ₹ 2300 lakhs have been given to remaining eleven FLCS of South Dang Forest Division. Each FLCS has got around ₹ 150 lakhs to ₹ 250 lakhs in Last ten years as a 20% share of net revenue obtained from e-auction of harvested timber. Statement of revenue sharing to FLCS is shown in Table 3.

### 2.2 Vanlaxmi Scheme

The FLCS get 20% of the total proceeds

**Table 3: Statement showing share of revenue to FLCS from the year 2005-06 to 2014-15**

| Name of Mandali | Details of paid amount (20%) in ₹ | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2005-06 | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 | |
| Shamghan VKM Ltd, Vaghai | 812995 | 2251007 | 4452359 | 1540008 | 1834107 | 1841523 | 1491156 | 1759518 | 1937552 | | 17920225 |
| Mahalpada VKM Ltd. Ahwa | 315922 | 2100789 | 2026331 | 2969629 | 3641717 | 2012635 | 1358972 | 3015862 | 1749989 | 1700330 | 20892176 |
| Kalamvihir VKM Ltd., Ahwa | 1020949 | 939484 | 5001922 | 2503288 | 320909 | 1945271 | 3005723 | 1963231 | 3389214 | 2334577 | 22424568 |
| Zavda VKM Ltd. Waghai | 1827088 | 520184 | 978117 | 306391 | 854536 | 972541 | 2210730 | 3257900 | 2206295 | 29907265 | 43041047 |
| Dang Pradesh VKM Ltd. Waghai | 1002717 | 4072402 | 3808972 | 1096724 | 1194490 | 2347646 | 1789301 | 3054117 | 436870 | 2642739 | 21445978 |
| Sakarpatal VKM Ltd., Waghai | 1671990 | 630917 | 633591 | 1978677 | 2749220 | 737898 | 2161589 | 1417545 | 1352586 | 2476118 | 15810131 |
| Galkund VKM Ltd., Waghai | 4531803 | 1587457 | 1563976 | 3794941 | 1162485 | 2971886 | 1522171 | 2846918 | 1663744 | 2151442 | 23796823 |
| Aherdi VKM Ltd., Waghai | 2124034 | 3898254 | 1253536 | 2672362 | 4653247 | 2065766 | 1381104 | 2903635 | 1875183 | 2287645 | 25114766 |
| Borkhal VKM Ltd., Ahwa | 2229190 | 1254716 | 3162129 | 2139646 | 3620548 | 1291418 | 981520 | 532228 | 1055794 | | 16267189 |
| Pimpari VKM Ltd., Waghai | 418245 | 420522 | 878071 | 3574231 | 467828 | 1124082 | 2458212 | 1203022 | 3070129 | 2743207 | 16357549 |
| Tanklipada VKM Ltd., Waghai | | | | | | | 926866 | 1151702 | 2692846 | 2073946 | 6845360 |
| Total | 15954933 | 17675732 | 23759004 | 22575897 | 20499087 | 17310666 | 19287344 | 23105678 | 21430202 | 48317269 | 229915812 |

and in addition 20% (from 80% of the revenue share of department) goes to the JFMCs of nearby villages (where respective coupes according to working plan were laid) for community development under this scheme. From such funding stoves, pressure cookers, machines for irrigation, water tanks, land levelling etc. are being provided which has brought down their fuel wood demand. Every year around 25 JFMCs comprising of around 3000 beneficiary families are benefited with a revenue of ₹ 100 to 200 lakhs. Statement of revenue sharing from year 2011-12 to 2017-18 to JFMCs is shown in Table 4.

## Discussions

Coupe harvesting through FLCS adopted in South Dang Forest Division has many advantages. It has given freedom to local tribal people from clutches of contractors. It has ensured fair wages to them for their labor. It has provided benefit of harvesting to real beneficiaries by removing middle man from the scenario.

Coupe harvesting through FLCS has shown many impacts on tribal population. It has led to socio-economic up-liftment of the tribal and local people. It has empowered tribal and local people to the extent that in the near future they can shoulder the responsibilities for the management of such societies all by themselves. The FLCs movement has made a rapid progress in the last three decades due to liberal policy of State Government.

## Acknowledgments

I express my heartfelt thanks to the Gujarat Forest Department, DCF and Staff of Dangs South Division for their guidance and help during the case study.

**Table 4: Financial assistance under Vanlaxmi Scheme provided to JFMCs from the year 2011-12 to 2017-18**

| Year | No. of JFMC | No. of beneficiary families | 20% of 80% amount(in lakh) |
|---|---|---|---|
| 2011-12 | 15 | 1277 | 111.47 |
| 2012-13 | 24 | 2324 | 209.42 |
| 2013-14 | 29 | 4120 | 178.63 |
| 2014-15 | 28 | 2902 | 239.31 |
| 2015-16 | 23 | 3170 | 332.19 |
| 2016-17 | 26 | 3440 | 271.17 |
| 2017-18 | 20 | 3550 | 280.59 |
| | | Total | 1622.78 |

FORESTS AND PEOPLE

# Tree Man of Saurashtra

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***Balasaib has been instrumental in bringing nature conservation within the reach of common man***

## Introduction

Virjibhai Devjibhai Bala: popularly known as Balasaib or V.D. Bala in the wildlife circuit is known for his phenomenal work on afforestation and rural people empowerment. Born on the 1st of February 1958 in a small village of Fadsar in the district of Jamnagar in Saurashtra, young Bala showed an active interest in environment and nature right from his early childhood days. He did his B.Sc. from Morbi and later completed his P.T.C from Lokbharti Sanosra. He later joined the forest department as a Forester and recently got promoted as the Range Forest Officer.

Balasaib has been instrumental in bringing nature conservation within the reach of the common man. He started and ran successfully several programs for school and college kids like "wildlife week celebrations", "snake awareness programs", "experience environment shibirs", seminars, etc. He brought people closer to nature by encourging people to plant fruit trees and keeping artificial nests and water bowls for backyard wildlife. A mind-boggling

number of trees - more than a lakh - have been distributed to rural and urban people at a token fee.

Balasaib has also been actively involved in rural women empowerment and development. To empower women in rural areas, especially those belonging to extremely poor villages he created *"Mahila Mandlis"*. These womans groups prepare juice out of the fruit of Prickly Pear *(Opuntia elatior)* also known as *'hathaliyo thor'* in the local language and sell it, thus generating income. Saurashtra being predominantly dry, this species of cacti is available abundantly in the region. Total income generated

through the activity was jointly two 2 lakhs rupees within five years i.e. from 2010 to 2015.

Due to rapid urbanization and over population, conflicts between humans and animals is on the rise. Reptiles, more specifically snakes, are highly misunderstood creatures and therefore face the brunt in this conflict. Due to a very high level of conflict, the number of people rescuing snakes increased phenomenally but very few had any proper training in handling snakes. Balasaib has always been an advocate for the proper handling of reptiles and to this effect a one day seminar on snake rescue and environmental awareness was held twice in Rajkot for all snake rescuers of Saurashtra. He believes that conflict and myths can only be eradicated through awareness and thus snake awareness programs were held for children and adults in rural and urban areas. People were made aware about the different types of snakes, their benefit to the society at large and the necessary precautions to take to not get bitten. They were also shown how to correctly administer first aid in case of a bite. A total of 1,69,600 people have taken part in this program since 2005.

Since 2010 there has been an alarming decline in the population of the house sparrow in urban cities, mainly due to habitat loss. Global warming is another crucial factor for the death of many birds in cities. In order to counter this trend, he started distribution of artificial nest boxes in Gujarat. Since 2010, 2,50,000 nest boxes and 8,000 water bowls were distributed in urban cities of Gujarat.

Balasaib also started a program to respect and honor those who have been working in the field of environmental conservation at the grass root level for a long time. Between 2005 and 2014 a total of 138 people from different parts of Saurashtra were honored under this program.

In his long career in the forest department spanning decades, Sh. V. D.

**Seedlings distribution by Balasaib since 2017**

| Name of the Tree | Time Period | Total Distributed | Target |
|---|---|---|---|
| Custard Apple | 2007 to 2014 | 90000 | Farms and House Gardens |
| Ficus Benghalensis | 2008 to 2014 | 5800 | Farmers |
| Ashoka | 2010 | 2000 | Cities/Urban People |
| Malaysian Saag | 2014 | 8000 | Farmers |
| White Sandalwood | 2014 | 2000 | Farmers |
| Gugad | 2010 to 2013 | 6000 | Cities/Urban People |
| Lemon (Citrus) | 2007 to 2014 | 35000 | Villagers |
| Various Fruit Trees | 2013/14 | 5000 | Villagers |
| Various Native Trees | 2005 to 2014 | 225000 | Villagers |
| Ayurvedic Plants | 2013 to 2014 | | |
| Rukhda | 2013 | 1000 | Farmers |
| Various Vegetables | 2010 to 2014 | 80000 | Villagers |

Bala has been successful in bringing a green revolution to the villages and urban areas of Saurashtra and inculcate a love for nature and backyard wildlife in the hearts of thousands of people. He also serves as the President of Navrang Nature Club, Rajkot and is a continuous inspiration to young kids and adults alike.

He was honored with "Van Pandit" by government of Gujarat in the year 2017. Balasaib shall soon retire from Forest Department but his work towards conservation and green Gujarat will never retire!

FORESTS AND PEOPLE

# Innovative Practices of Vyara Forests Division

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***Interstate borders are always prone for forest wood trafficking and this division shares interstate border with Maharashtra***

Vyara forests division represents the forests area of Tapi district which is situated in the southern part of Gujarat. Border districts of this division are Dangs, Navsari, Surat and Rajpipala. This division shares interstate border with Maharashtra. Area of the division is 90,000 ha. Vyara Forest Division is divided into 10 Ranges. The division has good number of valuable species like Teak (*Tectona grandis*) and Khair (*Acacia catechu*) in the forest areas. Locals are poor and for them illegal cutting is the means to earn some money. Interstate borders are always prone to forest wood trafficking. In private agricultural land, there are a good number of teak and khair trees, which are prone to be cut and sold without permission of the Forest Division. If they get permission to cut and sell the reserved trees there is a possibility of mixing the private khair and teak wood with illicitly cut teak and khair wood from the forests.

Innovative practices of Vyara Forests Division are categorised and mentioned as below:

**1. Innovative Protection Practices of Vyara Forest Division**

**(I) Monthly monitoring parade and flag march:** Sensitive beats and villages in terms of the forest offences are identified which requires special focus. Under this programme, the staff of

whole Range including watchmen, Beat guards, Round foresters, RFO, gather at a pre-decided place. ACFs and DCF also take part in this program. This parade and flag march is performed on the first Saturday of every month. In the morning, the staff performs the parade in a sensitive village followed by flag march. There are two psychological dimensions of this program (i) For staff, it strengthens the feeling of "Forest Force" and (ii) For people, it creates the feeling "Forest is a force".

**(ii) One day One beat:** This program is performed in the second Tuesday of every month. In this programme, the staff of the whole Range gathers in one beat. ACFs and DCF also take part in this programme. The beat is decided on the basis of sensitivity of the beats. During this time, the staff performs the beat checking which includes identifying the unregistered illicitly cut trees' stumps, illicit cultivation on forest land, the encroachments on forest land, the status of SMC works, the status of current plantations 2 years old plantations, 3 years old plantations, 5 years old plantations, the status of fencing, CPT trees, the intensity of grazing, direct-indirect evidences of wildlife if found etc. In addition to this, exchange of knowledge among the staff also takes place. After beat checking, the report is prepared and presented before the DCF.

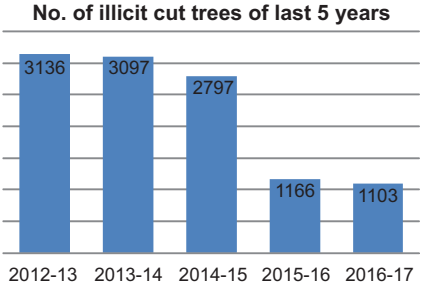
**(iii) Night tenting:** In this program, the sensitive compartments of the Range are identified every month for one or more nights as decided by RFO or senior officials. The night tenting activity is carried out. In this activity, the staff from every beat gathers in specific sensitive compartments of the Range. ACFs and DCF also take part in this activity. The entire staff conducts night patrolling in the sensitive compartments. They take dinner together at midnight in the forest. They spend the entire night in the forest. Apart from patrolling, knowledge sharing among staff regarding the techniques applied by the offenders, how to control forest offences etc. are discussed.

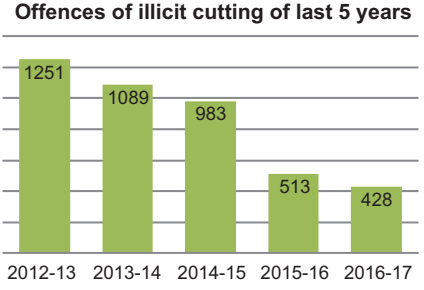
**(iv) Red alert:** The red alert is decided by the DCF. During red alert, Naka bandhi is carried out in the entire division. The senior officer patrols around in the night in the sensitive areas of the division to ensure that Naka bandhi is carried out effectively ensuring each vehicle is checked. All the nakas of the division are checked for their performance.

**(v) Night patrolling:** Night patrolling is done on regular basis. The Division has a very good networks of informers.

**(vi) Inter state co-ordination and raid:** This division maintains very good co-ordination with Maharashtra Forest Department. In the month of June, a successful interstate raid in Maharashtra was carried out. It was a joint raid of Vyara Forest Division and Maharashtra Forest Department. All above protection practices are unique in Gujarat as either it is carried out in Vyara Forest Division alone or it was started by Vyara Forest Division and now followed by other divisions as well.

The above practices give very good results. In last 5 years the forest offences have decreased by 66%.




**2. Innovative Practices of Plantation:** Vyara Forest Division has applied very innovative practices of plantations. Apart from regular plantation targets, the Division has adopted a new innovative concept called "Zero budget greening of a hill". In this approach Range is asked to convert barren hills/forest lands of at least 5 ha into green cover without spending a rupee. Every Range has a target of at least 1 ha. The watchmen and beat guards have the liberty to adopt their own method to raise plantations without any budget. They may sow seeds, they may do cut back, take advantage of root suckers or any vegetative propagation techniques, may protect the natural regeneration or any technique which can be used but it should be with a Zero budget. They will do this just by their '*Shram Dan*'. The division has 10 Ranges and therefore at least 50 ha area of barren hills/land will be converted into a green cover without any budget.

Other advantages of this practice is that the barren/degraded forest areas near the human habitats are selected on priority. The reason behind is that this type of barren/degraded forest lands near villages are prone illegal cultivation/ encroachment. If this is to be taken under this program, the frontline staff has to regularly visit this land for plantation and its subsequent protection. This routine movement of the staff in this hills/land can help the land to be protected from cultivation and encroachment.

**(i) Mission Drumsticks Plantation:** Tapi is a tribal district and the major population is poor. The side effect of this poverty is malnutrition. Drumstick is a very nutritive plant. So to increase the nutrition level of the tribals, the use of drumstick and plantation of drumsticks is being promoted. By selling different parts of drumsticks in the market, locals earn income as well.

**3. Innovative practices of People's participation and Public upliftment:** The '*Van Bandhus*' are dependent on forests for fuel wood, timber, grazing non timber forest produce etc. To ensure conservation of forests, their dependency on forests should be reduced. To reduce anthropogenic pressure on forests, the *Van Bandhus*

should be provided alternatives. They should be convinced about the sustainable use of forest resources. Therefore, to achieve the goal, forest conservation, people's upliftment is quite necessary. In Vyara Forest Division, for JFMCs activities, the projects are selected in such a way that the continuity of first project is maintained for the implementation of other projects. All the projects are maintained by the locals. It is illustrated forthwith as follows:

(I) Chain of projects including vermi-compost unit and Organic vegetables collection center: In Pipalwada JFMC, the division has started 165 beds of Vermi-compost unit in 2015. Initially the units were running very good, but after some time interests of locals decreased. To check this, the division has started the project Organic Vegetable collection' in 2016 as the villagers were producing vegetables for last few years but producing it only inorganically, and without proper market linkages. They were selling vegetables at a cheaper rate. Whereas for organic vegetable collection center, for example the vendor from Surat buys organic vegetables exclusively from their village with attractive rates. But to be eligible for this scheme, they have to use vermi-compost only. After success of this model, Vyara division has started vermi-compost unit in 20 JFMCs. In the vision document - 2022 *'New India Manthan'*, Vyara Division has planned to develop vermi-compost unit in 100 JFMCs and 50 vegetable collection centers in the different Ranges by 2022.

**(ii) *Bharti mela* - Industrial employment fair:** Surat is one of the highest industrialized cities of Gujarat. Tapi District is the neighbouring district of Surat. To make best use of this opportunity, Vyara Forest Division in collaboration of Labor Employment Department, organized the '*Bharti mela*'. In this fair total 1000 youth from different JFMCs of the Division took part. After the interview process, total 273 participants were selected for different jobs with attractive incomes ranging from ₹ 10,000 to ₹ 18,000 per month.

**(iii)** '***Bhagat Sammelan***': Tapi is a tribal district and also a remote one. Due to insufficient institutionalized medical services, tribals are still dependent on local '*Bhagats-Vaidhs*'. Bhagats preparing medicines from medicinal plants found from forests. Vyara division organizes a '*Margadarshan sammelan*' guidance workshop of Bhagats of the District with Government Ayurvedic doctors.

**(iv) *'Kutumb Jodo Karyakram*':** The global warming and climate change are global threats. To counter them, every citizen of the world needs to be a nature conservationist. As far as Vyara Forest Division is concerned, the Division has a plan to join every family of Tapi District in atleast one programme of the Forest Division by 2022 and make them aware about climate change and also to develop their love towards nature. This karykram is a part of future vision - 2022 of Vyara Forest Division under '*New India Manthan*'.

**4. Innovative practices in nurturing and building the capacity of the staff**

Ultimately the success of the Division is dependent on the efficiency of the staff. So to improve the efficiency of the staff, capacity building is necessary. For this, various trainings are organized *viz.* foresters meet, beat guards meet, training sessions for clerical staff etc. As we know, today is the era of people's participation and Joint Forest Management. Forester is a Member Secretary of a JFMC. So to convince JFMCs for co-operation in forest protection and for any livelihood schemes, the communication presenting skills of foresters are important. The presenting skills of the JFMC presidents/ secretaries need to be improved. Today, JFMCs are the face of the Forest Department. The Division is therefore organizing 'Foresters presentations' on the activities they have carried out in last six months. These presentations are presented before CCF and DCFs of the neighbouring Divisions and other officials. The other aspect of this presentation is also to review the works they have done in the last six months. This presentation becomes a knowledge sharing platform for all the foresters and all the JFMCs of the Division and also creates accountability.

## Acknowledgements

Dr. K. Sasikumar, IFS, DCF, Vyara Forest Division.

Staff of Vyara Forest Division.

FORESTS AND PEOPLE

# Preservation of Community Forest at Chengpui, Zotuitlang and Mausen Villages under Haulawng Range, Lunglei Forest Division, Mizoram

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***Condition of community forest is improved through the process of preservation and management by the department as well as the local users hand in hand***

Lunglei district is situated in the southern area of Mizoram located in between 92$^0$35''E and 93$^0$35''E longitude and between 22$^0$30''N and 23$^0$05''N latitude.

**Community Forest**

This can be defined as a forest protected, managed and utilized by local forest user groups. A forest user group is a group of people having right to manage, protect and use a forest area. The objective of community forestry is to develop and manage forest resource through the active participation of individuals and communities to meet their basic needs.

**Community Forest in Mizoram and their Importance to the Local People**

Forest in Mizoram is the property of the state. Since the introduction of the National Forest Policy in 1988 India has been experiencing a major shift in forest management and with the Government of India resolution of 1990 various aspects of participatory management favoring communal management and exclusive rights to forest use have been covered. This has been further strengthened during the tenth plan with the launching of National Afforestation Programme (NAP) having decentralized set up of Forest Development Agency (FDA) at the forest division level and the resultant Joint Forest Management Committee (JFMC) at the village level.

In most of the places in Mizoram, villages which are near to the forest had been directly or indirectly depending on the nearby forest and from which the villagers usually met their livelihood in obtaining their household requirement such as firewood, Non-Timber Forest Product (NTFP) etc. However, the non-judicious and un-thoughtful use of these community forest by the villagers in different parts of the state required attention and management intervention to the existing forest else it will lead to depletion of forest resources.

**Profile of Study Areas (villages):**

1) **Chengpui village:** About 20 km from Haulawng village with 40 household and 160 populations. The area under this community forest is 130 hactare (ha).
2) **Zotuitlang village:** About 10 km from Haulawng with 120 household and 520 populations. The area under this community forest is only 15 ha.
3) **Mausen village:** About 15 km distances from Haulawng village and towards the southern side with 62 household and 280 populations. The area under this community forest is 120 ha.

By the initiatives taken up by Forest Department, a project for preservation of community forest was formulated under Lunglei Forest Division so as to maintain healthy and sustainable resources to the local users and also with the objectives to fulfill:

1) Preservation of forest areas for protection of important watershed as well as forest around natural water sources of the village.
2) Protection of community/villages forest from fire, and other biotic pressure *e.g.* felling of tress for collection of timber and fuel wood.
3) Preservation of bio-diversity rich community forest reserve.

**Why Preservation of this Community Forest is Necessary?**

- The degradation of village forests started immediately following the political disturbance in the state in 1966 when group of villages were brought under a single administration unit and the forest and jungle cleared in the name of' security clearance' to mitigate attacks by insurgent.
- In this case, after villages were brought under a single administration fencing of the villages were done by bamboo and poles of suitable species to protect the village from insurgents and for which a chunk of forest was indiscriminately cleared. This has resulted in to the degradation of community forest.
- The degradation further continues owing to anthropogenic and other biotic factors. In the process the village forest over the years deteriorated and in many places is bereft of any vegetal cover.
- This is particularly true of the village supply forests. A concerted effort with proper management intervention is therefore urgently requires for restoration of such forest.

**Management steps taken up by the Forest Department for preservation of community forest-**

1) **Resource Assessment, Inventory and Survey:** The first and foremost requirement was resource assessment by way of vegetal inventory including survey and demarcation of the areas. That was taken up for each of the community reserves by the community through Young Mizo Association (YMA) which was one of the biggest NGO in Mizoram. The forest department facilitated the process by way of technical inputs- chain and compass

survey, scientific classification of plants and animals.

2) **Identification of the community needs:** The needs of the villagers were first being identified through the process of Participatory Rural Appraisal (PRA) exercises. While doing so, the need for increase in species diversity to provide long-term forest stability would always be borne in mind. At the same time, the need for increasing public awareness could not be overemphasized. Only through an enlightened public would such ventures for conservation and sustainable resource utilization succeed, *i.e.* to foster community support.

3) **Established goals-prioritized because of limited resources:**

a) Establish maximum tree cover through plantation programmes both for village supply and safety reserve provides assistance and incentive program and voluntary planting program.

b) Soil and water conservation measures in the catchment areas.

c) Identify entry point activities, create public education programs, eco-tourism sites etc.

**Awareness on Rights and privilege:** Three classes of village forest reserve constituted under section 12 of Mizoram Forest Act, 1955 has been followed:

**a) Village safety reserve-** for the protection against fire, constituted in the interest of health and water supply no one shall utilize for any purpose, any portion of land inside the reserve and no tree shall be cut in this except with the permission of the state government.

**b) Village supply Reserve-** for the supply of the needs of the village. Any person resident in the village may cut trees and bamboos from this reserve for his household needs.

**c) Protected forest reserve-** for protection of valuable forest from destruction in the interest of the village communities. No one shall utilize for any purpose any portion of land inside this protected forest reserve and no tree shall be cut except with the permission of the state government.

4) **Implementing Agency:** Initially the Implementation plan was such that for every community sanctuary respective existing agencies, namely the concerned Branch of YMA would be the implementing agency, and funds was made available to such societies from the forest department, which would be the nodal agency. However at the time of actual implementation; not only YMA was given priority to carry out the works for implementation but also a representatives from the Village Council, YMA, Church and locality of the village, out of which 50% of the members or one by fifth of the members should be women. The role of the department was limited to that of a facilitator, rendering necessary technical advice, wherever and whenever required.

**5) Monitoring, Evaluation and Revision**: Monitoring of the progress of the project was accorded very high priority and was carried out in a systematic manner through:

a) Periodic progress reports obtained from the nodal agency (Forest Department) and Program Implementing Agency (Village Community).

b) Field visit by program officers (DFO) of the department of Environment and Forests.

**6) Expected returns:** With mounting pressure on the various classes of forest in the state, the project is expected to rejuvenate the forest based resource while at the same time create employment opportunities. Once involved, both during the planning and implementation stages, the village community would have a sense of ownership over the area and would undertake sustainable utilization of the resource without compromising for the future. Thus, in addition to the immediate returns in the form of wage employment, the project will take care of the bio-diversity conservation aspects as well.

In order to prevent these reserve from fire as well as from encroachment and to make people aware of this importance to the people some management measures are taken up by the department which are as mentioned below:

a) Demarcation of the area and erection of boundary pillars.

b) Construction of inspection path and patrolling path inside the forest.

c) Fire line cutting all along the boundary and contour fireline inside the reserve.

d) Fixing of signboard at prominent places about conservation reserve.

e) Organizing awareness program for benefit of forest conservation amongst schools and local public.

f) Construction of watch tower with RCC basis and beam.

g) Gap filling works by planting of seedlings in the conservation reserve area etc.

**Result of preservation of community forest within the respective study areas:**

1) The condition of community forest is improved through the process of preservation and management by the department as well as the local users hand in hand. This is achieved by the management measures taken up inside the community forest by the department which includes demarcation of the boundary and subsequent erection of boundary pillars for community forest reserve respective to these villages. Likewise, protection measures such as creation of firelines and inspection path inside the area for preventing it from fire and other biotic interference. Apart from this, artificial regeneration by planting suitable species and their subsequent gap filling was also done. All these measures improved the quality and health of the forest and increased the growing stock of the area.

2) The preservation of community forest also directly protects

watershed of the nearby village which increase the water reservoir in the area and acts as a good source of water for village water tank, spring and well which had long been decreased due to depletion of forest cover.

3) The villagers could meet their requirements such as fuelwood, small timber, bamboo as well as other NTFPs after taking permission from the committee specially constituted for that, with permissible limit of quantity.

4) Through the entry point activities the villagers were benefitted in various manner which includes construction of community Hall, public urinal, construction of link road, church, waiting shed, culvert and other water tank depending upon the requirements of the public. Apart from this, the department also distributed LPG gas stove to the villagers that significantly reduced pressure on forest from firewood collection.

5) Women participation imparted with formation of VFDC to carry out the departmental works through this committee and for this the criteria was to include atleast 50% women into the committee as the committee members or one by fifth percent.

## CONCLUSIONS

The study on this community forest to the selected three villages is very helpful in perceiving the departmental goal towards maintenance of community forest in its present structure and composition to achieve sustainable utilization of such forest by the local users. Previously the local users depended heavily on the forest nearby their village and from which the maximum requirements were met.

However, the mere existence of community forest nearby the village as a reserve for security as well as to supply village requirement was not enough for the sustaining uses of such forest. The identification of such problems through the village survey, the management measures through different means of technical and people participation brought positive changes to the existing conditions of these community forests.

At the same time, the scientific and technical inputs given by the department augmented the stronghold of this community forest as there were some provisions under Mizoram Forest Act 1955. From this, the uses of community forest were regulated with certain rules and guidelines.

The four years project from the year 2011 to 2014 to preserve this community forest at three villages namely Chengpui, Zotuitlang and Mausen gave a good outcome for rejuvenating the forest and improve the growing stock and lastly benefit the local users.

## ACKNOWLEDGEMENTS

DFO Lunglei Forest Division.

Forest Department, Mizoram.

*Photo: Teak Tree at Nilambur*
*Credit: Abhilash D., IFS, Lecturer, CASFOS, Dehradun*

# FOREST PRODUCTIVITY

FOREST PRODUCTIVITY

# Increasing Tree Cover and Agro-forestry: A Success Story of Uttar Pradesh and Chattishgarh

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***Difficult to increase the forest area in present scenarios of urbanization, this kind of initiatives like agro-forestry may help in increase the forest cover by plantation of tress outside the forest area***

## INTRODUCTION

India is the country where farmers are considered to be the most deprived community and where modern farming concepts are still to spread. It is a known fact that 60% of our land is under agriculture whereas only 18% of GDP is coming from the sector. The situation demands early technological and policy level up gradation to boost our age-old agriculture system. That may be by upgrading tools, techniques, genetically crop-generation or adding some new concept regarding their value addition. This may be done by implementation of agro-forestry by planting more trees as a long term investment rotation in agricultural sector. Alongwith main agricultural crop, crop fields should also contain some fast growing tree species as per the field's capacity which will give a good return in 5-10 years of rotation. Agro-forestry is the fastest way to increase our forest cover in present scenario by plantation and conservation activities. In this article Uttar Pradesh and Chattishgarh states have been taken into consideration in agro-forestry sector.

In recent years the increase of tree cover is the indication of increasing agro-forestry and plantation in agriculture fields. Barren lands are being recovered and plantations are being done by the farmers. Even in Uttar Pradesh some farmers are taking lease of a land for 5-7 years and planting trees

**Forest Cover (as per FSI reports)**

| States | 2015 | 2017 |
|---|---|---|
| Uttar Pradesh | A net increase in the state cover. | A net increase 278 sq km than previous assessment. |
| Chattishgarh | Small decrease in total forest cover but in two districts positive increase. | Small decrease of 12 sq km but some positive changes as well. |

**Increases are due to plantation and better protection activities*

**Tree Cover (as per FSI reports)**

| States | Tree cover (in sq km) 2015 | Tree cover (in sq km) 2017 | Increase (in sq km) | Tree cover area % in 2015 | Tree cover area % in 2017 | Increase in area % |
|---|---|---|---|---|---|---|
| Uttar Pradesh | 7044 | 7442 | 398 | 2.92 | 3.09 | 0.17 |
| Chattishgarh | 3629 | 3833 | 204 | 2.68 | 2.84 | 0.16 |

**Tree Cover- Tree patches less than 1 ha in extent and scattered trees are taken into account; Thus tree included in tree cover constitute only a part of Tree Outside Forest (TOF). TOF refers to trees growing outside the notified forest area irrespective of size and patch.*

in agro-forestry method. *Eucalyptus* species is under consideration of this article.

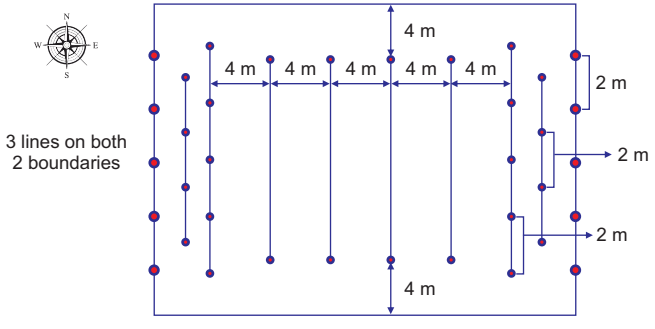
**Plantation in agricultural land in Uttar Pradesh**

In Uttar Pradesh, farmers in several districts are following the method of agro forestry by planting trees either on-two side of the boundary plot, or each and every side of the boundary, dividing the plot into several sub plots. Species selected for the plantation are mainly fast growing species *viz.*, *Populus deltoids*, *Eucalyptus species* etc.

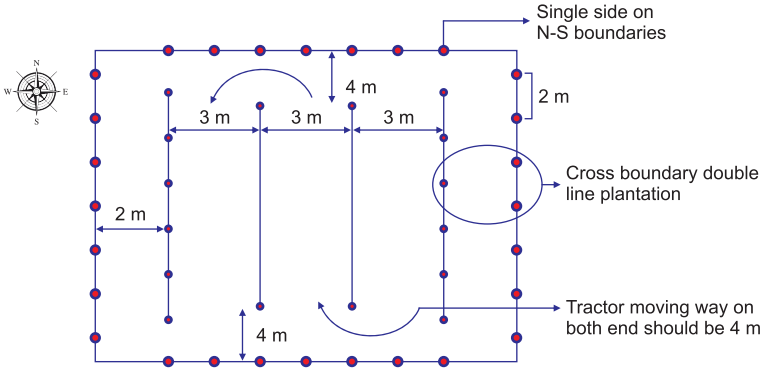
**Plantation Models**

Three main species of Eucalyptus are being planted *viz.*, *Eucalyptus globulus*, *Eucalyptus tereiticornis* and *Eucalyptus camaldulensis*. Some private agencies are involved in the agro forestry farming in Uttar Pradesh. They advise farmers to follow the Block Plantation model of spacing 0.5 x 0.5 m, 1 x 1 m, 2 x 2 m etc. But according to experts 4 x 2 m spacing for *Eucalyptus* plantation in agro-forestry model is the standard. In Hardoi district some plantations of 2 x 2 m spacing has gained utmost success which is an exceptional case.

In agro-forestry models one can also choose of planting trees only on two sides of a plot. In this case 1 ha land will contain 200 plants in 2 x 2 m spacing. That would ultimately give at least 200 x ₹ 1500 = ₹ 3,00,000/- at the end of five years. Again some farmers prefer more trees and they plant 500-800 plants in 1 ha land to gain more. This can be done easily by planting two rows or 3 rows in one boundary line and covering only two sides of the plot.




Agro-forestry model contains less plants but very economic for practice




Some farmers prefer three line of plantation on two sides of the field. North to south is the right direction of block plantation. If one is doing block plantation on East-West direction there would be problems regarding sunshine for the whole day, thus it hampers the growth of each tree in the field.

Between each row in the plantation a space of three meter is necessary to plough the land in coming seasons easily. Also on each corner of block plantation little bit more space than three meter is necessary as for movement of tractor and ploughing machine. One entry-exit gate is necessary if possible on two different side of the field for the tractor.

**Plant Protection**

Only at the time of planting anti termites treatment is done. Most of the time *Eucalyptus* plants manage water from the water provided for the crop growing. However, watering by preparing 0.5 m deep water channel throughout the field is also possible. For better growth some anti fungal spray before and in between rainy season is necessary. As far as fertilizer is concerned, plants do not need any fertilizer till the second year. After that use of 40-50 gram of NPK, 20-30 gram of zinc-sulphate and 20-30 gram of mixture of all essential micro-nutrients are required in 3-4 months rotation. Fertilisation should be done in split doses and in temporal variation.

**Some drawbacks**

Some negative aspects of *Eucalyptus* plantation are also there. It can reduce the fertility and area of land for crop production. After 2 years only shade bearer agro crops can be preferred if the plantation is denser (like 1200-1500 in one ha land). Some private agencies are misguiding the farmers and giving ideas of planting much more trees showing wrong calculations of profit.

**Problems faced by farmers**

They are again in the clever hand of traders. But most of the farmers are knowledgeable enough regarding plantation. Main problem is the marketing of matured *Eucalyptus* trees for which the farmers are not finding a good and reliable buyer. Most of the

time direct the buyers are the middle men. They are interested in buying the whole timber in lump sum price. Thus actual profit is always on the middle man side and not to the farmer's side. If 200 trees are to be sold they fix a rate of ₹ 500/- to ₹ 700/- per tree. However, if those are sold by weighing farmers could manage to get ₹ 1000/- per tree. Most of the time unauthorised people are opening sale centres who misguide the farmers to plant about 3000-5000 plants in 1 ha land. However, after 1-2 years the farmer realizes the fact of failure and are being cheated. By the time unauthorized sellers shift their office from one district to another. These are some points which are preventing the conventional farmers to accept the model for the better livelihood. They goes on the other side and creates hindrance in increasing tree cover in Uttar Pradesh.


**Glimpse of agro-forestry models followed in Uttar Pradesh and Chattishgarh**

**Increasing tree cover in Chattishgarh**

| Hariyali Prasar Yojona by Chattishgarh Forest Department | |
|---|---|
| **Plan preview** | Under the scheme every year, interested farmers for scheduled caste, schedule tribe and all other classes will be distributed minimum 50 plants of their desired species and maximum 500 plants per farmer. As far as the plantation of grafted plant is conserved maximum 50 plants per farmer will be distributed.<br>In this plantation, the cost per plant has been fixed in which 1st year plant preparation, plant transportation, planting, 2nd time drainage, fertilizer/pesticide; 2nd and 3rd years expenditure on fertilizer /pesticide and living plants are included. |
| **Proposed species for planting** | Khambhar, Bamboo, Teak, Amla, Jackfruit, Guava, Lemon, *Eucalyptus* species, Sirus, Munaga, Shishu, Sharif etc. |
| **Area selection** | The scheme will be implemented in all the districts of the state. More emphasis will be given in the districts of Durg, Janjgir Champa, Bilaspur, Mungeli, Mahasamund, Raipur, Bemetara, Balod and tribal districts which are in low forest area. |
| **Norms of expenditure to be spent in 03 years under the scheme** | Type of plant — Max expenditure per plant in 03 years<br>Common plant — ₹ 22.00/-<br>Clonal plant — ₹ 23.25/-<br>Fruit grafted plant — ₹ 43.25/- |
| **Benefits from plan** | • Employment creation in left extremism and other backward areas.<br>• Generation of approximately 2 million human days employment per year.<br>• Development of adjoining land.<br>• Increase in income of tribals and other backward classes.<br>• Improve the environment.<br>• Increase in the production of forest produce.<br>• Forestry expansion in non-forest land |

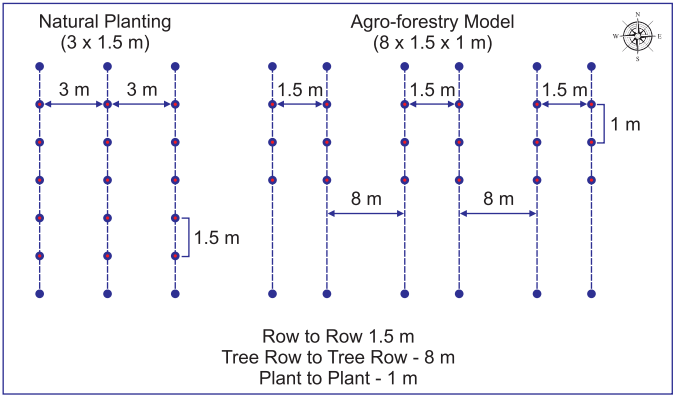
It is a wonderful project to increase earning from agriculture and to support the farmers. The method of yield outsourcing is also being suggested by the Forest Department. This kind of project is helpful for farmer as well as to grow more and more trees outside forest area resulting net increase of tree cover. As it is very difficult to increase the forest area in present scenarios of urbanization, this kind of initiatives like agro-forestry may help in increase the forest cover by plantation of tress outside the forest area.

Basically two plantation models for *Eucalyptus* species are being followed in Chattishgarh:

Therefore, in natural plantation about 2222 plants are planted per hectare while in agro forestry model on an average about 2000 plants are being planted in 1 hectare land.

**Cost-benefit calculation based on Chattishgarh Forest Department**

Cost is not involved here as the farmers are getting all planting material free of cost from Forest Department.




- Sale price of 1 ton timber - ₹ 5500/-
- Per hectare 100 ton timber is produced.
- Therefore, profit from 1 ha land in 5 years is (₹ 5500/- x 100) = ₹ 5,50,000.
- In agro-forestry model if we are taking that from 2000 plants/ha. 50% will survive and rest 50% will be used for internal expense mitigation of agro crop. Then also 1000 plant/ha will survive.
- If 1 tree is giving ₹ 1000/- in five years then whole business is of = ₹ 1000/- x 1000 = ₹ 10,00,000/-.
- That means farmer can earn ₹ 2,00,000/- per year/ha by the forestry crop.
- This would be of extra benefit provided the total agricultural production of the land will be minimized by 20-30%.

## CONCLUSIONS

In coming days agro-forestry will be the key to reduce farmers economic degradation and to increase total carbon stock. But proper planning and help from Forest Department is needed to prepare a good channel between farmer's agro yield and its supply to the market. Chattishgarh Government is taking good care of the farmer in marketing which is a positive sign. Uttar Pradesh Government is also doing welfare of farmers distributing fast growing plants in large numbers which ultimately contributes net increase of tree cover.

FOREST PRODUCTIVITY

# Grassland Management and Grass Improvement Work in Rajkot Forest Division

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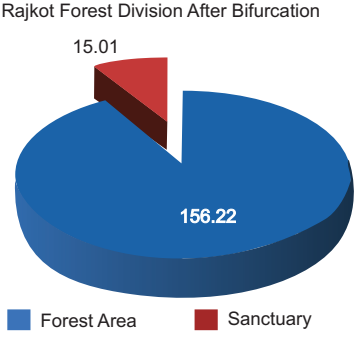
***Grass production is although increasing every year but use of modern technologies and effective protective measures can further help to increase yield with better quality***

## INTRODUCTION

The Rajkot Forest Division covered in Gujarat is covered by Rajkot, Lodhika, Paddhari, Kotda sangani, Gondal, Jam kandorna, Dhoraji, Jetpur, Upleta, Jasdan, Wakaner, Morbi and Tankara talukas.

Climatic Condition is dry, tropical climate, characterized by frequent drought and low rainfall with high temperature. Temperature ranges from 43$^0$C in May to 8$^0$C in December. The highest ever recorded temperature is 43.70$^0$C and lowest is 7.6$^0$C. Average, temperature is at the peak in month of May-June and continues to be higher up to August. The rainy days vary from 60 to 75 days per annum. The rainy months are July, August and September. The rainfall varies from 191 mm to 848 mm. Rajkot Division has scarcity of sweet water resources. The surface water consists of seasonal river flows, though insufficient rainfall. The water table is deep at about 100 to 225 ft which gets lower during summer months. According to Champion and Sheth's classification Dry Tropical Forests and Tropical Thorn Forests are the major forest types of Rajkot.




**Grasslands (*Vidis*) in Rajkot Forest Division:** Grassland is a landscape unit dominated by grasses. About 1400 km$^2$ of Grasslands in Gujarat are administrated by the State Forest Department and are known as *Vidis.* Out of the total vidis in the state, a large proportion (92%) is distributed in the semi-arid and arid regions of Saurashtra and Kutch.

Rajkot Working Plan covers the forest area of Rajkot district including the grasslands. Development and management of forest including

grasslands is the major thrust of the working plan.

**Reserve and Non-reserve *Vidis***

**1) Reserve *Vidi***: *Vidi* producing grasses above 1,00,000 kg per annum are known as Reserve *vidis*. Reserve *Vidis*' management had salient features like, Protection by *Vidi* Chowkidar and Departmental Guard. Cutting, collecting, baling, transporting and storing under the departmental supervision by Forester; works measured and paid by Range Forest Officers. Monitored by Assistant Conservator of Forests and other higher officials.

**2) Non-reserve *Vidi*:** *Vidi* producing grasses up to 1, 00,000 kg per annum are known as Non-reserve *Vidis*. The auction of grasses is done in the month of June-July, with regard to the following priorities.

- Gaushalas and cattle breeding institutions.
- Maldhari Co-operative societies.
- Local Milk producing Mandlies.
- Local Gram Panchayat.

**Grassland Management Working Circles**

**1) High Productivity Grassland Management Working Circle:** This working circle has vidi areas ranging from Godaladhar 48.25 ha to Bhadla vidi having area of 668.95 ha. Objectives are to raise the yield of grass through appropriate as well as effective management practices; to improve the quality of grass by replacing inferior grasses those come up annually by superior edible quality grass species; and to increase the productivity of land by adopting suitable soil and moisture measures.

The working circle includes Reserve as well as Non-reserve *vidis*. The *vidis*

| S.No. | Type of *Vidi* | Total Number | Total Area (ha) |
|---|---|---|---|
| 1 | Reserve | 19 | 6829.63 |
| 2 | Non-reserve | 123 | 5056.07 |
| | Total | 142 | 11885.7 |

**Taluka wise details of reserved *Vidis* in Rajkot division**

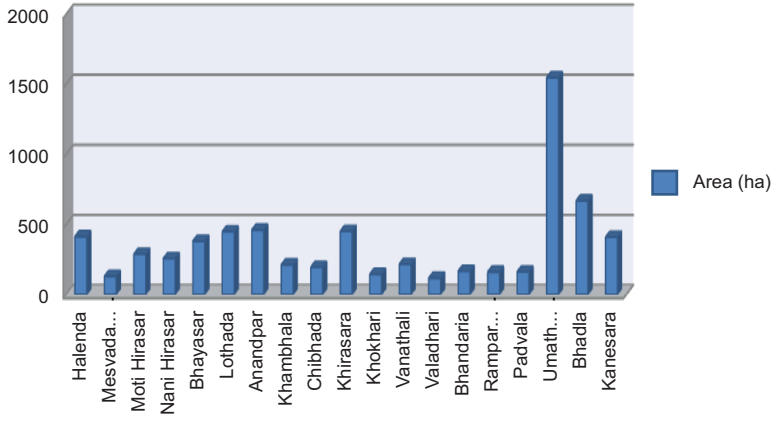


**Table: Main Grass Species found in Rajkot forest division**

| S.No. | Local Name | Botanical Name | Palatable/Non-palatable |
|---|---|---|---|
| 1 | Bhangaru | *Apaluda mutica* | Palatable |
| 2 | Lapdu | *Aristida adscensionis* | Non-palatable |
| 3 | Savarni | *Aristida funiculate* | Palatable |
| 4 | Dharaf | *Bothriochloa glabra* | Palatable |
| 5 | Zinzavo | *Bothriochloa ischaemum* | Palatable |
| 6 | Dhaman ghas | *Cenchrus setigerus* | Palatable |
| 7 | Fuliyu | *Chloris barbata* | Palatable |
| 8 | Gandharia | *cymbopogon jwarancusa* | Non-palatable |
| 9 | Jhinjhavo | *Dicanthium aegyptium* | Palatable |
| 10 | Sepiyu | *Eragrostris tenella* | Palatable |
| 11 | Kagdo | *Heteropogon contortus* | Palatable |
| 12 | Ghaulu | *Iseilema tenella* | Palatable |
| 13 | Shaniyar | *Sehima sulcatum* | Palatable |
| 14 | Mahoti | *Iseilema prostratum* | Palatable |
| 15 | Baru | *Sorghum halepense* | Palatable |
| 16 | Ratad | *Themeda quadrivalvis* | Palatable |
| 17 | - | *Dactyloctenium aegyptium* | Palatable |
| 18 | - | *Eragrostris tremula* | Palatable |
| 19 | - | *Melanocenchris jacquemontii* | Palatable |
| 20 | - | *Themeda triandra* | Palatable |

having production above average *i.e.* having productivity of more than 25000 kg per ha have been considered as 'Good' while those having less than the average as having 'Poor' status. Most of the *vidis* have soil of yellow clay to red murrum and black cotton.

**2) Low Productivity Grassland Management Working Circle:** This working circle was constituted in previous Plans separately to pay more attention to Non-reserved *vidis*. Although two *vidis* out of them are taken to High Productivity Grassland Management Working Circle for experiment. Objectives are to strive for the continued improvement of these area including Non-reserve *vidis* so as to bring them at par with the high productivity Grassland working circle areas in terms of grass yield to increase the productivity of land by adopting suitable soil and moisture measures.

It has also been prescribed that no 'fair' status non-reserve *vidis* shall be harvested for at least two years and 'poor' status for 5 years. The continued improvement of such *vidis* must be carried out until their production status gets converted to 'good'. Most of these *vidis* have undulating terrain with low hillocks. Soil varies from black cotton, alluvial, saline to murrum. The depth of soil varies from 45 cm to virtually exposed rock with no soil depth.

**Grass Harvesting, Mechanization and Transport**

Grass harvest involves multiple step process namely Cutting, Drying or

"Curing", Processing and Storing. Grass fields do not have to be re-seeded each year in the way that grain crops are, but regular fertilizing is usually required and seeding field every few years helps increase yield. However, tall grass at the proper stage of maturity must be cut, and then allowed to be sun dried and bailed. Then bailed grass is placed for storage into grass stack or into barn or shed to protect it from rot.

Grass can be raked into rows as it is cut, then turned periodically, to dry and then processing into bales afterwards. Once Grass is cut, dried and raked into windrows, it is usually gathered into bales or bundles, and then hauled to a central location for storage. Grass must be fully dried when baled and kept dry in storage.

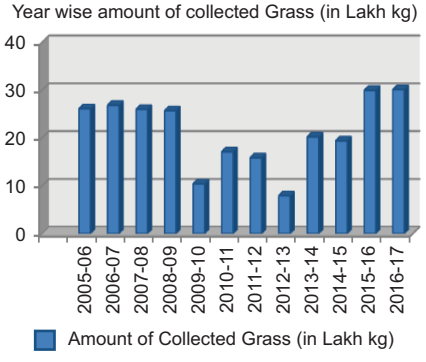
**Modern Mechanized Techniques**

Modern mechanized grass production today is usually performed by a number of machines. While small operations use tractor to pull various implements for mowing and raking, larger operations use specialized machine such as a mower or a swather, which are designed to cut the grass and arrange it into stacks in one step.



**Grass weighing, Pressing and Storage**

**Year wise Grass Production from Reserve *Vidis* in Rajkot District**




Balers are usually pulled by a tractor with large balers requiring more powerful tractors. The bales should be tied with 16 no. Black wire with Five knots. According to size, there are two types of bales. Small bales and large bales. There are 27 godowns with storage of 46.30 lakh kg grass (As on 31/08/2016).

**Improvement in Grass Production**

***Reasons for less grass production:***

1. Due to lack of sufficient fencing around all Reserve and Unreserved *Vidis*, problem of illicit grazing is there.
2. Due to plantation work carried out in *vidis*, thorny plant species have been increased.
3. Due to over growth of Gando Baval (*Prosophis juliflora), Gorad (Acacia senegal),* Kuvadiyu *(Cassia tora),* Lantana etc. Their unnecessary growth converts Grasslands into Treelands.
4. Lack of permanent *Vidi* Chowkidar's post.
5. Grazing by herbivores like Bluebulls.
6. Natural factors like Drought and Unseasonal rain.
7. Lack of proper Infrastructure and Insufficient and Irregular Financial funding.

**Measures to increase Grass production:**

**1. Irrigated Grass Improvement Project:** After ploughing the flat surface of *Vidis*, Chas-pala are prepared. After that "Thumda" plantation is done following Fencing work. Irrigated water supply is provided to increase grass production up to 2-3 times a year. This project requires lots of water so limited to certain area.

**2. Rainfed (Non-irrigated) Grass Improvement Project**: In this project after making Saucer, pit, contour, trenches-seeds mixed with vermin compost and soil are sawn to one place. It can be done by using pellets also. At present, under following plantation plan, grass improvement programme is carried out.

a) SMC Grassland Improvement.
b) Grassland development (Banni Project).
c) Pasture Development (FDA).

3. Direct seed sowing or Thumda plantation can be done to improve grass production in eroded areas of Reserve *vidis.*

4. Removal of unwanted growth of Gando Baval (*Prosophis juliflora), Gorad (Acacia Senegal),* Kuvadiyu *(Cassia tora),* Lantana *etc.* will increase the Grass production.

5. Bad quality grasses like Lapdu, Gandharu should be removed.
6. Protection wall and barbed wire fencing to provide protection from cattles.
7. Enough numbers of *Vidi* chowkidars or protection labors can be appointed for *Vidi* Protection.
8. **Soil and Moisture Conservation (SMC) Work:** Construction of check dams, retaining wall, forest pond, bore well *etc.* can be done. In sloppy areas, saucers, small contour trenches etc can be prepared and seed/ Thumda plantation can be done.
9. **Training and Awareness Programme:** For the work like Grass plantation, Grass collection, Pressing, Transporting, Stacking *etc.* training should be arrange for *Vidi* staff. Moreover, Farmers' Training should be arranged to aware them about storage and chopping of forge obtained from Wheat, Barley, pearl millet etc to ensure 25-30% of grass savings.
10. **Grass Storage:** The grass godowns should be constructed around the *Vidis* to minimize transportation expenditure. Moreover, quarters of *Vidi* Chowkidars should be constructed near to Godown so in case of Fire they can reach immediately. Increase in 20% space in godowns will help to manage grass distribution.

**Fire Management in Grassland**

Grass baled before it is fully dry can produce enough heat to catch on fire. One has to be careful about moisture levels to avoid spontaneous combustion, which is a leading cause of Grass stack/ Godown fires. Research has shown that heat is produced by the respiration process, which occurs until the moisture content of drying grass drops below 40%. Grass is considered fully dry when it reaches 20% moisture. Combustion problems typically occur within five to seven days of baling. A bale cooler than $49^0$C is in little danger, bales between 49 and $60^0$C need to be removed from a barn or structure and separated so that they can cool off. If the temperature of a bale exceeds more than $60^0$C, it can combust. Care should therefore be taken on these counts.

## Conclusion

Arid and Semi-arid regions of Saurashtra where climatic and edaphic conditions do not support growth of higher trees with great timber value resin etc. So, the grasslands are boon for such region where frequent drought occurs. The grass production is although increasing every year but use of modern technologies and effective protective measures can further help to increase yield with better quality.

## Acknowledgement

I wish to express my heartfelt thanks to the DFO Rajkot and Gujarat Forest Department for rendering help and guidance during the case study.

FOREST PRODUCTIVITY

# CDM Plantation: A Step Towards Greenery in Sujanpur Tira, District Hamirpur, Himachal Pradesh

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***CDM is designed to help developed countries to meet their emission limitation commitments and to assist developing countries to achieve sustainable development***

## CLIMATE CHANGE

Although it is an ongoing process but after the industrial revolution, in the middle of 19th century, there has been a clear trend, both regional and global, in the climate change. The climate is getting warmer due to both natural and human induced processes. A large part of world has agreed that the world's Green House gases ($CO_2$, $CH_4$ etc.) emission has to slow down. This was manifested in the Kyoto protocol in 1997. This thought was adopted at the Cop 3 (Conference of parties) held by United Nation Framework on Climate Change (UNFCC) under which several countries agreed to reduce their carbon emission on an average of 5.2% of 1990 year's level. To achieve this target many schemes were proposed and run. Clean Development Mechanism (CDM) concept was one among such scheme.

CDM is designed to help developed countries to meet their emission limitation commitments and to assist developing countries to achieve sustainable development. In practice developed countries finance a project in a developing country. The developing countries take the credit for the emission lowering and the developing country gets inflow of capital and technology.

**Indian forests, available land and carbon sequestration:** There are three possible way to maintain a sustainable development and at the same conserve and sequester carbon. First existing forest can be conserved more effectively, preventing loss of biomass and in some case increase biomass. Second, new area could be planted or regenerated. Third carbon emission could be reduced by the use of wood products received from the forest plantation instead of non-renewable energy such as fossil fuel.

In India 23% of the geographical area this considered wasteland this includes degraded forest land as well as crop and other privately owned non crop land categories and pasture land (excluding the forest land with 10-40% crown cover and the area under roads and settlements).

**Forest as a carbon sink:** Carbon can be stored in different ways, where natural stocks includes ocean fossils fuel deposits, the terrestrial system and the atmosphere physical processes transfer carbon from the atmosphere to the ocean and biological growth involves the shifting from one stock to another. Plants fix the atmospheric carbon in cell tissue as with the growth and $O_2$ is released and thereby transforming carbon from the atmospheric to the biotic system. There are four components of carbon storage in a forest ecosystem - the Trees, Plants growing on the forest floor, debris or litter and the soil (as interaction of dead plants and animal materials with the soil microbes).

**CDM plantation:** Himachal Pradesh and Haryana were the first state in India to implement CDM scheme in afforestation and reforestation program. We visited four places at Sujanpur Tira, in Hamirpur district of Himachal Pradesh. It is mandatory that the area which has a forest density less than 30% will be selected under the CDM plantation. The main reason of less forest cover was the denuded land and the reasons behind this were that in most of the cases land has a sloppy terrain and due to such terrain the area has become much susceptible to the excessive water runoff and so ultimately soil degradation occurs. The major reason behind the degradation was the Biotic pressure (Grazing) and fire in summer season. For the private lands one more reason of degradation was that, the owner leaves the agriculture land fallow.

The biggest site we have visited was Mehlaroo village where land was used by the people for fodder of cattle. Due to Biotic pressure and the above mentioned reasons, this site was denuded and villagers could get only grasses in some months that too in very less quantity. People wanted the government to carry out the plantation work so that their land will be safe from further degradation and they will get fodder for cattle through out the year.

CDM project started in 2008 here under the Mid Himalayan Watershed Project (MHWDP). The MHWDP is being implemented in mid and high hills ranges between 600 to 1800 meters by the Government of Himachal Pradesh covering 11 watershed divisions falling in 10 districts. Plantation is a major activity in this project and CDM plantation is also run under this project.

After examining the soil profile of the area, we found that the soil depth of the area was too low and the plants

**Livestock and other information**

| Particulars | Hamirpur | Sujanpur |
|---|---|---|
| Population | 412009 | 116059 |
| Family (No. of family) | 80024 | 24868 |
| Villagers (No. of person) | 381836 | 68151 |
| Livestock | 192720 | 49471 |
| Area (ha) | 110070 | 26551 |
| Irrigated Area (ha) | 3753 | 74 |
| Non irrigated area (ha) | 35535 | 12627 |
| Agriculture land (ha) | 50712 | 12701 |
| Forest Area (ha) | 20206 | 881 |
| Fallow land (ha) | 11300 | 733 |

*Source: DWDO Sujanpur*

cannot grow easily. So for vigor our growth they brought the soil from outside for plantation, which was very essential to grow a plant in any area. There are also 45 species of plants which are suitable for this type of land.

To protect and monitor the area there was a clear instruction that there will be a committee of local villagers which will also do the protection work . This committee is known as User Group. The user group was only formed by the local villagers and one person will be the president and other members will do the work according the rules and regulations of the contract while forming Village Development Committee for CDM work. In Himachal Pradesh, the span of contract is 20 years. 45 species were selected for the plantation under CDM by the specialized team. There were clear instructions that the 1st year plantation and beating up operation till 3 years and any other expenses will be borne by the project and after that any other work will have to be done by the User Group.

Since twenty years is not a shorter span of time so there was very much dedication to the work and assigned duty such as protection of planted area from the grazing through social fencing. So there was a provision of money benefit in every five year interval depending upon the survival percentage of plants.

The main hurdle was not the plantation, but post-plantation activities such as protection that was done by the user group itself. For this purpose forest department along with all MHWDP team run an awareness program and other entry line activities. They were also told about the funding they will get depending upon success rate and growth of plantation. Here we want to mention that in this World Bank funded scheme the fund is released on the fact that how much carbon is sequestered by the plant and this will be released after pre-determined period of time. In Mehlaroo and other sites the people are getting additional money by the sale of grass growing on planted land.

**Table of expenditure**

| Name of the Area | Year | Expenditure | No. of Plants |
|---|---|---|---|
| Mehlaroo | 2008-09 | 1071541 | 72020 |
| | 2009-10 | 224339 | 20350 |
| | 2010-11 | 178365 | 16280 |
| Chabutara Kot | 2008-09 | 38154 | 6837 |
| | 2010-11 | 39926 | 1367 |
| | 2011-12 | 20086 | 1025 |
| Khiah | 2008-09 | 1,24,759 | 5401 |
| | 2009-10 | 30000 | 1344 |
| | 2010-11 | 31551 | 1081 |
| Tauni devi | 2011-12 | 29809 | 2200 |
| | 2012-13 | 1550 | 500 |
| | 2013-14 | 2099 | 400 |
| Nadaun Kitpal | 2012-13 | 57590 | 2800 |
| | 2013-14 | 14820 | 700 |
| Badaran | 2013-14 | 50677 | 3200 |

*Source: Plantation Journal*

**Result**

| Name of the area and parcel area | Year of plantation | Survival rate |
|---|---|---|
| Mehlaroo (74.63 ha) | 2008-09 | 84% |
| Nadaun (13.5 ha) | 2012-13 | 64% |
| Chabutara (6.4 ha) | 2008-09 | 82% |
| Tauni Devi (2 ha) | 2011-12 | 70% |

*Source: Plantation journals, avg. height of plants 2 meter*

## Conclusion

Although the plantation activity and management of forest is the first duty of Forest Department, it is important to have co-operation between different bodies and gaining confidence of villagers and also monitoring that the benefits will distributed evenly among the beneficiaries. Experts from Indian Agriculture Research Institute (IARI) visited the site and approved that biomass and quality of grasses has been improved. Such an activity with peoples involvement aimed at sequestering carbon is definitely a pride for the Forest Department and local people as well.

FOREST PRODUCTIVITY

# Clonal Eucalyptus Initiatives in Gujarat - A Field Evaluation

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***A Scientific approach to raise valuable eucalyptus clone***

## Introduction

In Gujarat, forest cover is relatively low but tree cover-Trees Out-side Forest (TOF) is the second highest amongst the major Indian states. The fact that further allocation of land towards forestry purpose is almost impossible. Therefore, the only alternative for increasing the tree cover and augmenting the supply of forest produce is planting trees in the low productivity wastelands and farmlands with the help of people by organizing and motivating them. Accordingly, the government of Gujarat adopted a new approach more than four decades ago, and in 1969-70, Social Forestry was born as a People's Programme for planting trees outside the forest lands. Social forestry divisions, first in the country, were established in the State. With this initiative, the State became the pioneer in social forestry in the world. Of the total TOF, about 71.3% were on private lands - farmland and orchards (agro-forestry). Seven districts - Anand, Tapi, Gandhinagar, Mahesana Valsad, Surat Kheda and Godhra have tree densities over 30 trees/ha. The study area mainly focus on Godhra Division. Godhra is a headquarter of the Panchamal district of Gujarat state. Godhra forest division have 22% of territorial forest and total trees outside forest area is 98.77 lakh as per FSI's 2013 report. Main notable thing is that 50% of trees outside forest area (ToF) in Panchmahal district (2013) are Eucalyptus trees, the ToF in Gujarat is 4.25% of its geographical area as against to 2.78% of national average (2013 FSI). The reason is the Social Forestry Programme initiated in 1969-70 whose objectives were to improve tree resources and provide for timber, fuel wood and fodder needs of the state, and to increase green cover. In 1980, first time eucalyptus was introduced and farmers accepted it as a cash crop having little investment, little care and getting handsome profit. Forest Research Centre, Godhra, Social Forest Division and Forest Corporation are producing 50 lakh clones/year in Panchama district. This study is mainly focused on the changing economic trends of agro forestry species and changes of agro forestry need of the farmer.

**Clonal Eucalyptus Propagation:** An organism or cell, or group of organisms

or cells, produced asexually from one ancestor or stock, to which they are genetically identical are called as clone. Mother plants are raised in bed and selected stems were cut and collected into vessel having water with fungicide. After dipping it into hormone mixture planted in root trainers having vermiculite then placed in mist chamber till root develops. After that transferred to net house till they attained a desired height and kept out for hardening. It takes around 90 days to develop a clone.

During the case study three sites of clonal Eucalyptus plantation were visited for field evaluation.

**Case study 1: Gujarat Forest Development Corporation (Panam project )**

Out of 6146 ha, seedlings of eucalyptus from seed origin were planted on 4000 ha since 1981. However, from 2003-2004 onwards clonal propagules of eucalyptus were used for planting. Clonal varieties ITC 413 and JKSC 8 were used for non-irrigated areas and ITC 413 and JKSC 02 for irrigated areas with a spacing of 3 x 3 m. Major cultural operations like weeding, watering and ploughing are regularly carried out. As per working Plan 2014, the rotation period is 5 years. Coppicing is carried out for 3 generation, thus total life of one clonal tree is 20 years. On an average, 50% profit is being generated. Main reason for successful plantation is water canal passing through the reserve forest.

**Case Study : 2 Social Forestry Plantation - Gram Van (Village : Kakanpur)**

The state has about 18066 villages and more than 13000 panchayats. The annual income of the panchayats is usually very low; on the other hand, the Panchayats are in possession of plenty of Gauchar lands, where the amount and quality of grass is very low. The

**Plantation site of Panam project**

**Revenue** **in ₹**

| S.No. | Harvesting Year | Village Forest Numbers | Net Profit | 75% share | 25% share |
|---|---|---|---|---|---|
| 1 | 2005-2006 | 16 | 7648951 | 4054254 | 1351446 |
| 2 | 2008-2009 | 06 | 890291 | 442147 | 147383 |
| 3 | 2010-2011 | 05 | 1268467 | 605393 | 201797 |

scheme of Gram Van was started in 1974 all over the state in order to suitably develop such lands. Under this scheme, through Panchayat resolution, gaucher land is usually allotted to the Department for the purpose of creation of Gram Van. The creation of Gram Van has multiple benefits such as creation of source of income to the panchayat, supply of wood resource to local population at their door step, prevention of encroachments, soil and moisture conservation, etc. Upon maturity, the trees are auctioned and 75% of the net income (after deduction of expenses) is handed over to the Village Panchayat for use in developmental activities. The remaining 25% amount is deposited in a joint account of Range Forest Officer and Sarpanch, and is utilized for re-plantation activities in the village. In village Kakanpur, total eucalyptus plantation is 35 ha and plantation was carried out in year 2014-15 and 2015-16. The revenue generated under this scheme is depicted in Table 1.

**Case study: 3 Farm forestry / Agro forestry (Village: Malav)**

Malav is a village in Godhra the district with an area of 874 ha. 90% of private land is covered with Clonal Eucalyptus. Since 1991 people of this village are planting Clonal Eucalyptus. Rotaion period is form 3 to 4 years. Due to non availability of labours, irregular water supply, less agriculture output and water scarcity they have started Eucalyptus plantation (clone varieties JKSC 2, JKSC 8, ITC 413). 2.5 x 1 m spacing was used, so that they can grow agriculture crop in between lines. Now a days majority of farmers have their own high-tech nursery for propagating clones and they are selling them too. Demand is of 3 to 4 lakh clones per year in the village and J.K. paper mill, Songarh, Gujarat and Forest Department is providing clones to them. Majority of the timber goes for the pulp industry. Forest department is providing them clones at ₹ 5/- clone and technical inputs for plantation as well.

**Farm forestry irrigated model (FF 1):** In this scheme irrigated land is selected, after which Forest department provides them 1000 seedlings/ha or ₹ 8 seedlings, if seedlings were brought from other sources. Major cultural operations are

**Eucalyptus pole depot**

Table 1: Eucalyptus Profit chart ( Before year of 2015-16)

in ₹

| Per ha seedlings in block plantation (2.5x1 m) | Per ha total expenses 1st year | Survival rate | Plants available to harvest | In best condition volume per tree | In normal condition volume per tree | Rate per 20 kg | Total income | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | In best condition | In normal condition |
| 4000 | 88000 | 80% | 3200 | 42 kg/1.2 m | 35 kg/1 m | 80 | 537600 | 448000 |

carried out under supervision of Forest department. If survival rate is more than 50% then department provides them ₹ 4000/ha (up to 2 ha). After 4 years farmers can harvest. So with this scheme, department is encouraging farmers to grow more tress in their private land and indirectly it reduces pressure from forest, increasing tree cover and it also works as carbon stock.

**Benefits of clonal eucalyptus**:

1) Easy to raise
2) Clonal seedlings fetches 30 to 40% more price than seed origin
3) Resistance to diseases
4) Rotation period is less as compared to seed origin
5) Quality and quantity wise giving better results
6) Straighter, uniform and knotless bole
7) Less labour intensive

Eucalyptus are mainly used as timber for poles, pulp and fuel wood. But challenges ahead are like due to less durability of its pole industries are now using steel pole and paper industry are using *Leucaena leucocephala* and other species for pulp but still it is generating more profit than agriculture crops.

**Challenges observed after year of 2016**

Due to increasing of Clonal eucalyptus Agro forestry area in the state of Gujarat, the demand from Paper mill decreased. Usually J.K. paper mill located in the Sonagadh, Vyara region prefer to use Eucalyptus grown in the south Gujarat region. The Eucalyptus grown in south Gujarat to be proved

cheaper than Eucalyptus grown in the central Gujarat region due to more expenditure on transportation. The prices of the wood has fallen from ₹ 80/20 kg to ₹ 47/20 kg during the last two years. In the same Malav village, few farmers clear felled their whole plantation before crop become mature and they planned to shift to agriculture crop.

## Conclusion

Clonal Eucalyptus plantation under agro forestry system are making immense contributions towards development of wood based industries, local value addition, employment generation, diversification of agriculture, greening of the country and environmental amelioration. Likewise, clonal technology, supported with improved package of silvicultural management techniques and due safeguards, offers wonderful possibilities of very substantial improvements in productivity of plantations and very significant enhancement of quality of plantation grown timber. Expansion of clonal plantations of suitable species on degraded forest lands with reasonable soil depth and exploitation of full potential of clonal agroforestry plantations on private farmlands can lead us to realization of our dream of 33% tree cover as well as self sufficiency in timber, fuel wood and wood based products in near future consistent with environmental safeguards.

## Suggestions

Apart from clonal eucalyptus, department should diversify its plantation species for farm forestry. Taxation rules about farm forestry becomes a hurdle to achieve Social Forestry's goal. Support system like Minimum Support Price (MSP) should be initiated for the forest products. Social Forestry department should change its strategies according to people's needs.

FOREST PRODUCTIVITY

# Convergence for Tree Planting

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***Various Government Departments and Gram Panchayats are envisaged to join hands for intensive greening by planting 50 Crore seedlings in three years in Maharashtra***

## Introduction

The depleting green cover is one of the major cause for climate change and it is also affecting the monsoon. Intending to fight against global warming, climate change issues and to save the environment, the Maharashtra state government has decided to plant trees on large scale. The Government has set a target of planting 50 Crore sapling in the next three years *i.e.* from 2017 to 2019.

In 2016, the drive of 2 crore seedling plantation was initiated by the State Forest Department and the date was fixed by State Forest Department on 1st July 2016. In this drive Forest Department involved common people, 22 other Departments of Government, Gram Pachayats, Colleges, School students and NGOs. The government also created awareness about plantation, environment and its effect on climate change through print and electronic media, advertising on government vehicle and also through seminar on 2 crore plantation drive. The effort of Government and active people participation resulted in planting 2.82 crore seedlings against target of 2 crore plantation across the State. Our Hon'ble Prime Minister Shri. Narendra Modi appreciated the work of State Government of Maharashtra. The Limca book of record also took note of this drive.

After the success of this 2 crore Plantation drive and in order to continue the momentum, the State Government of Maharashtra has initiated 50 Crore plantation of sapling in the next three years from 2017 to 2019.

The State of Maharashtra has about 20% of its geographic area under forest cover. It aimed to increase it up to 33% in coming years. So through 50 crore plantation scheme it aimed to increase the tree cover of the state.

### Government Action Plan

Government has fixed the target of 50 crore plantation in next three years. It has divided the target of plantation among forest department and other government department in the ratio of 75% and 25%.

In Maharashtra, the monsoon starts around 8th of June every year but takes time to cover the entire state. Hence, based on the rainfall coverage, the

**Detail of the target of 50 crore plantation of the State Government is as follow**

| Year | Plantation Period | Forest Department | Other Government Department | Gram panchayat | Total Target |
|---|---|---|---|---|---|
| 2017 | 15 June to 7July 2017 | 2.25 Cr. | 75 Lakhs | 1 Cr. | 4 Cr. |
| 2018 | 15 June to 7July 2018 | 7.50 Cr. | 2.50 Cr. | 3 Cr. | 13 Cr. |
| 2019 | 15 June to 7July 2019 | 18.75 Cr. | 6.25 Cr. | 8 Cr. | 33 Cr. |
| Total | | 28.50 Cr. | 9.50 Cr. | 12 Cr. | 50 Cr. |

flexibility in the plantation period was fixed across the 36 districts of Maharashtra.

**Nursery Management**

To meet the demand of this massive plantation drive, Maharashtra forest department has taken all necessary steps for providing quality seedlings good height with 2 to 3 years age, suitable for the local climatic condition has been decided to be planted. The variety of plant species like local plant, medicinal, fruit tree, ornamental, timber plant etc. has been decided to be made available for plantation purpose.

20% mortality for 50 crore seedlings means 60 crore seedlings must be made available for the drive. In order to meet the target of seedlings, the State Government has decided to develop more nurseries through Forest Division, Social Forestry Division, MGNREGA Yojana and other Government Departments like Agriculture, PWD Department etc. Further, if required seedling can also be made available from private nurseries and non-government organisation institute run nursery.

**Plantation Site**

Degraded area of forest and non forest land, community land, road sides, canal bank, railway lines, institutional land, agriculture field border area has been selected for plantation site.

**Nursery for plantation**

**Micro Plan**

The Forest Department had proposed a micro plan for 1st July 2017 plantation. The micro plan was prepared for each project area. The micro plan included following:

1. Site demarcation and map preperation.
2. Treatment plan preparation.
3. Site preparation.
4. Planting programme with temporal target.
5. The choice of species and method of establishment.

**Monitoring Committee**

Committees have been formed at District and Taluka level. The duties of the committee working at various level is to plan, implement and coordinate among various agencies participating in this work. Experts, technician, NGO working in the field of forest, wildlife conservation, environment, biodiversity conservation have been made members of the committee.

a) **District level –** District Collector is the Chairman, while DFO will be Member Secretary.

b) **Taluka level –** SDO is the Chairman while RFO will be Member Secretary. Committee will take review of work on quarterly basis. In the meeting, local MLAs and MPs will also be invited.

**Mobile application - 'My Plants'**

A mobile application "My Plants" has been developed to record details of the plantation such as numbers, species and location into the computer system of the Forest Department. All volunteers at individual and organizational level should download and use this application to record their tree plantation work through the application, which was operational from 1st - 7th July.

Forest Department has developed Geo-tagging computer software system, which will collect detailed information about the site selection, pit digging, which plant species planted, its

**Plantation at agriculture university area, Parbhani**

Initiative of plantation by schools

photographs and the latitude and longitude of the place of plantation. It also includes reporting of plantation actually done.

The Forest Department has developed a format in which it will collect information of actual plantation.

**Green Army Formation**

One of the objective of plantation is to increase the forest cover from 20% to 33% which is mandatory. Due to insufficient staff, Forest Department has introduced Green army. The purpose of Green army is to create a social platform to involve the citizen in activities relating to forest and wild life (conservation, protection and preservation).

Any individual like student, women, senior citizen, Government employees, NGO by registering on the official portal of Green army Maharashtra, can become its member.

The role of Green army is to actively participate in different activities and programs organized by Maharashtra Forest Department like plantation, group patrolling for conservation of forest, volunteering for wildlife census.

**Eco-Battalion**

The state government is planning to rope in eco-battalions to execute its ambitious project of planting saplings in the drought-hit Marathwada region in the next three years. Eco-battalion will help the department in effective implementation of the plantation drive and survival of saplings. Disciplined and systematic execution of the allotted tasks of the eco-battalions is praise- worthy.

Green army and eco batalian

## CONCLUSION

1. Forest department always does plantation in open, degraded area. But on 1st July 2016, 2 crore plantation in one day drive was successful because of active participation of common people. This huge involvement of people has lead to conversion of this drive into a movement. This is an achievement of the Forest Department which has helped in achieving target of 5.4 crore plantation against target of 4 crore for the year 2017.
2. In last few years, rainfall in Maharashtra state has decreased and has become sporadic and un-predictable. People are realizing the consequence of environment degradation, forest and wildlife loss, biodiversity destruction etc. So this plantation scheme will be helpful in increasing not only Green cover but also helping in raising water table and reducing soil erosion and many more things.
3. Introduction of concepts like Green Army to help in plantation scheme for Forest Department is very handy innovation.
4. Coming years will actually show the success and failure of the 50 crore plantation scheme.

FOREST PRODUCTIVITY

# Performance of Peach Based Land Use System in Gravelly Riverbed Lands

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***Small and marginal farmers who depend on cultivation of annual crops can have this system for getting additional incomes other than annual crops***

## INTRODUCTION

Approximately one third areas (one lakh hectare) of Doon Valley is affected by soil degradation, which is presently out of cultivation due to presence of high percentage of boulders/stones (70-75%), sands (19-22%), silt (4-5%) and poor clay (2-3%) in the soil. This leads to a very high infiltration rate (30.0 cm $hr^{-1}$) and poor water holding capacity. On the other hand, is not possible to put arable land under fruit cultivation in view of decreasing land: man ratio on account of industrialization, population pressure, *etc.* However, degraded river bed lands can be brought under cultivation of fruit species like peach with soil and water conservation measure like micro-site improvement, mulches and inter-cropping of pulse and oil seed crops. Agri-horticultural systems is a land use and land management system in which agricultural crops *viz.* pulses, flowers, medicinal and aromatic plants, spices and condiments are cultivated in and around an orchard. There are many fruits like peach, mango, guava, litchi, pomegranate, plum, apple, pear, aonla, *etc.* are being grown commercially in the Himalayan states like Uttarakhand, Himachal Pradesh and Jammu and Kashmir. In this context, Peach (*Prunus persica* L.) is an important temperate fruit species of Indian Himalayan states which has wide range of cultivars ranging from subtropical to true temperate climate which needs chilling from 500 hours (low chilling cultivars) to 1000 hours (high chilling cultivars) for successful cultivation. In the plain area like Dehradun where low chilling cultivars (Saharanpur Prabhat, Pratap, Shan-e-Punjab, Floradasun, *etc.*) can be grown successfully with intercropping initially during juvenile phase up to 5-6 years. Low chilling cultivars are of subtropical origin and can be grown upto 1200 m above mean sea level. Its plant is easy to establish and also it does not require much inputs for its maintenance and gives good returns. Peach based agri-horticultural systems help in employment generation through diversification by introducing the crops in the pure peach system, in addition to management of orchards and fruits processing, thereby increasing income and reducing

migration of rural folk of foothill of Himalayan region to urban areas. Thus, to have more productivity from degraded lands through diversification create more opportunities for employment and income generation which will ensure the socio-economic development of the rural people of the area.

**Salient features**

The Peach (cv. Shan-e-punjab) plantation can be established with a suitable pit filling mixtures of 75% imported soil (65% sand, 7.2% silt and 2.8% clay) + 25% gravels + 50 kg FYM + recommended NPK for better aeration and moisture conservation on degraded riverbed lands, since peach is very susceptible for water logging hence sandy loam soil is better for growth and development (Fig. 1). As this technology developed for degraded lands therefore watering through drip irrigation system is beneficial during establishment of fruit plants and fruiting period for sustainable fruit productivity. This system helps in conservation of vegetation, soil, nutrients and provides fruits and food grain on a sustainable basis. The degraded lands can be improved through fruit based agri-horticultural systems. The crop rotations like Blackgram - toria can be practiced to utilize the interspaces for getting additional benefits from the systems.

**Fig. 1. Cultivation of Toria with peach on degraded land**

**Orchard establishment in degraded land**

The site selection for peach plantations should have soil depth around more than 90 cm. including degraded soils consisting of coarse textured soils and small to medium sized stones and gravels. Clear area of all unwanted shrubs and weeds and then demark the area for pit digging at 7 m apart in square or rectangular system. System of plantation to be followed depends upon area available. Preferably, triangular system may be followed for plantation as it accommodates 16% more plants as compared to square system of plantation. Proper drainage for safe disposal of water during rainy season should be provided. Generally the pit size depends upon canopy spread of fruit species. Demarcation/ layout of area should be completed with the help of ropes and fixing pegs and pit digging has to be done during in the month of December-January. One cubic meter pit size is suitable for peach plant in degraded land. Pit filling mixture should have FYM @ 50 kg, 25% gravels and 75% soil (65% sand, 7.2% silt and 2.8% clay) for degraded lands of Doon Valley (Fig. 2). Chemical fertilizer should be applied and half dose of recommended NPK (40:20:40 g) with chloropyriphos @ 20 ml/10 liters of water for drenching of pit and fill back the pit with this filling mixture. The level of filling mixture into the pits

should be up to 10-15 cm above from ground level. The planting of fruit plants should be done with at least one year old plants of 1-1.5 m height of selected cultivars during January to February. Keep graft union 20-30 cm above the ground and press soil firmly around the base. Provide support to peach plants with 1.5 m long stakes to keep plant straight. Provide watering immediately after planting with nearly 20 litre of water. Periodic monitoring of plantation helps in mortality replacement in the next year.

**Intercropping in *kharif* season**

Field preparation for sowing of *kharif* crops is undertaken after the first onset of rains and FYM is added at the rate of 5 t $ha^{-1}$. Sowing of black gram at the rate of 10 kg $ha^{-1}$ is carried out after the first monsoon showers are received in July. Weeding is carried out 1-2 times after sowing. Pod harvested in the month of September and crop residues/biomass is turn back into the soil by ploughing for improvement of soil characteristics which added 13.6, 7.45 and 41.3 kg $ha^{-1}$ of NPK after harvesting of crop.

Pit (1 $m^3$)

Gravels (25%)

Good soil (75%)

Farm yard manure

**Fig. 2**

Average yields of black gram 3.55 q $ha^{-1}$ may be obtained under optimum management in degraded sites. Turmeric crop can be introduced after 7 years of plantation as it grows well with shade and its yield does not affected by developing canopy.

**Intercropping during *rabi* season**

Field is prepared in the first week of October by ploughing up to the plough sole depth. Toria @ 4.0 kg $ha^{-1}$ is broadcasted just after the second ploughing on the same day or the next day. Crop is harvested in the month of January and stover is ploughed back into the soil. An average yield of 3.6 q $ha^{-1}$ may be obtained from the degraded. An average stover yield of Toria (5.0 q $ha^{-1}$) was harvested and ploughed back into the field for fertility improvement.

**Performance results**

The cost of establishment of a peach orchard is ₹ 35,280 $ha^{-1}$. However, this cost can be reduced further to ₹ 30,000 $ha^{-1}$ by adopting *in-situ* grafting technique of plant propagation. Moreover, it is suggested that the former practice be adopted to ensure quality plants. Evaluation of the peach based agri-horticulture system revealed that there is positive effect of black gram on the performance of peach trees and fruit yields. After seven years of growth, canopy development of peach attained an average size of 30 $m^3$. Peach yields were recorded in increasing trend and average yields of 45 kg $tree^{-1}$ (9.0 t $ha^{-1}$) from 4$^{th}$ to 15$^{th}$ year of plantation were obtained. Peach based agri-horticulture practice is economically viable with a B: C ratio of 3.50, calculated for a period of 30 years life of peach tree. Using the crop combination of black gram-Toria for the first seven years after fruit planting, the payback period was calculated to be 7 years. Toria cultivation is more profitable than black gram due to the absence of weeding operations during *rabi*. Peach based agri-horti system produced blackgram 355 kg $ha^{-1}$, toria 358 kg $ha^{-1}$ and peach fruit 9000 kg $ha^{-1}$ resulting higher net profit. The crop residues of blackgram and toria added 10.5, 5.34 and 35.5 kg NPK $ha^{-1}$. Cowpea residue addition also helps in improvement of site soil conditions.

**Cost of technology**

The total cost of cultivation for the

peach (25% gravels, 65% sand, 7% silt and 3% clay) + blackgram- toria rotation is about ₹ 40,240. Output in terms of net profit per unit area is ₹ 65560 $ha^{-1}$ $yr^{-1}$ from degraded land which is presently out of cultivation.

**Impact and benefits**

Peach based agri-horticultural system, the net income raised from ₹ 20250 to ₹ 65560 $ha^{-1}$ $yr^{-1}$ under irrigated condition for peach and rainfed condition for intercropping of blackgram and toria. Improved agri-horticultural system has wide scope of replication on degraded lands in north-western Himalayas.

**Advantage of the peach based agri-horti system**

1. A well-developed agri-horti system helps to conserve soil and water conservation on sloping land, builds up soil organic matter and provides multiple benefits to the user. The system can also with stand adverse weather conditions for short periods. The agri-horti system can reduces surface runoff and allows for the infiltration of water into the soil profile by means of its canopy. Investment is made only once for duration of 25-30 years, depending on site conditions. It improves soil physico-chemical properties by turning over of biomass.
2. Small and marginal farmers who depend on cultivation of annual crops can have this system for getting additional incomes other than annual crops. The yield of intercrops is available from the first year and the fruits from fruit plants by the fourth year depend upon the fruit species.
3. The development of orchards and intercropping under agri horticultural systems at different ages of fruit trees has potential for providing sustainable agriculture to the rural people in various activities related to crop and fruit productions. On a ten year cycle of peach orchard establishment, management and harvest of fruits, intercultural operations of intercrops generate employment opportunities of 130-140 person days $ha^{-1}$ $yr^{-1}$.
4. Fruit based land use system will increase fruit availability and nutritional security to the people of India. Presently 100 g fruits are available per head against 120 g which too low to provide nutritional security. On the other hand, Wastelands hitherto unfit for agriculture can be utilized for mango based agri-horticultural systems using this cropping sequence for a period of about 6 years until canopy closure by the over storey begins to reduce crop yields and shade tolerant crops like Turmeric and Colocassia can be grown as under storey crops.

FOREST PRODUCTIVITY

# Grassland Restoration

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***Proper management interventions in non-reserved grasslands has both ecological and social benefits***

## Introduction

Various species requires different resources in terms of food, shelter water and other habitat components. Some species need dense forest cover while some need open or degraded habitat, which also governs the resource partitioning between the different species for their survival. The degree of forest canopy cover a species requires in their habitat is crucial for suitability of the area for a particular species. The higher the resources, the better are the chances for the survival of species. The survival of various wildlife species in Gir protected landscape also depends on how well the habitat related resources are managed. The highly degraded forests interspersed with grasslands need to be managed scientifically so that these areas support good number of wildlife population.

## Management of highly degraded patches of forests

These forest patches consist of large grassy open blanks with very sparse and poor scrub type vegetation. Both annual and perennial grasses are found in these areas. *Sehima sulcatum (Shaniyar), Dichanthium annulatum (Jinjavo)* and *Iseilema prostratum (Moshti)* are some of the palatable grasses growing in these areas. The better drained areas have more palatable grasses. In the plains and in pockets where moisture in the soil is more, either due to tree cover or due to depressions, inferior grasses make their way. Maldharis are the people residing in settlement villages with their cattle, have free access to head load of grass from the sanctuary which they will have to cut and carry for which no permit will be required.

**Various categories of vegetation calculated from satellite data by SAC - Ahmedabad (ISRO) in Gir PA.**

| Total Area 1412.1 km² |
|---|
| 1. Forest cover with crown density above 10% Dense and open forests - 906.4 km² |
| 2. Degraded forests, grasslands with scattered trees - 345.5 km² |
| 3. Highly degraded forests, grasslands and blanks - 122.2 km² |
| 4. Water bodies - 18.2 km² |
| 5. Cultivated land in-forest settlement - 19.8 km² |

There is a pressure on the Gir PA from grazing, especially during the monsoon season. Livestock of the people residing on the edge of the forest and the livestock of the Maldharis who have been resettled on the fringes of the forests graze on the fringes of the PA. If these livestock are allowed to graze within the forest areas they may cause an irreparable damage to the habitat.

Unrestricted grazing has given way to weeds and unpalatable grass species in the area. Villagers have presumed that they have the right of grazing in the non-reserved *Vidis* (Grasslands) and restriction against this practice without involving local people is a difficult task. In order to restock the degraded grasslands the plan proposes to rehabilitate the entire area of non-reserved *Vidis* under Participatory Grassland Management (PGM) approach. The degraded patches of Savannah forest are identified and grasslands are developed inside the protected areas under Banni Grassland Development Project. This scheme is mainly for grassland developments for restoration and management of habitats of GIR ecosystem.

*S. sulcatum* is an important palatable grass species of GIR forest. It is having life span of about 40 years and its stays green during dry season. It has strong fire resistance, hence a best quality palatable fodder for herbivores. Therefore, it was imperative to restore the grasslands by augmenting with *S. Sulcatum.* The process adopted in Jamvala Range of Gir West Division is described below:

## Site preparation

Removal of invasive species like *Lantana camara* and *Cassia tora* and pruning of trees was done before sowing of seeds.

**Plantation details**

| | |
|---|---|
| Scheme | Banni Grassland Improvement |
| Plantation year | 2017-18 |
| Circle | Junagadh Wildlife Circle |
| Division | Gir-west Division |
| Range | Jamvala (Nagadla RF) |
| Area | 25 ha |
| Total cost (1 year) | ₹ 414804 |

**Plantation operations**

| *Site description* | |
|---|---|
| Habitat | Open Savannah forest |
| Soil | Sandy- loam with rocky substratum |
| Terrain | Undulating |
| Average annual rainfall | 900-1000 mm |
| Vegetation | *Acacia nilotica, Butea monosperma, Acacia leucophloea, Tectona grandis, Acacia catechu, Azadirachata indica, Zizyphus mauritiana* |
| Herbivores | Chital and Nilgai |

## Seed collection

Seeds were collected from wild *S. Sulcatum* during October 2016 and were stored properly in grass depot of Jamvala range.

## Sowing of seeds

After preparation of site it was monitored for two months and weeds were removed frequently. Since the plantation was completely rainfed sowing was done immediately after the first rain occurred. A total of 350 kg seeds were sown over entire area of 25 ha.

## Utilisation of developed Grassland

After 6 months of sowing, an encouraging 93% survival rate was observed alongwith sign of restoration of the degraded areas such restored areas not only provide source of grasses for the local people but also release grazing pressure off the prime wildlife habitats. Thus such management interventions in non-reserved grasslands has both ecological and social benefits.

**Established clumps of *Sehima sulcatum* after three months of plantation**

**Sufficient growth attained by *Sehima sulcatum* clump**

## ACKNOWLEDGEMENTS

I am heartily thankful to Mr. Pradeep Singh, DCF, Gir West Division and Mr. D.P. Vaghela, ACF, Jamvala Sub Division their kind guidance and co-operation during the course of case study. My special thanks to Mr. Jinjuvadia, RFO, Jamvala Range and Mr. Rathod, Forester, Ghatvad Round for the support and help.

FOREST PRODUCTIVITY

# Potential of Bamboo based Agroforestry in Degraded Lands for Sustainable Development of Rural People of Uttarakhand

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***Need to produce quality planting material, extension of farmer friendly propagation technologies, managing the plantations properly, use of proper silvicultural practices, age of harvesting, seasoning treatment to improve productivity***

## INTRODUCTION

The agricultural land and forest area is shrinking day by day due to human interference in Uttarakhand. In this condition there is only option to raise trees outside forests specially on degraded land of farmers. The soils in the Uttarakhand state have been degraded to large extent due to constant pressure of grazing and other reasons such as soil and water erosion, etc. The soil degradation is of different natures like physical degradation, chemical deterioration. The water logging conditions and presence of heavy metals in soils are also responsible for degradation up to some extent. Recently, ICAR-National Bureau of Soil Survey and Land Use Planning (ICAR-NBSS& LUP-2005), Nagpur has published that 146.82 million hectare (m ha) area is reported to be suffering from various kinds of land degradation. It includes water erosion 93.68 m ha, wind erosion 9.48 m ha, water logging/flooding 14.30 m ha, salinity/alkalinity 5.94 m ha, soil acidity 16.04 m ha and complex problem 7.38 m ha. India has vast expanse of degraded lands and nearly half of our landmass is under various types of degradation and needs ecosystem restoration interventions through different agroforestry practices.

The promotion of agroforestry on degraded land through planting of suitable bamboo species with medicinal and agriculture crops and develop a sustainable bamboo based agroforestry model for utilization of these lands in Uttarakhand is a better option to maintain soil fertility as well as economy on priority. To maintain this economy and ecology, bamboo may be a promising species under dry conditions in the state. Every farmer wants maximum returns from his farmland in a short rotation but due to excessive application of chemical fertilizers and change in climatic condition affected the production drastically. Resultantly,

the land is going to be depleted and degraded day by day. In this condition, some changes in land use pattern are required to fulfill the needs of farmers. For this purpose some value addition with a normal agriculture is a need today.

The forest areas have been the traditional source of medicinal plants and herbs. The position cannot be sustained much further because on the one hand the areas under forests have been steadily shrinking and on the other the requirement of medicinal plants and herbs has increased rapidly. This resulted unscientific and over exploitation of medicinal plants in the forests. About 95% of medicinal plants used by the industries are collected from the wild. Over 70% of the plant collections involve destructive harvesting because of the use of parts like roots, bark, wood, stem and the whole plant in case of herbs. Keeping in view, the cultivation of some important medicinal plants and suitable agricultural crops will enhance the economy by developing a sustainable and economically viable bamboo based agroforestry practices.

**About Bamboo**

Bamboos are of very vital importance from ecological, commercial and environmental. Bamboo is a promising renewable natural resource and its benefits are spread through employment provision, income generation and environment protection. It is well known for faster growth, multiple uses and aesthetic beauty. The bamboo species as *Dendrocalamus strictus*, *Bambusa bambos* and *Bambusa nutans* is a multipurpose tree species and an important for paper pulp, handicraft and furniture, construction, food, medicine, raw materials for cottage industry and fodder source in India. They occupy lower and middle canopies and thus, they protect the soil from erosion conserve moisture and check further degradation of site besides offering protection to a number of floral and faunal species. Through bamboo based agroforestry system enhancement the economy of the farmers in Uttarakhand.

**Bamboo based Agroforestry**

It is the most sought after species by Joint Forest Management (JFM). It has been tested for Soybean and Wheat rotation in a separate experiment and the suitability up to 5$^{th}$ year at 3 x 4 m, 4 x 5 m and 5 x 6 m spacing was evaluated in Madhya Pradesh. There were no reductions in yield performances of either crop observed from closer spacing to wider spacing. Therefore, it is recommended that a closer spacing initially may be tried but the final spacing for promoting the best bamboo growths may be encouraged through thinning bamboo clumps as the system progresses. The cultivation of agricultural crops was found to be beneficial to the bamboo growths also. Therefore, the system components are complementing each other. It is suitable to all areas that can adopt Soybean and Wheat growing areas as bamboo tried include *D. strictus*, *B. nutans* and *B. bambos* of central Indian region.

Financial analysis of bamboo based agroforestry models was worked out in Madhya Pradesh by Ashutosh *et al.* (1996). They suggested that bamboo (*D. strictus*) cultivation on low value lands at closer spacing fetches higher monetary benefit. Agrawal and Ojha (2003) has already reported in national seminar and study carried out to rehabilitation the degraded land through different agroforestry models in Chhatisgarh region with ten tree species including *Bambusa spp*.

Khandwa *et al.* (2003) have studied enrichment of soil through agri-silviculture system. The bamboo based agriculture system proved economically viable having multiple outputs from the current year onward the system gives ₹ 30,000/ha/year net return from the bamboo plus recurring tangible benefits of ₹ 10,800 & ₹ 4000/- through vegetables and Sunhamp, respectively. Besides their intangible benefits in terms of soil productivity enhancement and carbon sink expansion. In Madhya Pradesh, the impact of bamboo based agroforestry models with short rotation agricultural crops namely soybean, niger, greengram, mustard, wheat, blackgram and pigeon pea were investigated. The model has played a significant role in soil management including checking soil erosion and improvement of soil fertility of degraded agricultural lands (Jamaluddin *et al.*, 1998). Lal (1995) has reported development of bamboo based nine agro-forestry models for eco-rehabilitation and social upliftment of rural people in Allahabad district of Uttar Pradesh. Shanmugavel and Francis (2000) reported higher annual net returns (₹ 13,300) when pigeon pea was inter-cropped in alternative rows at 3 x 3 $m^2$ spacing. Cost benefit analysis of bamboo plantation based on *D. strictus* at Gual Pahari, Haryana revealed that this system yields better economic returns (Rawat *et al.*, 2002). Singh *et al.* (1992) studied the effect *B. nutans* on the yield of some agricultural crops at mid hills of eastern Himalaya. Under the experiment, bamboo was planted or allowed to grow along farm boundaries, drainage channels and uncultivated wastelands. Through experimentation it was found that agricultural land near bamboos can be effectively utilized for growing ginger, turmeric, cardamom, orchard grass and dinanath grass up to a distance of 11-15 m from bamboo

**Bamboo – Wheat agroforestry**

**Bamboo – Black gram agroforestry**

rows. Rice, finger millets, soybean, setaria and fine stylo were suitable crops beyond this distance.

**Capacity building through training to the rural people**

To make the people of rural areas, various training programmes are usually organized for the Villagers, Farmers, NGO's, Officials from Government Departments. Besides, Craft *Melas*, Exhibitions and demonstrations and public awareness on institute level for the capacity building having been organized. Generally, five days training are organised on Bamboo handicrafts for farmers/artisans of the States of Uttarakhand and Uttar Pradesh are organized by the institute under National Bamboo Mission. During the training bamboo product designing *i.e.* Flower Stand, Bottle Stand, Chair, Pen Stand, Rack, Flower Pot, Jangla, Magzine Stand, Lamp, 3 stand flower pot, Mirror Stand with lamp set, Tray, *Tokri* etc. and their

**Artisans/trainees preparing bamboo handicrafts**

finishing was done by the trainees under the supervision of faculty of the institute and master trainers.

Overall, there is a need to produce quality planting material, extension of farmer friendly propagation technologies for producing sufficient planting stock, managing the plantations properly, use of the proper silvicultural practices, age of harvesting, seasoning treatment, etc. to improve productivity, which will improve the economy of the stake-holders. The role of bamboo would also be effective in carbon sequestration, land reclamation, soil and water conservation, and sustainable development of the rural people of Uttarakhand. The production of bamboo depends on its sustainable utilization and this is only possible when the products of the bamboo made regular use by the stakeholders. To make the utilization of bamboo, more and more capacity building programmes for rural artisans are necessary to make them capable to produce better quality artifacts so that they can compete with other products available in the market and give proper return for their livelihood. Further, more utilization of bamboo will certainly extend the bamboo based agroforestry on degraded land.

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FOREST PRODUCTIVITY

# Rubber Growing Soils of Bishalgrah Block, Sepahijala District, Tripura: Their Characteristics, Suitability and Management

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***Inappropriate agricultural practices, overgrazing and indiscriminate deforestation cause soil degradation which results decline in soil fertility, productivity and soil quality besides environmental hazards***

## Introduction

Planting rubber is one of the management practices in north-east India to replace shifting cultivation and control land degradation, produce natural rubber and generate income, and improve site quality. The state of Tripura has been under rubber plantation on denuded forest lands since 1975. Consequently, a large portion of the degraded tropical rain forests is under rubber plantations, even though the climate and other conditions are not always favorable.

Tripura Forest Development and Plantation Corporation Limited (TFDPCL) adopted rehabilitation of degraded forestland through commercial rubber plantations on 7087 ha area as its primary objective along with sustainable rehabilitation of tribal shifting cultivators in the state of Tripura. The Corporation is a pioneer in developing successful models for permanent settlement of tribal shifting cultivators through rubber cultivation by providing each family one ha of Rubber plantation for latex extraction. TFDPCL organized resettlement of more than 1133 scheduled tribe families and 70 scheduled caste families under different schemes and projects and creating employment for around 3585 people directly and to an almost equal number indirectly.

Soils are indispensable resources but their multipurpose use and continuous exploitation have serious impacts on the ecology of a particular region. Information of the soil with respect to its genesis, characteristics, classification, extent of distribution, potentials and problems is imperative for any developmental planning in a specific area. Hilly soils are very prone to

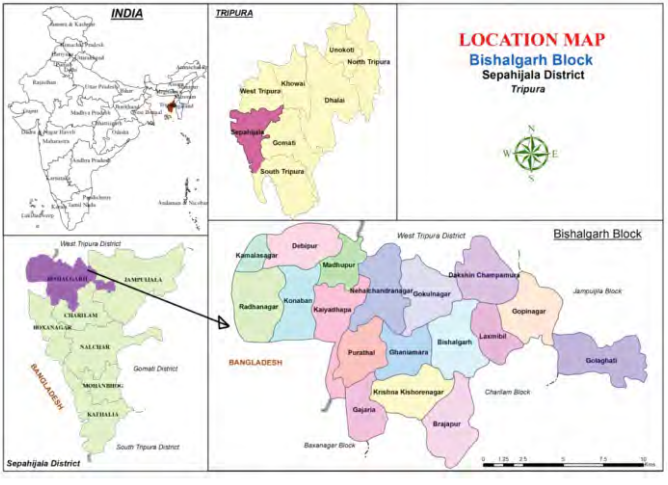
degradation and pose a serious threat to agricultural productivity. Inappropriate agricultural practices, overgrazing and indiscriminate deforestation cause soil degradation which results decline in soil fertility, productivity and soil quality besides environmental hazards (Blum 1997). Inaccessibility, fragility, marginality, heterogeneity, natural instability and human adoption mechanism are the key factors to be focused for sustainable agricultural development in such areas. The present study was undertaken to characterize the soils of rubber growing area and to evaluate the suitability of rubber and their management in Bishalgarh block, Sepahijala district, Tripura.

## Study Area

The study was carried out in Bishalgarh block of Sepahijala district, Tripura, India (23°36′51-23°45′02 N, 91°08′58-91°23′00 E) covering an area of 170.51 km$^2$. The area is characterized by humid subtropical climate with annual mean maximum temperature is 36ºC and annual mean minimum temperature is 7ºC. Mean annual rainfall is 2340 mm and about 85% of rainfall is from south-west monsoon. Geomorphologically, the study area represents undulating topography (325% slope). The rocks are sandstone, siltstone and shale grading into clay. These rock types are repeated as layers one above the other. Depending on their characters and the presence of fossils, these sedimentary rock sequences are divided into Surma group (the oldest), Tipam group and the Dupitila group (the youngest).

## Methodology

The IRS-R2 LISS-IV satellite data of 06 January 2015 was interpreted to delineate the landform units and land use/land cover. Soils of different landforms and land use/land cover were studied in the field in respect of their morphological properties by digging profiles. Soil samples of each horizon of representative pedons were



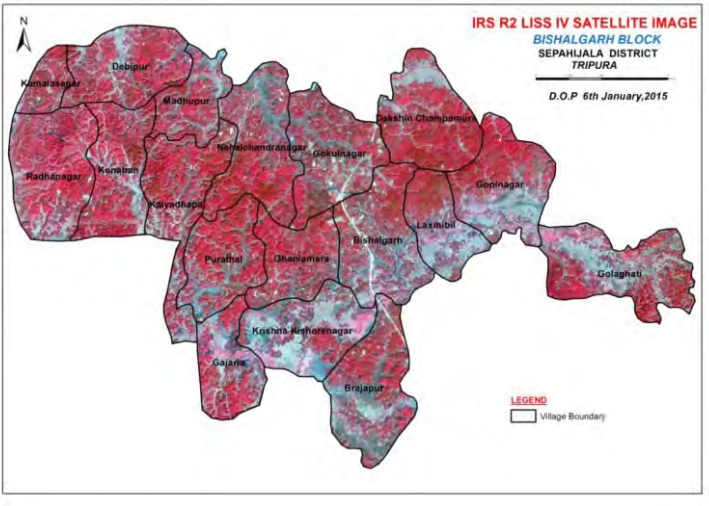
collected, processed (<2 mm) and analysed for important physicochemical properties using standard procedures.

**Characteristics of soils**

Soils at the study sites are Ultisols which developed on tertiary hill sediments of unconsolidated beds of sedimentary rocks. They are sandy clay loam/clay loam in texture. Accelerated erosion accounted for a substantial loss of silt, clay and organic matter from upland areas, which, in turn, were deposited in the valleys. Induced leaching and surface runoff of basic cation have caused the soils to become strongly acidic over time. Some basic properties of surface soils were Bulk Density (BD) 1.551.67 Mg $m^3$, pH 4.0-4.6, sand 29.060.3%, silt 14.930.6%, clay 24.940.4%, OC 0.630.92%, exchangeable $Al^{3+}$ 1.53.1 cmol ($p^+$) $kg^1$, CEC 5.0-9.0 cmol ($p^+$) $kg^1$ and base saturation 37-45%. The characteristics of the sub surface soils were BD 1.401.67 Mg $m^3$, pH 4.4-5.3, sand 20.146.6%, silt 14.233.3%, clay 17.049.3%, OC 0.240.81%, exchangeable $Al^{3+}$ 3.64.0 cmol ($p^+$) $kg^1$, CEC 4.2-8.9 cmol ($p^+$) $kg^1$ and base saturation 19-46.8%.

Sedimentary rocks (siltstone and shale) which range in age from Miocene to loosely consolidated sediments of recent age in Bishalgarh block

Rubber is grown in both the traditional and non-traditional areas experiencing high rainfall. It thrives well under acid environment in the soil. The optimum pH for rubber is reported



Landscape and soil pedons of Rubber growing soils

to be in the range of 4 to 6.5 and it can tolerate up to the pH of 3.8 at the low and 7.0 at the higher side. Rubber is grown in soils with a wide range of CEC. While CEC of 2-16 cmol ($p^+$) $kg^{-1}$ is reported in Malaysia. It ranges from 3.5-18 cmol ($p^+$) $kg^{-1}$ in soils under rubber in India. On an average organic matter contents of 0.7 to 1.0% and more than 1.0% have been found to be slight to no limitation for rubber plantation. The slow rate of oxidation inside the closed canopy of rubber plantation helps to maintain high organic matter status in the later stage.

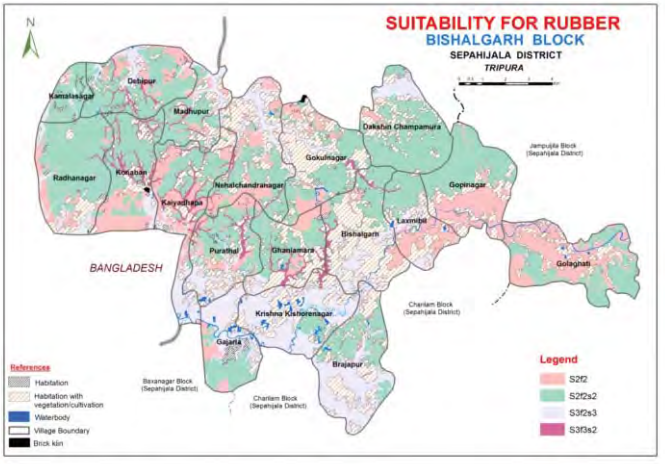
**Suitability of Rubber**

Soil suitability for rubber in Bishalgarh block, Sepahijala district, Tripura was worked out in two steps. In the first step suitability criteria for rubber crop was evolved with the help of existing literature with special reference to north-eastern region of India. Emphasis was placed on land characteristics or land qualities, *e.g.* climate, soil, *etc.* which determine the limitations. In the second step, the defined suitabilities were superimposed on soil maps according to the map legend (soil composition) to prepare a relative suitability map for rubber in Bishalgarh block, Sepahijala district, Tripura.

The evaluated suitability of rubber showed that 56.50% TGA of the block is moderately suitable in moderately sloping (510% slope) to steeply sloping (1525% slope) with high KCl-Al. whereas, 16.71% TGA is marginally suitable due to water stagnation in valley lands.

**Management**

The yield of rubber and the income of rubber growers in the block may be increased by adaptation of following management strategies:




- Rubber plantation with application of recommended dose of NPK fertilizer in two equal splits.
- Amelioration of soil acidity with application of 200250 kg lime ha$^{1}$ in furrows.
- Use of biofertilizers particularly phosphate solubilizing micro-organisms.
- Use of manures to reduce the adverse effect of soil acidity (particularly high Al) which would also improve the soil health.
- Use of specific management practices like mulching, ridge and furrow system, *etc.* which can help in conserving soil moisture for *rabi* crop.

## Conclusions

From this study it is concluded that Bishalgarh block showed that rubber was moderately suitable in the undulating plains and uplands without forests. It is therefore, recommended that the marginal lands may be useful for growing rubber subject to their availability.

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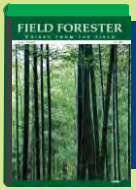


# FIELD FORESTER

## VOICES FROM THE FIELD

**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.

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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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