FIELD FORESTER

VOICES FROM THE FIELD

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PERIYAR / KERALA

Innovative Eco-development Initiatives to Conserve Forest Biodiversity and Alleviate Rural Poverty

Management interventions can be effectively and equitably prioritized towards those most dependent on forest resources in order to maximize biodiversity conservation

Abhijeet Arun Mane

The term eco-development is used to describe an integrated, sustainable approach to environment and development. It has been defined as:

"…development at regional and local levels, consistent with the potentials of the area involved, with attention given to the adequate and rational use of natural resources, technological styles and organizational forms that respect the natural ecosystems and local social and cultural patterns."

In an Indian context, eco-development as a strategy recognizes traditional dependencies of people on forests for domestic use as well as supplementing livelihoods. It seeks to rationalize the demands of communities by promoting efficient use of resources and alternative livelihoods. In essence, eco-development aims to strengthen nature conservation through participatory processes that empower local people to take responsibility for their socio-economic well-being in ways that do not reduce the biodiversity capital maintained within Protected Areas (PAs).

Legal and Policy Framework

The National Forest Policy, 1988 provides the basis for involving local people in forest conservation and development. The Odisha Government, through its Joint Forest Management (JFM) Resolution (2008), has adopted eco-development as a strategy for securing support from local communities in PA management. Eco-development activities provide a strong linkage between conservation and development; they may include eco-tourism and off-farm activities, as well as providing specific alternatives to local biomass dependence. This policy provides for the institution of Eco-Development Committees (EDCs) in villages located within and adjacent to PAs along the lines of Van Samrakshyana Samitis (VSSs or Forest Protection Committees) for forest areas. However, there is a fundamental difference between VSSs and EDCs. VSS members

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may benefit from usufructs (the right to use and derive profit or benefit from property that belongs to another party – in this case the state – as long as the property is not damaged), including fuel wood, fodder, bamboo and a share in the timber produced from forests 'assigned' to the community in return for forest protection and management duties. Such opportunities do not exist for EDC members since usufructs, except regulated grazing, are prohibited under the Wildlife (Protection) Act, 1972. Eco-development initiatives must be consistent with this policy.

Eco-Development Initiatives

Bamboo handicrafts

Bamboo handicrafts is an eco-development initiative to empower the tribal and local communities. The members can be trained to make innovative and marketable products from bamboo that can be sold through ecoshops. This will help in improving the status of living of the tribes and local communities.

Bee wax balm

Bee Wax Balm can be made from bees wax collected from the fallen honey combs from the buffer and fringe areas. Bee Wax Balm is used for curing head ache, body pains and for massaging.

Plastic free mineral water bottle

This is an innovative measure to make the forest free of plastic mineral water bottles. As the tourists tend to throw away the mineral water bottles inside protected area after drinking.

Micro planning Steps

1. Develop a common vision among PA staff
2. Identify a conceptual model and strategy for eco-development
3. Build a facilitation team
4. Facilitate village micro-planning
5. Prioritize activities in micro-plan and allocate resources
6. Coordinate and monitor micro-plan implementation at village cluster level

This will help in keeping the forest a plastic free zone and provide pure drinking water to eco-tourists and employment opportunities to the resident people.

Eco-Tourism

Community based eco-tourism programmes can provide a major share of employment to the tribals living in the Reserve. Some of the most sort after eco-tourism programmes are tents, tree-top hut, bamboo rafting, full moon census, machan world, island nest, etc. These eco-tourism programmes provide an excellent opportunity to the visitors to enjoy the beauty of the forest and at the same time contribute to the livelihood of the local tribals. The guides are from the local villages itself and are trained by the department, thus adding to their income opportunities.

The hospitality given to the tourists should be good as it affects prospects of eco-tourism. The behaviour of the staff should be such that tourists should be satisfied with the service.

Eco-shops

Honey, bee wax balm and medicinal spices prepared in a scientific manner can be sold through Eco-shops. Other items like t-shirts, jackets, hats, caps, pens, key-chains, etc., can also be sold. The revenue generated from the Eco-shops will help in the empowerment of local tribes.

Honey collection

A majority of the tribal population of the reserve traditionally depends on honey collection. The honey collected by the tribes is sold to local traders through barter system. This leaves the poor tribal people always in a debt trap. So an eco-development initiative can be taken up to collect honey scientifically and to do value addition in terms of filtering, bottling, labeling and sealing. Now the tribal will get almost 30-40% more income directly from the Eco-shop. This will improve the economic status of the poor tribals in the sanctuary. Honey collection activities will be confined to the buffer and fringe areas of the reserve.

Paper bag unit

This is an initiative to empower tribal women in the sanctuary. The products can be made by the trained tribal women. The paper bags can be sold at the entrance. This will also help in making the area a plastic free zone.

Souveniers from Recycled Plastic

As a step to make the reserve plastic free, a plastic reduction unit can be been launched. Plastic waste from the waste bins placed at different locations of the Sanctuary acts as primary collection points. Then the plastics are segregated into bottle plastics, bag plastics, etc. These are washed, cleaned and dried. Then it is shredded to small pieces in shredder machine and are transported to a factory where they are made into pugmark keychain souvenirs, which can be sold through the Eco-shop.

Mechanisms to Sustain Eco-Development

In return for support received from the Project, EDC members must reciprocate by way of various commitments to

Case Study 1

Free of plastic mineral water bottles are already being prepared at Parambikulam Tiger Reserve. As the tourists arriving in Parambikulam tend to throw away the mineral water bottles inside the sanctuary after drinking water, the department has introduced an innovative eco-development initiative - “Parambikulam Dhara”. The department started a eco-development unit which is now run by Kuriarkutty EDC volunteers and gives them some income. The bottles are placed at the entrance of the sanctuary. The bottles have to be returned while exiting and a fine of Rs 100 is charged if the visitor does not return the bottle back. Thus, Parambikulam Dhara helps in keeping the sanctuary a plastic free zone and provides pure drinking water to tourists and employment opportunities to the resident people.

Case Study 2

The exclusivity of Protected Areas (PA), as envisaged in the developed countries is not possible in the Indian context, due to the human dominated landscape. The population that draws on the resources of the PA for subsistence is largely rural. A participatory management strategy of protected areas and eco-development aims at conserving biodiversity by addressing both the impact of local people on the protected areas and the impact of the protected areas on local people. In accordance with the tripartite agreement signed between the external donor agencies (World Bank and IDA), Government of India (GOI) and Government of Kerala (GOK), Eco-development Committees (EDCs) were constituted. In response to the changed paradigm of partnership, EDCs have emerged around many PAs. Periyar Tiger Reserve (PTR) in Kerala is one among the seven PAs in India selected for the implementation of IEP. This also ensures a reciprocity in forest conservation which will ideally act as a social fence around the PA. In Periyar, there are currently 72 EDCs. The target population is about 58,000. Different categories of EDCs include village EDCs like tribal settlements, hamlets, etc. Some are user groups like grazers, fuelwood and thatching grass collectors and pilgrimage based EDCs. There is a third category of professional group EDCs like ex-cinnamon bark collectors, tribal trackers cum guides, watchers welfare. etc. In the neighbourhood EDCs, the stress is on socio-economic upliftment; in user group, the stress is on reduction of negative impact on PA resources; and, in professional group EDC, the aim is promotion of long-term positive interaction of the group with the PA.

ensure that biodiversity is protected and conserved. These commitments extend to buffer zones and core areas of PAs that may be assigned to the EDC for protection duties to complement the enforcement work of Forest Department staff. They should include the following, for which the Executive Committee has responsibility:

- No fire, poaching, illegal felling of timber or encroachment in village forests or any other forests assigned to the EDC for use (e.g. grazing) or protection.
- No grazing by goats in plantations within village forests or any other assigned forests.
- Provision of intelligence, information and other assistance in the prevention and investigation of offences and offenders.
- 100 per cent immunisation of village livestock (implemented in year 1) with project funds and subsequently sustained by registration of all fire-arms in the village.

Eligible benefits

In return for successfully protecting forests, EDC members may be granted the following benefits on a quid pro quo basis:

- Rotational grazing by cattle in 'assigned' forest areas within

Case Study 3

Piloting Eco-development in Satkosia Tiger Reserve

Previous micro-planning exercises carried out in Odisha's PAs had no community participation. Micro-plans were prepared and implemented by PA managers but the community at large was neither aware of nor consulted on the various activities initiated in and around their villages. Gradually, during the last decade, managers have become increasingly aware of the need to engage local communities in PA planning and management. However, micro-plans continued to reflect the PA managers' mindsets and failed to capture the community's perspectives. Hence, there was a need to develop a truly participatory eco-development process and standardise the use of relevant Participatory Rural Appraisal (PRA) tools, thereby capturing the needs of communities and targeting forest dependency at household levels in order to conserve biodiversity.

sanctuaries (grazing in a sanctuary may be permitted by the Chief Wildlife Warden in accordance with provisions under Sections 29 and 33 (d) of the Wildlife (Protection) Act, 1972). The rotation cycle may be defined by the EDC, in agreement with the authorities.

- Effective monitoring procedures should ensure that grazing is sustainable and not jeopardising forest regeneration.
- Rotational collection of fuelwood from village forests.
- Regulated collection of NWFPs from village forests, for personal consumption purposes only.
- Regulated collection of bamboo raised in plantations in village forests.

Eco-development towards a more sustainable future for people and their environment requires engagement of all key stakeholders in the development of a shared vision at the outset of the process. This provides the foundation for developing a plan of action to conserve biodiversity through the alleviation of poverty by specifically targeting those most dependent on forest resources.

- Strengthening the capacity of community members to participate actively in planning and implementation of eco-development.
- Trusting in the process and the ability of communities to find their own solutions, such as the simple method of classifying forest dependency and wellness developed by villagers.
- Training, supervision and long-term mentoring of those facilitating participatory processes.
- Well-facilitated, participatory micro-planning generates understanding and trust that cements good relations between PA authorities and local communities.

COMMUNITY INTEGRATION

Peoples' Participation in Forest Conservation and Livelihood Generation

One of the most significant impacts of the JFM programme has been the change in the attitude of local communities and forest officials towards the forest

Aman Thapa

India is a developing nation and majority of its population lives in rural areas. Forests play a vital role in the rural economy and provide different kinds of benefits, like jobs, incomes and environmental benefits. The forestry sector is the second largest land use after agriculture and about 70 per cent of India's rural population depends upon forests to meet its domestic energy need, livelihood and cash income from fuelwood and non-timber forest products (NTFP). More than half of India's 70 million tribal people, the most disadvantaged section of society, subsist from forests.

India has 2.5 per cent of the world's geographical area with a total of 328.7 million hectares. According to the State of Forest Report (FSI 2013), India has 69.78 million ha. forest cover, which accounts for 21.23 per cent of the country's total geographic area. India supports 16 per cent of the planet's human population and 18 per cent of cattle population, due to which the forest cover has been reducing both in quality and extent in most of the states. There are serious problems of encroachment, grazing, forest fire, shifting cultivation and illegal felling and most of the species of flora and fauna are endangered.

After all, forestry is about people. It is about trees, that can serve the needs of the people. Forestry and Forest Policy should concern itself in every conceivable way in which, forests, woodlots and trees can contribute to the livelihood of people in particular and human welfare in general. In fact, the future of human society is intrinsically linked to the future of the forest. Traditionally, forest management practices aimed at developing and understanding the protective and productive aspects of natural forests. People's livelihood issues and people's role in safeguarding the resources and their active participation were relegated to secondary place. Only recently the social role of forests and forestry together with their protection and production roles have received attention. The depletion of forest resources has aroused the passion of the forest department and general public for conservation and protection of forestland and has become a top priority on the country's development agenda.

FRO Trainee *(2014-15) Batch, Casfos, Coimbatore*

The National Forest Policy 1988 of India envisaged people's involvement in conservation, protection and management of forest. It emphasized that forest produce must go first to the people living in and around forests. Further, in June 1990 a Government resolution supported the creation of village level institutions and involvement of non-governmental organizations in forest management. With the active support of local organizations, people's participation in forest management, was initiated and is generally known as Joint Forest Management (JFM). Now, it is recognized that participatory management of forests is key to sustainable development. The village committee known as the JFM Committee and the Forest Department enter into a JFM agreement for safeguarding the forest resources from fire, grazing and illegal harvesting, in exchange for which they receive non-timber forest products and a share of the revenue from the sale of timber, through community funds.

Joint Forest Management originated in West Bengal accidentally at the Arabari Forest Range in West Midnapore, in 1971. Ajit Kumar Banerjee, working for the Forest Department as the Divisional Forest Officer, was conducting trials which were constantly being disturbed by grazing and illegal harvesting by the local population. At the time there were no initiatives for sharing of forest resources between the government and the locals. The forest official, against the suggestions of his co-workers, sought out representatives of 11 local villages and negotiated the terms of a contract with an ad hoc Forest Protection Committee. The initial programme involved 612 families managing 12.7 sq. km of forests classified as "degraded". Twenty-five per cent of profits from the forests were shared with the villagers. The experiment was successful and was expanded to other parts of the state in 1987.

There are evidences that JFM has rehabilitated the country's degraded forests and the overall forest cover of the country has increased. Incidents of illicit felling and illegal encroachment have sharply declined with recovery of fodder resources, prolific growth of understorey vegetation and it has also led to increased biodiversity and wild herbivore population. One of the most significant impacts of the JFM programme has been the change in the attitude of local communities and forest officials towards forests. Sustainable forest management is key to the sustainable rural livelihood. There has to be a harmonious balance between conservation of forests and development of communities through livelihood security. Over-exploitation can lead to destruction of the resources, like medicinal plants, grazing pastures, game animals, fish stocks, forests, and water aquifers. This can result in extinction at the population level and even extinction of whole species.

Trends of forestry are changing, whether it is conservation or administration. During our study tours ,we went through so many exposures like: Baralikadu JFM model, Periyar foundation, Gondwana herbs (Gadchiroli), Sukhomajri, Mussorie (mine reclama-

tion area), Mudhumalai tiger reserve, Allapally and so many other forest, fringe and rural areas. People living in forests are facilitated with various livelihood opportunities like manufacturing plant operators, eco-shop managers, NTFP collectors, coracle drivers, food suppliers to tourists with their traditional foodstuffs, drivers, guides, workers, forest watchers, etc. They are getting exposure to the outer world by tourism activities. Many young people are preparing for the civil services exam and other higher studies after interacting with visiting officers, ministers and urban people. People are also willingly participating in management and conservation of forests.

A sustainable alliance has to be forged among government, non-government and local level organizations. Village dynamics, sociological insight, perception and knowledge of people have to be understood properly, for formulation, designing and implementation of any effective approach to JFM which, in turn, can lead to integrated development of the rural poor. Self-reliance and Gandhiji's 'Gram Swaraj' may indeed become a reality. Even in the age of liberalization and globalization, it has to be understood that there can be no financial assets if there are no ecological assets.

JODHPUR / RAJASTHAN

Raising a Plantation on Stone-bed

The vision of the Machia Biological Park is to create one of the best examples of ex-situ conservation and at the same time a beautiful tourist spot

Md Raheman

The vision of the Machia Biological Park is to create an opportunity for the citizens of Jodhpur to have a biodiversity park very close to the city. The effort is to create one of the best examples of ex-situ conservation and, at the same time, the best tourist spot in the area. Jodhpur already has a tradition of very good in-situ conservation. The Machia Biological Park, sited in Machia forest block of 604 ha. near Kaylana Lake, will also create awareness on the importance of conservation of flora and fauna for the benefit of the future generations in addition to conservation of the gene pool of endangered wild species of the region.

Machia Biological Park was conceptualized in the year 1982-83. It is located 8 km away from Jodhpur railway station on the western side of Jodhpur. This park is basically the satellite zoo of thec city's old heritage zoo. Machia Biological Park has an area of 41 ha. out of 604 ha. area of Machia forest block. The legal status of Machia forest block is protected forest, notified vide notification no. II9(6) forest/90 dated 01-07-1990 under the Rajasthan Forest Act 1953.

The area is mainly rocky composed of Rhyolite having undulating ground, numerous manmade water bodies like Kaylana Lake, Takhatsagar Lake, Akheraj Lake, and so on. This area has low soil quantity and if soil is present, it has low soil depth.

The natural vegetation here is dry scrub forest consisting of scanty tree cover of species like *Acacia senegal*, *Prosopiscineraria*, *Prosopisjuliflora*, *Capparis decidua*, *Zizyphusnimmularia*, *Commiphorawightii*, etc. The scarce vegetation is a result of of the low rainfall received by this zone.

Previously, the plantation was started by making a loose stone container of 20cm width. The depth/height of this structure was around 100 cm and diameter was 60 cm to fill the mixture of sand and manure in the ratio of 4:1, respectively. Species selected were Gular, Neem, Peepal, and Bargad of approximately 3-4 feet height for planting. Now, five years later, the height of these plants is approximately 10-12 feet.

Since the topography is undulating and the terrain is rocky, there was low

Xxxxxxx xxxxxxx xxxxxxxx

success of survival as well as slow growth so a new technique was adopted. Blasting was done by applying the blasting material, which is detonators and rock blasting accessories, through registered blasting authority. In this method, single and double blasting was adopted according to the suitability of the area. Single blasting left behind pits around 2-3 feet deep. Double blasting left pits of around 3-4 feet. Material generated by double blasting was left such to provide enough space for the soil and roots of plants to penetrate into the rock crevices. The open pit was then filled with soil mixture in proportions of 1:1:4 (FYM:Clay:Sand). The seedling of the desired plant was planted in the pit to grow like it would in regular soil. Irrigation facility was provided inside the park for trees, and included methods like spot irrigation by conveyance pipe and taps and drip irrigation.

The double blasting technique was found to give good results in Rudrakshakunj and Kamalkunj. Trees like *Ficus religeousa*, *Ficus bengalensis*, *Ficus zyziphus*, *Cardia mixa*, *Aengel marmalose*, *sygamum cumini* were planted along the roads. Clearly, the efficacy of the double blasting technique provides an opportunity to raise plantations on such rocky terrain elsewhere as well.

USE OF TECHNOLOGY

Preventing Forest Fires

Infra-red detection and surveillance system has been found to be highly effective

Manoj Ashok Dhanvijay

Conserving unique natural areas should be a priority for advanced societies in our time. One of the biggest threats faced by these natural areas is wildfire devastation. The unfortunate reality is that most of these areas are unprotected, or at most only monitored during certain months of the year and then, only during certain times of day, leaving the night periods more vulnerable without proper monitoring. The entire system suffers from teams of workers woefully ill-equipped in terms of manpower and technology. With changing time, various solutions have been derived from the specialized satellite infrastructure coupling with infra-red technology and ICT.

Infra-red fire detection system is a reliable system for surveillance and recognition of spontaneous fires inside the forests, free air dumps of waste or combustible materials like paper, waste or charcoal among many others. Since forest fires usually break out during the summer as materials are mostly inflammable, the probability of spontaneous combustions is high with disastrous effects for man and environment.

Thus, many recommend the usage of fire early warning systems based on infra-red cameras. High performance infra-red cameras like PYROVIEW 380L and 640L combined with powerful software like PYROSOFT FDS, for analyzing thermo-graphic images allows for early warning and prevention of fires. The infra-red cameras mounted on a pan-tilt head automatically monitors the user defined area to be observed and continuously quantifies the surface temperature distribution. The FDS software checks the temperatures inside the regions of interest (ROI). An alarm will be raised in case the pre-defined temperature limits are exceeded and the current infra-red image is saved. Alarms and the system status are displayed on the monitor and the control panel. External equipment for alerting and firefighting can be controlled via the flexible I/Osystem.

Fire Detection System (FDS) Components

The forest fire detection system consists of the components listed in the table below, along with proper specifications.

The proposed scheme based on infra-red image processing performs early detection of any fire threat. With the

RFO (Tr.), Kundal Academy of Development, Administration and Management, Kundal, Ta.Palus, Distt. Sangli (MS)

aim of determining the presence or absence of fire, the proposed algorithms performs the fusion of different detectors which exploit different expected characteristics of a real fire, like persistence and increase. Theoretical results and practical simulations are presented to corroborate the control of the system related with probability of false alarm (PFA). Probability of detection (PD) and dependence on Signal to Noise Ration (SNR) is also evaluated.

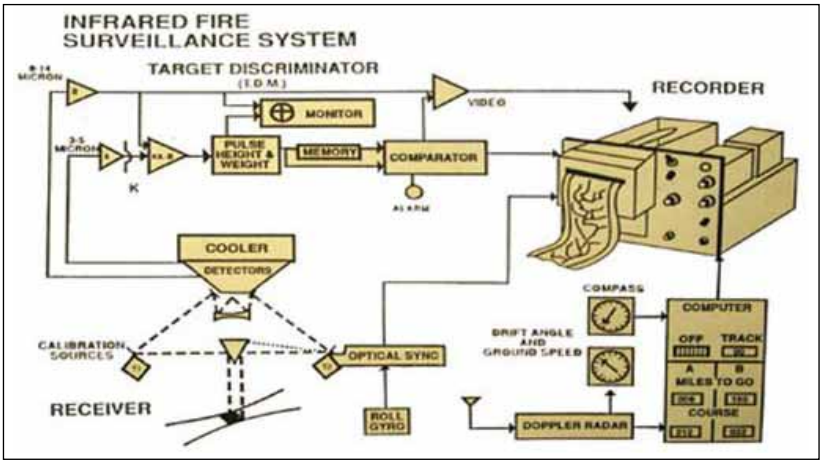
The infra-red image is displayed in a pseudo colour image mode gray-scale; the brighter the colour, the higher the temperature. In case of fire areas exceeding the temperature limits become red coloured. The operator recognizes the source of fire immediately and can start fire-fighting actions. The infrared image on the left side shows an initial fire in a paper stock. Because of the early recognition and warning, fire fighting is started instantly with a high efficiency, thereby preventing ecological and material damages.

Applications of Infra-red surveillance system

The infra-red surveillance system is very effective in monitoring various aspects related to forests:

1. Automatic surveillance and monitoring of forest fire.
2. Keeping effective watch over the plantations.

• Infra-red camera detects infra-red radiation with infra-red image sensor and transfer RS image information as digital data via Ethernet.	– temperature range from –20 °C to 300 °C (optional: 500°C) – spectral range 8 µm to 14 µm – 384 × 288 pixels or 640 × 480 pixels depending upon camera – maximum frame rate 50 Hz – integrated air purge to prevent/delay disposal of soiling
• Weather-proof housing	– with heating and hard-coated GE window
• Pan-tilt head	– move towards to programmable positioning – free manual positioning – 359° horizontal, 180° vertical, 0.2° resolution
• Reference radiator 2	– control of camera function, lens soiling – little deviations are corrected, malfunction information when heavily soiled
• Power supply/USV	2 isolated feeds (1x buffered, 1x unbuffered) – switch for feeds – optional: separated USV for 4 h operation
• I/O system programmable bus controller	– control of pan-tilt heads, control panel, video system, reference radiator – control system status – transmission to PC –altering via relay, 24 V
• Touch-PC	– operation and surveillance station – with 21"/19" touch display
• FDS Software	– server-/client software



Block diagram of infra-red fire surveillance system

Infra-red camera

IR-surveillance in forest area

3. Detecting forest crime by keeping watch over poachers.
4. Illicit felling can be detected.
5. The movement of wild animals can be studied.
6. Various works undertaken in forestry.
7. Measure growth of the forest cover if connected with satellite.
8. Wildlife census if GPS-enabled and geo-augmented.

Applicability in Forests of Maharashtra

The state of Maharashtra with a geographical area of 3,07,713 sq. km has 61,939 sq. km as forest area. The state's forest cover is estimated to be approximately 20 per cent. The state has 6 national parks, 47 wildlife sanctuaries and 4 conservation reserves. This is a total of 57 PAs with 10,057,013 sq.km area, amounting to 3.26 per cent of the state's geographical area. These areas include the difficult terrains of Western Ghats, Melghat, and others. Thus it is an obvious fact that in order to protect these forests from dangers of fire, infra-red fire detection and surveillance

E-eye to keep a tab on tigers in Corbett

With poachers posing a massive threat to tigers in India, the National Tiger Conservation Authority (NTCA) has launched a pilot project in **Uttarakhand's Corbett National Park** for round-the-clock surveillance of the park using high definition cameras. The project E-eye (electronic eye) is a software-based system where 10 high resolution thermal and infra-red cameras mounted on a tower are spread across the 350 sq. km area of the park that falls in a highly sensitive zone bordering Uttar Pradesh. The cameras capture image of objects weighing more than 20 kg and generate alerts if they are crossing the boundary. The alerts are sent to the control room in the park and the NTCA office in Delhi. The cost of the project is around ₹3.5 crore. The cameras monitor the area 24X7 and send images even during the night. It has helped in checking infiltration, poaching and illegal mining in the area. The NTCA was helped in this project by a Pune-based company, Binomial Solutions Private Limited, set up by a group of young engineers and management graduates. The cameras can capture thermal and normal images of the body mass irrespective of forest density and inclement weather conditions. The company is also working with the Wildlife Institute of India (WII) to develop a parallel system for counting of tigers. Besides this, the tender for installing a similar kind of detection system and work of installation is already in the pipeline at **Assam's Kaziranga National Park.**

system can be a good tool. The following are strategic and potential sites/ places where such installation can be useful:

1. Sahyadri Tiger Reserve in Sangli, Ratnagiri, and Kolhapur districts.
2. Melghat Tiger Reserve and Gugamaal National Park in Amaravati district.
3. Pench National Park in Nagpur district.
4. Tadoba-Andheri Tiger Reserve in Chandrapur district.
5. Natural forests in Gadchiroli district.

In these areas and in many others infra-red systems can prove very effective in dealing with forest fire as well as surveillance needs given their limited accessibility and other threats.

The installation of infra-red fire detection and surveillance system is thus an effective module for forest conservation and surveillance. Its unique combination with ICT can give comprehensive results in terms of forest project monitoring and keeping watch over plantation works. Beyond this, it can turn into an innovative methodology when paired with GPS, remote sensing satellites, etc., for real-time updates about the forest on a single click!

MAHARASHTRA / KERALA / GUJARAT

Comparative study of coastal ecology

There is urgent need for better conservation and restoration works along the north coast of Mahashtra

G.P. Gangode

India's coastal zone is endowed with abundant coastal and marine biodiversity that include a wide range of mangroves, coral reefs, sea grasses, salt marshes, mud flats, estuaries, lagoons, and unique marine and coastal flora and fauna. India also has major stocks of corals, fish, marine mammals, reptiles and turtles, sea grass meadows, and abundant sea weeds. Mangrove cover in India has been estimated at approximately 3,15,000 ha. spread over west and along the east (Orissa and West Bengal) coast and Andaman and Nicobar islands. The Sunderbans in West Bengal has one of the largest mangrove forests in the world. The mangrove flora of India comprises 50 exclusive species belonging to 20 genera.

According to the latest evaluation, 67 per cent of the mangroves and associated plant species are endangered, while 97 per cent of the plant species are threatened. Indiscriminate cutting, reclamation for agriculture and urbanization, fuel and overgrazing by domestic cattle have severely degraded mangroves in India. The threat to mangroves in recent years comes mainly from aquaculture and urban settlements.

Coral reefs are found in the Palk Bay, Gulf of Mannar, Gulf of Kutch, central west-coast of India, Lakshadweep and Andaman and Nicobar islands. A few species of corals have recently been reported from the Maharashtra coast. A total of 50 genera and 13 sub-genera of reef-building corals are known to occur in Indian reefs representing more than half of those recorded from all over the world**.** Over 630 species of marine algae have been reported. A sea grass called *Enhalus acroides* is now a threatened species. *Dugong dugong*, a mammal dependent on the sea grass for its food is also threatened.

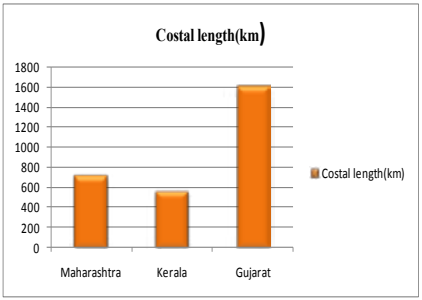
A comparative study of coastal ecology of three states – Maharashtra, Kerala and Gujarat – was conducted during 2014-15. Parameters such as geomorphology, biodiversity, mangrove plantation and its status, conservation and restoration works (CRW), and environmental impact on costal ecology were studied. Various data was collected by observation and inputs from government agencies and web source are used for comparative analysis.

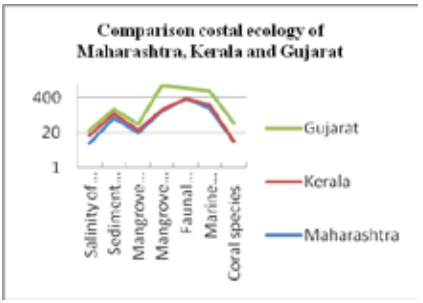
Observations and data collection

FRO Trainee, Batch 2014-15

Comparative coastal ecology of Maharashtra, Kerala and Gujarat

S.No.	Particular	Maharashtra	Kerala	Gujarat
1	Coastal length(km)	720	560	1600
2	CoastalGeomorphology	Undulated	Wetland	plane
3	Coastal climate	Tropical monsoon	Tropical monsoon	Tropical monsoon
4	Salinity ofcoastal sea water(ppt)	2 to 8	2 to 8	2 to 8
5	Sediment quality (mg/lit.)	27 to 70	15 to 34	19 to 45
	Floral Biodiversity			
4	Mangrove Species (no.)	20	4	16
5	Mangrove area(sq.km)	186	17	1046
	Faunal Biodiversity(No. spp.)	350	---	539
6	Marine Fish species	160	52	487
7	Coral species	9	00	37
8	Conservation & Restoration work Mangrove plantation growth from 1987 to 2007 (sq.km.)	— 46	— 5	Very good work 619
9	Environmental impact	Sever adverse effect on north coast	Less adverse effect	Moderate adverse effect





during the study tour at Herne beach of Dapoli (Maharashtra), Kovalam beach of Thiruvananthapuram (Kerala), Marine National Park, Jamnagar, Gulf of Kutch (Gujarat) and personal visits to the Maharashtra coast are the basis for comparison of the coastal ecology of Maharashtra, Kerala and Gujarat.

The Maharashtra coast that stretches between Bordi in the north and Terekhol in the South is about 720 km long and 30-50 km wide. The shoreline is indented by numerous west flowing river mouths, creeks, bays, headlands, promontories and cliffs. There are about 18 prominent creeks/estuaries along the coast many of which harbour mangrove habitats. Like elsewhere in the world, the coastal region of the state is thus a place of hectic human activity, intense urbanization in pockets and enhanced industrialization, resulting in degrada-

Visit to Marine National Park, Gujarat

tion, directly or indirectly, of marine environment through indiscriminate release of domestic and industrial effluents, reclamation, offshore constructions, movement of ships and a variety of cargo at ports, etc.

Kerala has a 590-km long coastline endowed with beautiful beaches, estuaries and lagoons. The coastal belt, a narrow strip of lowland, is the most beautiful region of Kerala, flanked by the presence of paddy fields and coconut trees dominating the landscape. In Kerala, mangroves are distributed in Keeryad Island, northern part of Kochi Port and Research Farm at Puthuvypin, Mahe to Dharmadam coastal belt, Mallikkad, Ashram, Pathiramanal, Mangalavanam and in several other small bits. It is reported that 17 true mangrove species and 23 semi-mangrove species occur in the state. There are also some dominant mangrove species recorded in the state. The mangrove area in Kerala is estimated to be about 17 sq. km, of these 36 per cent are degraded or in degrading condition.

Gujarat is the north-western state of India and the total length of the coast line, facing the Arabian Sea is about 1,600 km, based on the geographical situation geomorphological position and variable natural land, the Gujarat coastal zones may be divided into five regions: the Rann of Kachchh, Gulf of Kachchh, Gulf of Khambhat, Saurashtra coast and the South Gujarat coast. Out of these five regions, the Gulfs constitute the major mangrove zones of the Gujarat coast. We visited the Marine National Park and mangrove plantation area at Jamnagar , and found 100 per cent survival and good management.

Coastal and marine environments are threatened by the lack of integrated development planning, especially given the large concentration of towns, petrochemical complexes and industries along the coasts. Only 9 per cent of wastewater from coastal towns is treat-

Visit to Mangrove plantation, Jamnagar

ed before entering the waters, adding to their already heavy chemical burden from the huge volumes of agricultural run-off that routinely flow into them. In addition, large numbers of coastal people remain dependent on natural resources for their livelihoods, in the absence of alternative livelihood opportunities. However, the returns from traditional fishing are diminishing due to environmental degradation and over-exploitation. Risks from climate change will only accentuate these challenges.

As comparison of coastal ecology among three states, Gujarat was found to have maximum coastal biodiversity, better CRW and mangrove plantation. Maharashtra has a huge potential for coastal ecological development but the northern coast of Maharashtra faces an overburdening of human population, industries, seashore activities and there is urgent need of better CRW.

However, in spite of the coastal ecological richness and contribution to the national economy, coastal and marine areas have not received adequate protection and are under stress. About 34 per cent of India's mangroves were destroyed during 1950-2000 (although substantial restoration and conservation has taken place over the past 10 years); almost all coral areas are threatened; marine fish stocks are declining; and several species of ornamental fish and sea cucumbers are fast disappearing. Such rapid depletion and degradation, unless arrested, will impact the livelihood, health and well being of the coastal population, affecting in turn prospects for India's sustained economic growth.

WILDLIFE / NAGALAND

Foes turn friends for migratory Amur Falcons

The Nagaland Forest Department has played a key role in the conservation of Amur Falcons and creating awareness among the local community

Florence T. Sangtam

In their incredible journey, the Amur falcons (*Falcoamurensis*) travel up to 22,000 km a year – known to be one of the longest distance migration of birds – from Mongolia, roost in Nagaland for some months before carrying onwards to the African sub-continent. A protected species under the Convention of Migratory Species (CMS), tens of thousands of these raptors congregate near the Doyang reservoir in Nagaland every year and this is believed to be the single largest congregation of Amur falcons recorded anywhere in India

Till 2012, the local communities in Wokha used to hunt the falcons for their meat and capture them for commercial sale when they stopped by to roost in Nagaland. Doyang reservoir, the falcon's pit-stop, before their lengthy onward journey across the Arabian Sea to Africa had turned into a death trap for the birds. The birds were trapped by the hunters in the mist nets lined up near the reservoir and collected early in the morning. Besides killing them for meat, the raptors were also kept alive and later sold in the local district markets prompting a Rapid Action Project (RAP) to protect the birds by Wildlife Trust of India (WTI) and the Nagaland Forest Department. Down the line, the situation at Doyang has seen a remarkable change of events for the better. The reservoir is now one of

RFO Trainee, 2014-15 Batch, ASFOS Burnihat, Assam

the safest places in the North-East for the visiting raptors. And the hunters of migratory Amur Falcons have now turned into protectors. Nagaland has become the 'Falcon Capital' of the world. The birds which used to be earmarked for the cooking pot are now the pride of Nagaland.

Alternative livelihood support in the form of poultry farms was provided to the villages, who were part of the hunter groups and landowners where the Amur Falcons roost. An MoU was signed and a subsequent resolution passed by the village councils of Pangti, Ashaa and Sungro, making hunting the Amur Falcon illegal and punishable, which helped in reaching a zero mortality rate in Doyang , by the end of the bird's roosting period. An awareness campaign was initiated to gain the local community's support and also sensitize them on the need to conserve the visiting guests, emphasising the ecological and ethical importance of the Amur Falcon and urging the villagers to ensure safe passage of these migratory birds. Churches also played a key role in spreading the message of compassion for the Amur Falcon, and thus motivating the people to come forward to protect the falcons during their roosting period in Nagaland. Amur Falcon Roosting Areas Union (AFRAU) is also supporting the conservation efforts of the Wildlife Trust of India at Pangti. AFRAU members are jointly working with the Amur Falcon Protection Squad formed by WTI for the conservation of the migratory birds with the support of Nagaland Forest Department.

Signages were installed in strategically important areas and posters and leaflets were handed out among the community. Wildlife films were screened and workshops were held during wildlife week in October. The Amur Falcon campaign was also conducted in local schools across Wokha targeting school children to sensitize them on the need to conserve the falcons. Nagaland Wildlife and Biodiversity Conservation

Amur Falcons in the Wokha sky

Trust (NWBCT) started conducting nature camps under its 'Friends of the Amur Falcon' programme for building awareness on conservation of biodiversity among the children and villagers in areas where the Amur Falcons were visiting for the third consecutive year.

On November 6, 2013, three Amur Falcons – Naga, Pangti and Wokha, named after Nagaland, Pangti village and Wokha district, respectively, were satellite tagged with an antenna and solar panel, weighing 5 grams, fitted on their back in collaboration with scientists from the Wildlife Institute of India, Ministry of Environment and Forest, the UNEP, The Environment Agency-Abu Dhabi and the Nagaland Forest Department and released in Doyang forest. It was now possible to track their movements. From November 7, Naga, a male, had taken the route of Wokha in Nagaland, Assam, Bangladesh, the Bay of Bengal,Andhra Pradesh and Karnataka before entering the air space over the Arabian sea. During the same period, Pangti, a female, took the route of Wokha, Assam, Bangladesh, West Bengal, the Bay of Bengal, Andhra Pradesh and Maharashtra before beginning the journey over the Arabian Sea. Wokha, also female, followed Pangti's path and was tracked flying over the Bay of Bengal way behind the other two. The movements of all three birds are being monitored by scientists in Hungary, filtering satellite data through a dedicated website. This is the first time the Amur Falcons in Nagaland were satellite tagged and their movements to South Africa are being monitored.

Gaining support from the community in Nagaland to protest against harming these endangered raptors was essential for the future of the species. Continued efforts are needed to keep the locals motivated and provide a safer migratory passage for the Amur Falcons in the years to come. This model of community conservation by people can be replicated in other parts of the world as well.

COMMUNITY INTEGRATION / TAMIL NADU

Venom for anti-venom: A source of livelihood to Irulas

A co-operative society has been able to harness the traditional skills of Irula tribals and provide them with ways and means of social and economic upliftment

Anu Thakur

India is a land of rich ethnic diversity. There are still some social groups which would defy the very principles of human material progress and adhere to the traditional ways of living and earning their livelihood. India counts significantly amongst the nations which house a large population of tribals inhabiting widely varying ecological and geo-climatic terrains. As per the 2011 Census Report, tribal population in India is 104.5 million. From ages they have survived the ordeals inflicted upon them by the nature and by other social groups.

The Irulas are Dravidian inhabitants and one among the 36 sub-tribal communities in Tamil Nadu with a population of about 1.17 lakh. *Irulas* are the second largest population of tribals in Tamil Nadu. The origin of the word *'Irula'* is not clear. It could have been derived from the Tamil word, '*Irul*' which either refers to the dark complexion of the Irulas or their being capable of finding one's path in the dark forests.

These small groups of indigenous forest-dwelling people have remarkable expertise in catching snakes. They were one of the leading suppliers of snake and lizard skins to the global skin industry. The reckless exploitation that ensued threatened the local extinction of several species and subsequently hunting was banned in 1972 with the implementation of Wildlife Protection Act. This deprived the Irulas of their main source of livelihood.

They do not have a fixed means of livelihood. They are unskilled in doing any alternative kinds of job. They earn their living by doing `coolie' work in rice mills and agricultural fields of the landlords. Fishing is also an occupation in some of the Irulas' villages. Many of them do not possess even a Scheduled Tribe or land certificate for the place they stay in.

Irula Snake-Catchers Industrial Cooperative Society (ISCICS)

We had an opportunity to visit the Irula Snake-Catchers Industrial Cooperative Society (ISCICS). It is located in the premises of the Madras Crocodile Bank at Vadanemmeli, Kanchipuram district of Tamil Nadu. In the early 1980s, Romulus Whitaker

Forest Range Officer Trainee of 2014-15 batch, CASFOS, Coimbatore

Unique code being clipped into ventral scales

Venom extraction

and Revathy Mukherji started a self-employment scheme to help the Irulas come out of their abject poverty. Their continuous efforts resulted in the official registration of ISCICS on December 19, 1978.

The main objectives of this co-operative were to harness the traditional skills of the Irulas, to accord dignity and respect to their indigenous knowledge and to provide them with ways and means of social and economic upliftment. In due course, a specialist snake handling facility was established at the Crocodile Bank.

We need to pay an entry fee of ₹10 for the Snake Pit centre where the *Irulas* introduce us to a variety of poisonous snakes which are kept inside systematically arranged mud pots covered with white cloth. "The snake is very poisonous," says Muthu while pulling out a slithering Russell's Viper from the mud pot. He narrates non-stop details of the life history and characteristics of snake. He makes all of us pretty excited while extracting the venom. He firmly holds the snake's

Irula handling Indian Cobra

Snakes kept inside systematically arranged mud pots

neck over a glass receptacle and the venom percolates down into it.

The ISCICS focuses on four poisonous species: Indian Cobra, Common Krait, Russell's Viper and Saw-scaled Viper that account for the majority of snake bite-related deaths in India. *Irulas* always move in groups of four or five to ensure that there are people around to aid each other in the event of a snake bite. They consume a herb before setting out to catch snakes, details of which they are reluctant to share.

The licensed members then go out and catch the snakes which are sold to the society at a fixed rate. Once purchased, the snakes are kept in individual earthen pots. The length, weight, sex and site of capture are recorded at the time of purchase. Each snake is marked with a unique code clipped into its ventral scales. Venom is extracted from each snake once a week for four weeks. The snakes are then released at predetermined sites in Reserve Forests in the presence of a Forest Range Officer.

Venom, once collected, is frozen, dried and stored at 10º C in the freeze chamber. This turns it into minute crystals. The crystallized venom is gathered in airtight bottles and stored in a refrigerator. The society sells the venom to a number of laboratories for conducting medical research and preparation of anti-venom.

At present, the annual turnover of the 350-member strong cooperative is ₹1.5 crore. An Irula is paid ₹2,000 for catching one Cobra or Russell's Viper, ₹700 for Common Krait and ₹250 for Saw-scaled Viper. The society is involved in extracting venom, which is in great demand for making anti-venom serum. For every one gram of venom from Indian Cobra, Russell's Viper, Common Krait and Saw-scaled Viper, 10, 10, 40 and 100 numbers of individuals are required, respectively. A gram of Cobra venom costs ₹ 25,000, that of Krait ₹40,000, Russell's Viper ₹30,000 and Saw-scaled Viper ₹45,000. The cooperative also earns ₹6-7 lakh annually from the entry fee to its Snake Pit Centre.

Apart from this the members are paid for catching rats and snake feeds besides other bonus and incentives like medical allowance, an interest-free housing loan, an educational loan for children and an insurance cover of ₹10 lakh if a member dies of snakebite. If a member is bitten by a snake, treatment costs are also covered.

"The formation of the society and subsequent permission to collect snakes was an uphill task for Irulas," says S Dravida Mani, Secretary and founder member of the ISCICS. "We established ourselves without any financial support from government. Now, the society has the ambition to become a global pharmaceutical company. It wants to expand nationally and manufacture serum which meets WHO standards." "We are going to train tribals in other part of the country and invest ₹10 crore to become a competent global exporter," says Mani.

Given the high standard of goals, as regards the economic and social upliftment of Irulas by employing agencies such as ISCICS, much more is yet to be done. Though this exposure has somewhat exposed the tribe to the success parameters of human social and economic growth but the numbers achieved are none to boast of as of now.

It is heartening to see that this community has also ventured into manufacturing of numerous medicinal products, herbal teas, shampoos and other organic products derived from various trees and shrubs. The words of Robert Frost, '*miles to go before I sleep*', manifest the essence of goals and standards to be achieved by this ethnic group. The Irulas need comprehensive engagement and a lot more attention from the government and the society at large.

COMMUNITY INTEGRATION / MAHARASHTRA

The Jungle Man

Co-opting local forest residents can be an asset to the forest department in terms of understanding wildlife and traditional knowledge

Ashish Narayanrao Hivre

From May 3-10, 2015, I got an opportunity to go for wildlife estimation in Koyna wildlife sanctuary along with all the RFO trainees of our academy. It was our maiden experience-gathering opportunity of a wildlife census. Koyna wildlife sanctuary is located in Satara District of Maharashtra and has a total notified area of 423.55 sq. km.

Koyna wildlife sanctuary includes the eastern and western catchments of Koyna dam, which is a major hydro-electric project centre in western Maharashtra. The sanctuary is well protected by the large extent of the Shivasagar reservoir and the steep slopes of the Western Ghats on both the sides. This protected area is connected by a vegetal cover corridor of Chandoli and Radhanagari wildlife sanctuaries in the south. The average altitude is 897 metres above sea level. The mean annual rainfall is 5,500 mm.

The forest types here are southern tropical evergreen forests and southern moist mixed deciduous forest. Dominant species are Anjani, Jambul, Hirda, Awala, Pisa, Ain, Kinjal, Amba, Kumbha, Bhoma, Chandala, Katak,

Shamrao Kokre's hut in the forest

Range Forest Officer (Tr.), Kundal Academy of Development, Aadministrationand Management, Kundal, Ta.Palus, Distt. Sangli, (MS)

Nana, Umbar, Jambha, Gela, Bibba etc. Karvi is found almost all over the area. Climbers such as Shikekai, Garambi are quite frequent. Shrubs species and medicinal plants such as Karvand, Vagati, Ranmiri, Tamalpati, Toran, Dhayati, Kadipatta, Narkya, Murudsheng, etc. with small quantity of Bamboo are also seen. Quite a large number of ephemerals, bulbs of seasonal plants are found.

The sanctuary shelters tigers (2), panthers (14), gaurs (220-250), sloth bears (70-80), sambars (160-175), barking deer (180-200), mouse deer, dholes, giant squirrels, otters, common langoors, pythons and cobras. A unique species of toad, *Bufo koyanansis,* is endemic to this protected area.

ACF Puranik had told us about the method of census and the steps to be followed for the census. He gave us the necessary equipment like GPS, range finder, camera, booklet, sleeping bag, ration required for eight days. I had been allotted the 'Maldev beat'. I was accompanied by beat guard Ram Shelke and forest watcher Vaibhav Jadhav. Shelke told me that Maldev is the last beat of the Koyna wildlife sanctuary.

On May 3, we began our journey at 9.00 am from Koynanagar to Maldev beat. we reached at 06.00 pm by launch. That was my first longest journey by launch in wildlife area. I enjoyed it thoroughly and was once in lifetime experience for me. My whole journey was through core area of Koyna. At dinner, Shelke told me about Shamrao Kokre who lived in Maldev beat. The rehabilitation of the whole Maldev village was done way back in 1960.

Shamrao Kokre and his family with the author

The Kokre household was the only one which is yet to be rehabilitated. Kokre was living with his wife and son. After dinner, we went for water hole census at night.

In the morning, we visited Kokre's home. At that time, only his wife was present. I asked some questions about their livelihood. She told me that their entire dependence is on the forest. They use fruits, tubers and bulbs as vegetable. She also told us that some years ago, they used some forest land for agriculture purposes but now the forest department had prohibited the same. The forest department had already offered to shift them from the forest area but they were not ready to do so.

Korkre's house is an open hut.

There were no doors and windows. His house was built up with timber and straw extracted from the forest. Around his house we saw signs of wildlife like leopard, sloth bear, wild pig, and so on but he loved to sleep in the open. His wife told me that initially they had 250 cattle. Their main earning was from the dairy produce but due to attacks by tiger and leopards, they were left with only nine animals. The nearest village was almost 10 km away at Tiwre. She showed me several paper cuttings which spoke about Shamrao Kokre.

In the afternoon, Shamrao came to our tent to visit us. Shelke introduced me to him. I was amazed to see that Shamrao, despite being 82 years old, was very fit and in good health. We had very little conversation at that time. He thought that I had come to convince them to leave the forest area. He left us after half an hour. Shelke told me that the forest department and Kokre were at loggerheads about the rehabilitation. Kokre is not ready to leave the place, though all his sons and daughter have shifted to the city area. Shamrao's refrain is: "I am born in the forest and I shall die in the forest."

After frequent visits, he opened up. He told me about the flora and fauna of the Koyna wildlife sanctuary. This 82- year-old man has lot of knowledge about the forest and we can describe him as "walking flora". He also told me about changes in habitat over the years and the condition of the sanctuary before the Koyna dam and status up to the date. He also told me about changes in animal behaviour. He also informed that very few tigers are left in the sanctuary. One day I requested him to come with us for trekking. We started trekking at 6.00 am. After the completion of transect-line survey, we moved on to reach the Kusumlata Plateau at 12.00 noon.

During the trek, he told me many details about the flora of the region. He told me about the multivitamin and anti-oxidant properties of theleaves of the Pisa plant (*Actinodaphne hookeri*). He is also familiar with the medicinal value of the entire flora present in that area. He told me that, he knew all the natural trails right from Belgaon to Thane that is whole of western Maharashtra. He has walked throughout Maharashtra. Standing atop the Kusumlata Plateau he showed me the boundaries of the Satara, Ratnagiri, and Kolhapur districts. He also showed me old Vasota and New Vasota fort and their distinguishing characters. He again showed me the "W" point located there.

One of his best abilities is that he can locate the animal by odour. He can smell different animals and locate their position. To share just one of my experiences with him: One evening, we were sitting outside our tent when he suddenly got up and said, "I will show you sloth bear." So we followed him towards the water hole and sure enough we had a sighting of sloth bear at the water hole. He informed us that the most dangerous animal in the sanctuary is the sloth bear. There had been many incidents of man and sloth bear conflict. He gave us tips on how to save ourselves from the sloth bear and also showed us the den of a sloth

bear. He also said that the leopards of Koynanagar were not maneaters and they had never attacked a human being.

Clearly, Shamrao Kokre is a knowledgeable resource person having a good understanding of wildlife behaviour. The forest department can take benefit of his knowledge for the management of the forest. Though he is 82 years old,, but taking into consideration his extraordinary knowledge about the forest,we can treat him as a special case and offer him a job of forest labour so that we can utilise his knowledge.

The forester gets transferred after every three years so we cannot have the same familiarity with the area. His son also has good knowledge about the forest. Interestingly, Shamrao has never been attacked by animals. His affinity with all things wild can be utilized in the course of man-animal interface.

As discussed, he possesses good knowledge about the flora and their uses. This can help us for the conservation and the preservation of some rare and endangered flora. We can also appoint Shamrao as a trainer for the forest guard and foresters, or as a guide for the beat boundaries.

WILDLIFE / MAHARASHTRA

A Success Story

An initative to help conserve the vulture population brings forth results with the help of community participation

Kalpana Homkar Chinchkhede

Do you know the decline of which species has cost India US$34 billion? The decline of this species has been recorded as the most rapid decline in history of a large population. In the 1980s, one of the sub-species was considered as the most numerous species of raptor in the world, with around 80 million individuals, but today, however, its population numbers only several thousand. These birds of prey are one of the most efficient scavengers, constituting India's optimal natural animal disposal system. They live in communities and mostly near human habitation. For the deceased Parsi to reach heaven, these species serve as intermediaries between earth and sky. The dead body is placed on a Tower of Silence where these birds by consuming the body, liberate the soul. The dwindling population of

Vulture group in Damrancha village

RFO Trainee (2014-15), Burnihat, Assam

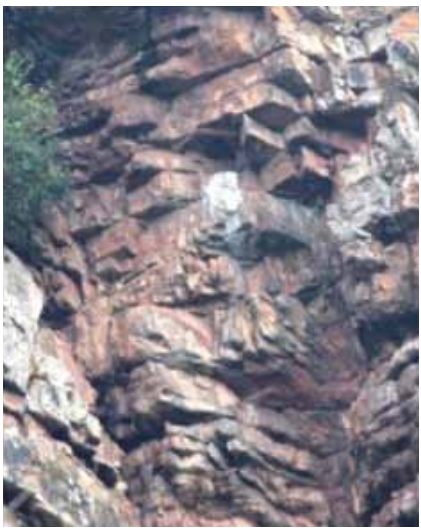
A carcass being put on one of the *machans* or vulture restaurants

Parsi Indians, deprived of their celestial emissaries, has been obliged to drop these ancient customs for reasons of hygiene, since now bodies take six months to disappear. I am talking about Vultures.

One can imagine the quantum of acceleration in decline given that the population of White-rumped Vulture (*Gyps bengalensis*) fell 99.7 per cent between 1993 and 2002. The population of the Indian Vulture or Long-billed Vulture (*Gyps indicus*) and the Slender-billed Vulture (*Gyps tenuirostris*) fell 97.4 per cent. Out of nine species found in India, these three species are in danger of extinction. Research shows that in India, feral dog populations have increased by 30 per cent due to the disappearance of vultures, which consequently has increased the risk of human rabies and anthrax. After much work on possible viral causes of the decline, the culprit was discovered by Dr. Lindsay Oaks and his team in 2003: diclofenac. It is a common anti-inflammatory drug administered to livestock and was widely used in India in the 1990s. The drug is fatal to vultures. A vulture is exposed to a mortal dose of diclofenac if it eats from the carcass of a recently treated animal. A simulation model demonstrates that if only 1 per cent of carcasses were contaminated by diclofenac, Indian vultures would be decimated and a study of carcasses showed that 10 per cent were contaminated.

Following research on veterinarian diclofenac, the drug was taken off the market in India on March 11, 2006 and a replacement drug, meloxicam, was quickly developed and proposed after tests on vultures in captivity. Meloxicam affects the cattle the same way as

diclofenac, but is harmless for vultures. The disappearance of vultures has allowed other species, such as rats and stray dogs, to take their place. These newly abundant scavengers, however, are not as efficient as vultures. A vulture's metabolism is a true "dead-end" for pathogens, but dogs and rats become carriers of pathogens. Stray dogs also attract leopards to the human inhabited areas which can result into man-animal conflict. Dogs carry diseases like rabies, anthrax, plague, etc. from rotting carcasses. Statistics show that in India, 30,000 people die from rabies each year – more than half the world's total. A person is bitten every two seconds and one dies from rabies every 30 minutes. Seventy per cent of the victims are children under the age of 15. The Indian government treats half a million victims each year at a cost of ₹1,500 per person. Poor citizens do not have access to this care. Moreover, huge sum of money is needed to control the population of stray dogs. I was talking about all these expenditures when I mentioned US$34 billion at the beginning of the story.



Nesting site of Long billed Vulture In Lakkameda

Every cloud has a silver lining. I am going to tell you a story of one such silver lining. This story started on October 8, 2013 as a joint effort of the people and the forest department. The place was Kamlapur range, Sironcha Forest Division in Aheri Taluka of Gadchiroli district of Maharashtra, where a group of 12 to 15 individuals was sighted. The first sighting was done by Atul Rambhau Deokar, who got his first posting as a Range Forest Officer in this range. This was the beginning of a long and exciting story. He along with his team of three Forest Guards, Kadari, Pophali and Lade, started monitoring the birds. One nest of White-Backed Vulture on a teak tree in the same village gave a ray of hope. It was kept under regular monitoring with the help of local villagers. They conducted surveys in the villages in the vicinity and discussed the sightings with the locals. The next monitoring targets were the 'Dhorphodi' sites, a common place where dead cattle were put outside the village.

The results of this monitoring by the dedicated Kamlapur staff revealed that the vultures were being badly disturbed by stray dogs while feeding on the carcasses. Little was left by the dogs for the vultures to feed on and the vultures had to wait for their turn to feed. So, the team decided to set up 'Vulture Restaurants'. This restaurant is a 30mx33m structure which is fenced by a chain link on wooden poles. A wooden

Vulture restaurant in Kamlapur

platform called *machan* of 10ftx10ftx3 feet is erected inside this fence. Around ₹90,000 was spent to raise one such structure. These restaurants were set up in other ranges as well. Now, they have raised 11 vulture restaurants. Posters were distributed by the department with an appeal to bring the dead animal to these restaurants with an assurance or ₹250 per dead body. A format was developed for data collection from each restaurant that would be helpful in any future endeavor to conserve vultures. The staff kept a meticulous record of the account of the villagers bringing the dead animals. They also maintained a proper data along with lat/long of the vulture sightings at these restaurants. These records were regularly maintained by the respective Forest Guard and checked by Round Officers. This gave them a fair idea about the population of vultures in the area. Vultures are territorial and they migrate locally. The whole area was divided into grids for counting of nests. This made the survey more robust.

Participation of the local people was the most important part of the story as they were the ones who provided the food for vultures. In return, the vultures provided them with hygienic environment. The villagers were getting financial benefits too. Moreover, the limelight was on this area as the place of this success story, making the locals proud and happy!

The department started the concept of 'International Vulture Awareness Day' to make people aware about the significance of vultures. This day is celebrated annually on first Saturday of September. Meetings of the staff and the villagers were organized where they were sensitized through discussion, documentaries and the suggestions for the cause were invited. In one such meeting, the idea of "Gidhad Mitra' (Friend of Vulture) was put forth. These individuals support the department in survey, monitoring and creating awareness. The first Gidhad Mitra,

Shrihari Gurjalwal was selected from the Kamlapur range.

Now, as the awareness is spreading, people bring injured vultures to the Range Office where they are treated by the Livestock Development Officer (LDO). Here, the people do not use diclofenac and the LDO do not prescribe it. But, still the medical stores are kept under regular observation. Besides, awareness regarding the negative impact of diclofenac on vulture existence is being spread. Diclofenac is not a problem in this area. Here, the drug is not used as the tribals do not go in for such costly treatments for their unproductive cattle. But, the major problem was the unavailability of sufficient food because of stray dogs. This obstacle was overcome with the introduction of vulture restaurants.

At the beginning the vulture population was just a group of 12-15 birds. Aforementioned conservation efforts resulted in the sighting of a group of 80-90 individuals on August 18, 2014 at Kamlapur. At the beginning the team found only one nest. Later, a new nest was sighted on a teak tree near a vulture restaurant. The positive development is that the villagers from other areas themselves have asked for vulture restaurants near their villages where they have reported the sighting of this valuable species. This shows that they are aware about vultures and the important role they play in maintaining the health of the ecosystem. In Deokar's own words, "People's participation is vital for the long term survival of the vulture."

Training programmes were conducted for the frontline staff regarding vulture diversity, physiology and ecology by Deokar. The department is planning more awareness programmes. The research regarding the necessity of vulture restaurants is going on. The department wants to see whether the vultures would still come without the fencing and the machan. The department is thinking of conducting studies regarding the population, group dynamics and sex ratio of the vultures. A rescue centre for vultures is in the pipeline. Dhorphodi sites are conserved and villagers coming forward for vulture conservation are encouraged through financial incentives and by honoring them. Also, the Gidhad Mitras are paid an honorarium of ₹2,000 monthly for monitoring the vultures and providing information to the department. At present, three Gidhad Mitras work for the department. They provide regular updates of sightings of the birds.

This unique success story shows the importance of people's participation in conservation of endangered species and how much the support and contribution of the staff matters. Deokar and his team have proved that 'Actions speak louder than words'. Here the dedication of a handful of 'greens in uniform' has actually made it possible. The vulture was very near local extinction in this area. The increase in the number of individuals of this species is a matter of pride not only for the Kamlapur staff, but for the entire local community. And now it will be possible for the coming generations to get a chance to see this amazing raptor in flesh and blood and not only read about it in books.

WILDLIFE / MAHARASHTRA

Adapting to kill

An account of the newly observed predatory behaviour of the Greater Coucal (Centroupus sinensis), a member of the cuckoo family

Sonal Dattatraya Valvi

The Greater Coucal is one among the family of non-parasitic cuckoos and is largely terrestrial. It is known to live in open forest, scrub, grassland, shrubbery and groves about human habitations. This birds stalks along the ground or clambers and hops with agility amongst branches in search of food. Greater Coucal have been known for feeding on caterpillars, large insects, snails, lizard, young mice and bird eggs. In addition, there is a report by B. Laxmi Naraya *et. al.* from Hyderabad of Greater Coucal feeding on the Common Myna.

Therefore the addition of data describing the unusual predatory behaviour of the Greater Coucal by killing individually and feeding on a Indian Hare (*Lepus nigricollis)* is reported here. The Indian Hare killed by the Greater Coucal was approximately 30 cm length and 15-20 cm height. By observation, the hare can be considered as a sub-adult and its weight must be approximately around 1 kg.

Behavioural observation was found coincidently on the campus of the Kundal Academy of Development Administration and Management

Plate 1: Greater Coucal capturing the upper neck portion of Indian Hare

***Range Forest Officer (Trainee)**, Kundal Academy of Development Administration and Management, Kundal, Taluka Palus, District Sangli, Maharashtra*

Plate 2: Greater Coucal jerking the Hare and lifting above the ground to give larger jerks

(Forests), (K.A.D.A.M) Kundal, Taluka Palus, Sangli district of Maharashtra. The site is at latitude N 17°07'37.5" and longitude 74°25'20.0".

The Greater Coucal was tracked for around 15 minutes before it attacked and killed the Indian Hare.

The K.A.D.AM campus has come into existence from a year or so and construction and developmental work is still under progress. The site was earlier an undulating region with degraded grassland, which is 1 km outside the Kundal Village. Thus the site where the incident was observed still has the characteristics of degraded grassland and small shrubs, with an approximately area of 4 hectares. The common avifauna found here are Sunbird, Indian Robin, Magpie Robin, Pond heron, Egrets, Wagtail, *Ashy prinia*, Brahminy Starling, Black Drongo, Common Kingfisher, Babbler, Laughing Dove and Greater Coucal, etc.

The attacking, killing and feeding on the Indian Hare (*Lepus nigricollis)* has been captured on video and photographs are also taken for documentary evidence.

Observations

1. On 28/01/2015 at 7:15 a.m., I saw a Greater Coucal in the campus of academy. Till 7:25 a.m., I patiently watched it for some photographs. It was just wandering / stalking on the ground and it was inspecting the area. In a short span of 10 minutes it went twice to a small Acacia tree and was watching the whole area from above. At around 7:25 a.m., it came down from the tree and landed near the grass. After walking for 10-12 metres in the grass, it caught hold of a small Indian Hare in its beak.
2. For the first instance, it caught hold on the upper neck region of the hare. A struggle ensued for around 10 minutes. During this period, the hare managed to escape once and started to run. But the Greater Coucal caught hold of it again by its ears and same above region of neck by its

Plate 3: Greater Coucal feeding on the Indian Hare killed by it.

Plate 4: A Jungle Crow working as scavenger by taking the remaining beheaded part of Indian Hare.

beak. The hare was struggling continuously by moving its legs but was unable to escape. The Greater Coucal almost lifted the Hare above the ground and was continuously jerking the neck. In order to lift the hare by its beak, the Greater Coucal was jumping on its both legs for changing the position and giving a larger wrench.

3. By the end of the tenth minute, the Greater Coucal managed to lay the Hare on its back and swiftly got hold of the neck region from underneath. In this position, it managed to penetrate its beak into the hare's neck and finally succeeded in killing the hare.
4. The Greater Coucal immediately started feeding on the kill and continued for the next five minutes. It started eating from the neck.

5. Suddenly a Shikra (*Accipiter trivirgatus*) landed at the sight. The Greater Coucal ran into a nearby open bush (1-2 metres distance from kill) leaving the kill there itself. I was watching this scene from around 15 metres. I believe that both the birds were able to sense my presence. The Shikra stayed there for approximately one minute and left the site without any remarkable move.
6. The Greater Coucal came back to the kill and started feeding again. After approximately 2-3 minutes, it had considerably reduced the volume of the kill. Then, it picked up the remaining carcass of the hare in its beak and took a flight to move out of the campus area (around 15 metres).
7. The story did not end here. The next morning when I visited the site again, I saw a Jungle Crow was picking at the head of the hare killed by Greater Coucal. This shows the common scavenging behaviour of the crow.

From the above observations, it can be said that the Greater Coucal killing a sub-adult hare was reflective of opportunistic prey capture. Since the site comprises degraded grassland, so the common food availability for Greater Coucal must be scarce. Thus it was seen adapting itself to kill and feed on Indian Hare. The Greater Coucal used its beak to the fullest to capture and kill the hare. In this incidence, no use of its legs or claws was seen for capturing or killing the hare. It can, thus, be stated that given the opportunity, the Greater Coucal feeds on the hare and is able to capture and kill it individually.

LADAKH / JAMMU & KASHMIR

A glimpse into the cold desert

Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro Intro xxxxxxxxxxxxxxx

"The land is so harsh and the passes so numerous, that only the best of friends or the worst of enemies would visit you"
(Ladakhi folklore)

Raza Ali Abidi

Ladakh comprises of Leh and Kargil districts in Jammu and Kashmir in the northern most part of the country. Ladakh literally means 'land of passes' and is famous for mountain ranges and passes. Ladakh has four major mountain ranges - the Great Himalayan Range, Zanskar, Ladakh and the Karakoram ranges. Ladakh is one of the least accessible parts of the Himalayas with most of its area located above 4,000 metres above mean sea level. The region remains cut off from the rest of the world for approximately six months during winters due to heavy snow fall.

Ladakh has always been an important region owing to its location. In the past it was a crossroad to important trade routes, like the famous Silk route and nowadays it is strategically important as it shares an international border with both Pakistan and China.The famous Kargil War was an armed conflict between India and Pakistan that took place between May and July 1999 in the region.

Climate and Topography

The terrain in Ladakh is dominated by a maze of enormously high snow capped peaks where valley heights range from 2500-4500m while passes of up to 6000m and peaks reaching above 7000 m can be seen all around. The world's second largest glacier outside the polar region -Siachen- is located here and is the world's highest battlefield. It's no wonder that such daunting heights play an important role in determine the land's temperature. In winter Leh and Kargil experience temperatures as low as - 30°C and Drassat -50°C is the second most coldest inhabited place in the world. During summers the weather is pleasant, the average temperature goes over 25°C, but with low humidity the sun can still be scorching hot. The Himalayas create a rain shadow effect in the region, thus rainfall is a mere 2 inches but there is heavy snowfall in winters and it is the melting snow in summer which sustains life in this region. The major waterway of Ladakh is the Indus River, as it flows down it is joined by its other tributaries. The Suru valley, drained by the SuruRiver, one of

FRO Trainee, Batch (2014-15), Thang Dumbur Sankoo, Kargil, Ladakh

Landscape view

the tributaries of the Indus forms one of the most significant valleys' of the region.

People

Ladakh can be broadly classified into four regions Kargil, Zanskar, Leh and Nubra and is inhabited by people of different ethnic groups,namely the Mons, Dards, Tibetans and Baltis. Mons belong to the Aryan race, while the Dards are confined mainly to Drass and the Indus valleys. The Tibetans are the dominant racial strain in eastern and central Ladakh, two ethnically and culturally distinctive groups are the Tibetans living at Choglamsar and the nomadic Changpas with their herds of pashmina (a fine type of kashmere wool used for making shawls)bearing goats in the eastern plains.Baltis and Purigpa are mainly found in western Ladakh in the Kargil region, and in some parts of the Nubra valley and Leh region.

Animal husbandry, agriculture and agroforestry form the basis of livelihood and food security in the permanent settlements of Ladakh. Agriculture depends entirely on melting water from glaciers and people cultivate only staple crops like barley and wheat. Peas, mustard, potatoes, carrots, turnip, radish, green leafy vegetables and alfalfa are also regularly cultivated on terraced fields sometimes in combination with apple and apricot trees.

Do you know?

On October 29, 2012 a Guiness world record was created in Ladakh in which 9,814 volunteers planted 99,103 saplings of Ladakhi willow in one hour.

Local house on the way to Zanskar

Flora

The vegetation of the area is sparse owing to the harsh climatic conditions. The physiographic conditions of the region ensures a short growing season (2-5 months) with exposure to harmful infra-red and ultraviolet radiations. High transpiration rates due to excessive heat often causeplant mortality, inadequate hours of sunlight especially during the winter season results in frost injury to plants. All these lead to poor seed germination, poor plant growth, poor root formation, deformed canopy, reduced radial growth and other physical signs/ phenotypic manifestations which affect the productive biomass production in totality of the region.

Natural vegetation is overwhelmingly herbaceous - comprising of a few tree species and a few shrub species. The forest cover in the region is very low (0.06% in Leh and 0.05 % in Kargil). The major trees growing in the area which are usually manmade plantations are poplar (*Populus*spp.) and willows (*Salix* spp) and shrubs like *Hippophae spp.*and *Myricaria spp.* can also be seen along river banks. Horticulture crops include apple trees and apricots which are grown up to 3500 m. The main trees are willow and poplar and they meet the requirement for fuel and timber. They provide a good yield of fodder for the animals and twigs for baskets. Fragrant juniper (*Shukpa*) grows naturally and is used for ceremonial and religious purposes. Firewood is scarce for both domestic and occupational use in cold deserts.

The herbaceous element is comprised of *Thymus, Medicago, Trifolium, Anemone, Potentila, Epilobium, Verbena, Allium, Aconitum, Delphenium, Aquilegia, Primula, Geranium, Polygonum*

Do you know?

Chewang Norphel a retired civil engineer from Ladakh, came up with the idea of artificial glaciers to overcome water scarcity in the region and was awarded the Padma Shri for his contribution.

Himalayan Marmot

and Cannabis. This abundance of the herbaceous element, has been the mainstay of the traditional medicinal system (*sowarigpa*) prevalent in this region.

Fauna

The fauna of Ladakh has much in common with that of Central Asia generally, and especially those of the Tibetan Plateau. Ladakh has a rich wildlife, cats found in the region include the Snow leopard (*Unciauncia*), Lynx (*Lynx lynx*) Pallas's cat (*Otocolobusmanul*). The dog family is represented by Wolf (*Canis lupus*), Red fox (*Vulpesvulpes*), Tibetan sand fox (*Vulpesferrilata*) and Dhole (*Cuonalpinus*). Other animals include Brown bear (*Ursusarctos*), Stoat (*Mustelaerminea*), Mountain weasel (*Mustelaaltaica*), Stone marten (*Martesfoina*), Eurasian otter (*Lutralutra*), Himalayan marmot (*Marmota bobak*), Wooly hare (*Lepus oiostolus*) and the Ladakh-pika (*Ochotona ladacensis*),

Ladakh's mammalian herbivores, belonging to six families, include eight wild ungulates: Tibetan gazelle (*Procaprapicticaudata*), Tibetan antelope (*Pantholopshodgsoni*), Blue sheep (*Pseudoisnayaur*), Ladakhurial (*Ovisvigneivignei*), Asiatic ibex (*Capra ibex siberica*), Tibetan argali (*Ovisammonhodgsoni*), Tibetan wild ass (*Equus kiang*) and the wild yak (*Bosgrunniens*).

The avian fauna includes the black necked crane – the state bird of Jammu and Kashmir, bar-headed geese, ducks and several other water birds which breed near the lakes in thousands. The other birds in the region are Bactrian magpies, grey tits, chough, raven, sparrow, kite, kestrel, Turkoman rock pigeon, and many other species of birds. Tsomoriri – a Ramsar site - and PangongTso are important grounds for the migratory birds. Hemis National Park, the largest national park of India

Do you know?

The Bactrian camel *(Camelus bactrianus)* is a double humped camel found in Ladakh, and nowhere else in the country

Landscape view

is known as one of the places for highest density of snow leopards.

The cold deserts have a unique biodiversity and have been occupied by human beings since the dawn of civilization despite the harsh climatic conditions. The people of the region rely heavily on the trees for fuelwood, fodder, timber, agricultural implements and fire wood to escape the harsh cold winters. Though the cold desert covers more than fifty per cent area of Jammu and Kashmir statelittle attention has been paid to its holistic development area owing to the challenging climatic conditions and topographical limitations, there is immense potential for development in this area.

TILORA (PUSHKAR) / SETRAWA (JODHPUR), RAJASTHAN

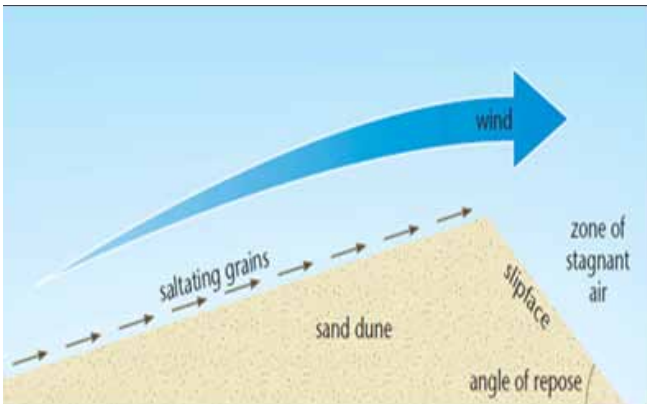
Sand Dunes Stabilization and Plantation

Stabilizing dunes involves multiple actions including the planting of vegetation. Small shrubs and grasses are better sand binders than trees.

Vrushali B. Tambe

Sand dunes are common features of shoreline and desert environments. In physical geography, a dune is a hill of sand built by either wind or water flow. These occur in different shapes and sizes. Sand dunes occur throughout the world, from coastal and lakeshore plains to arid desert regions. There are numerous types of sand dunes, these include longitudinal, crescentric, linear, star, dome and parabolic shaped dunes. In Rajasthan, parabolic dunes are found in Shergarh area, linear or longitudinal dunes in Drishadavati in the north east Thar), transverse dunes on the Indo-Pak border and star shaped dunes in Mahangarh and Suratgarh area. There are three essential prerequisites for the formation of sand dunes, these include; an abundant supply of loose sand in a region generally devoid of vegetation; wind energy source sufficient to move the sand grains and topography whereby the sand particles lose their momentum and settle out.

Sand dunes can have a negative impact on humans when they encroach on human habitats. Movement of sand dunes can happen through a few different means, all of them helped along by wind. One way that dunes can move is by saltation, where sand particles skip along the ground like a bouncing ball. When these particles land, they may strike other particles and cause them to move as well, this



RFO Trainee, Kundal Academy of Development, Management and Administration (Forests), Kundal (MS)

process is known as creep. With slightly stronger winds, particles collide in mid-air, causing sheet flows. In a major dust storm, dunes may move tens of metres through such sheet flows. Sand avalanches, which is sand falling down the slipface of the dunes–the face of the dune opposite to the prevailing wind direction–also move the dunes forward.

Sand Dunes Stabilization

Stabilizing of sand dunes involves multiple actions. Planting vegetation reduces the impact of wind, wooden sand fences can help retain sand and other material needed for a healthy sand dune ecosystem. The stabilization of dunes is done by the following methods;

Straw Checker Boards

This method has been used extensively in China since 1950's. In this method, wheat or rice straw or reeds (50 – 60 cm in length) are placed vertically to form the sides of the checkerboard, which are typically 10 –20 cm high. Optimum grid size ranges from 1 x 1 m to 2 x 2 m,depending on local wind and sand transport conditions. Smaller grids are made in areas of stronger winds.

Sand Fences

Sand fencing is widely used in coastal areas. The most effective configuration is a single linear fence perpendicular to the predominant sand transport direction. Fences 1.2m (4') high with a vertical arrangement of 3.8 cm (1.5') wide wooden slats with a gap of 2.5 cm (1'), giving a porosity of 50% are the most effective.

Surface Cover

This method involves spreading wood chips, agricultural straw and other materials on the surface. It is widely used in the control of wind erosion from agricultural areas. The use of straw from agriculture can be however a problem in areas of high winds and sand flux rates, unless it is anchored or crimped to the surface. Wooden material is stable in wind speeds up to 18 m/sec (40 mph) while wheat straw is stable only below wind speeds of 6.5 m/s (14.5 mph).

Vegetation

This method involves direct seeding or transplantation of indigenous and exotic species. Plantation of grass slips or direct sowing of grass seeds is done on the leeward side of micro-wind breaks.

Status in Rajasthan

In Rajasthan, cultivation of dune slopes is a major form of land use. Dunes are largely owned by private farmers. Initiallythe plantation of exotic trees and shrubs was carried out however today locally adapted species which can provide some economic return to the local population are being planted. Small shrubs and grasses are better sand binders than the trees. There are a total of 72 sites under the sand dune stabilization projects.

Projects under sand dune stabilization include the Desert Development Program, the Biodiversity Project, Climate Change Adaptation in Rural Areas of India (CCA RAI), Combating Desertification Project

Sand Dunes Formation

Various materials used for Checkerboards Barriers. (a) Straw; (b) Shrub branches; (c) Stones and Shrubs; (d) Plastic.

Ditch fence

Loose Stone Fencing

(CDP, and the RFDP Phase-II. The funding agencies for these projects are the National Agricultural Band for Rural Development (NABARD) and the Overseas Economic Cooperation Fund (OECF) of Japan.

The activities under these projects include; *surveying* – the area is first surveyed to assess the present vegetation cover and identify gaps where bare sand patches and sand dunes occur. Following which *site selection* is carried out. After site selection the micro plan for the site is prepared, this takes into account the population of the village, status, requirements etc. In the next step *fencing* of the selected area is done, three types fencing can be done; ditch type fencing; loose stone wall fencing and barbed wire angle iron fencing.

Once fencing is completed mulching and cross mulching is carried out. Local vegetation is used and planted in the direction of the prevailing

Mulching

Khip grass

wind (from west to east). Mulching along micro-windbreaks on the dune slopes is carried out by burying local shrubs upside-down in the sand in parallel strips, these include *khip*grass (*Leptadeniapyrotechnica*) and *saniya*grass (*Crotalariaburhia*). After mulching, the seeds of creepers, grass, shrubs and smaller trees are sowed along the windbreaks. Grass seed pallets with seed: manure: sand: clay in the ratio of 1:1:2:2 are prepared. The grass species used include, *Calligonum polygonoides* (*Phog*), *C.polygonoides* with *Cassia angustifolia*, *Cenchrussetigerus* (*Dhaman*), *Lasiurusscindicus* (*Sewan*) and *Aervatomentosa* (*Bui*).

Plantation with trees and shrubs is carried out in the following fashion. Pits are dug in April, these are dug in the spacing of 3m×3m / 4m × 4m /5m×3m. Transplanting of nursery seedlings is

Original site with *Prosopis*

Successful Plantation

carried atthe onset of monsoon and 500 plants are planted on each hectare. The species used include *Acacia tortilis, A. senegal, Prosopis cineraria, Anogeissus pendula, Zizipusjujuba, Acacia nilotica, Maytenusemarginata*. Two 'kharif' crops *Pennisetumglaucum* and *Vignaaconitifolia* and two 'rabi' crops *Cicer arietinum* and *Brassica juncea* are also used.

Choice of woody and grassy species:

The choice of woody and grass species depends on climatic and ecological conditions.Species selected for planting should meet a number of criteria. These include capacity to grow in nutrient poor environment, existence of tap root system, resistance to strong, hot, dry winds and their abrasive action, rapid growth and ability to regenerate easily and the capacity to improve dune soil.

After all these activities are completed, there is a schedule of operations to be followed. During the

Sand Dune plantation in Shairgarh

first year weeding (once), watering (three times) and hoeing (three times) is done and the replacement of casualties (usually 20%). Operations during the second year include weeding (once), watering (two times) and hoeing (once). The operations during the third year are watering which can be carried out once or two times.

Role of People

For the management of the plantations Forest Management Committees are constituted. The forest guard is the Secretary of this committee. The committee helps in the protection of the plantation. This scheme is kept in place for three years. After 5 years the plantation is handed over to the Gram Panchayat and grazing is permitted. The monitoring of the site is carried out by NABARD.

Threats

The plantations face a number of threats these include the following: *natural* threats (hostile climate characterised by extremes of temperature, drought, high wind velocity, evaporation, scanty rainfall, termites, rats, porcupines and Nilgai; *social* threats (apathy and indifference towards the development programme); *financial* threats (huge expenditure, and requirement of financial resources); *operational* threats (actual working, lack of data, lack of detailed survey, carrying water from a long distance and non- availability of material on time).

Economic and Environmental benefits

There are a number of benefits both economic and environmental which accrue from the stabilization of sand dunes. These include among others, improved nitrogen and organic matter status in the arid zone dune, effective control ofthe drifting of sand, fodder for livestock. At the age of 50 months, *A. tortilis* produced 5.2 tons ha^{-1} fuel wood as compared to 7.00 tons ha^{-1} from *P. juliflora*and 7.15 tons ha^{-1} from *Calligonumpolygonoides*.*C. polygonoides* produced the highest biomass in the form of fuel wood utilizing minimum

Plant species suitable for sand dune stabilization in Thar Desert. (Venkateswarlu)

Annual rainfall zone (mm)	Trees	Shrubs	Grasses
150-300	*Prosopisjuliflora, Acacia tortilis, A. senegal*	*Calligonumpolygonoides,Ziziphusnummularia, Citrulluscolosynthis*	*Lasiurussindicus*
300-400	*Tecomellaundulata, Parkinsoniaaculeata, Acacia nubica, Dichrostachysglomerata, Colophospermum mopane, Cordia rothii*	*Ziziphusmauritiana, Z. nummularia, C. polygonoides, Citrulluscolosynthis*	*Cenchrusciliaris, C. setigerus, L. sindicus, Saccharummunja*
400-550	*A.tortilis, P. cineraria, P. juliflora,A.senegal, Dalbargiasisoo, Ailanthus excelsa, Albizzialebbek, P. aculeata,T.undulata,D. glomerata, C. mopane*	*Z. mauritiana, Cassia auriculata*	*C. ciliaris, C. setigerus, S. munja, Panicumantidotale*

amount of soil water. The environmental benefits include microclimate amelioration, soil improvement and sheltering of habitations. The projects also provided experimental verification of the concept of planting *Cassia angustifolia* and *Cenchrusciliaris* under canopy vegetation,this provided the best combination for production of fodder and fuelwood. The sand dune stabilization projects in Rajasthan have had a success rate of 90 percent. It has also revealed that a minimum of 40 percent survival of the plantation is necessary to get some benefits both economic and environmental. The projects have also provided an opportunity for reexamination and reformulation of strategies to nurture dune vegetation.

MUSSOORIE / UTTARAKHAND

Mine Reclamation: A Success Story

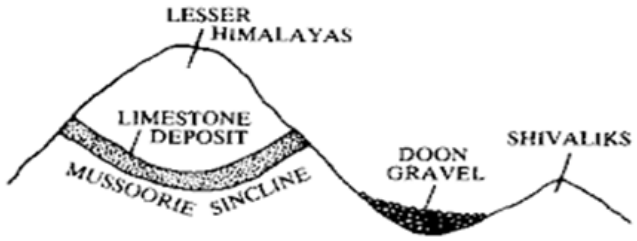
Timely intervention and well-thought strategies saw reclamation activities conducted by the Forest Department bear fruit

Sarika Khot

Mussoorie is a beautiful hill station just above Dehradun city, the capital of Uttarakhand state. The place is an important tourist site and gets visitors from all parts of the country. The present day lush green hill station was once severely degraded area due to heavy mining activities. The hills of the Mussoorie are reservoirs of high quality limestone and lime mining was in vogue in the area till three decades back. Mining in the region started in the British period, initially around the river beds later moving toward the mountain slopes, and by the year 1888 about 36 lime kilns were in operation in and around Doon valley. At that time about 16,000 tonnes of limestone were being exported annually from the Mussoorie hills. The opening of the railway in 1900 by the Britishers further aided the supply of limestone from this region. The activities continued post Independence and by the early 1980s, there were 101 mining leases.

The mining activities led to serious ecological imbalance, not only affecting the mining sites but also the areas surrounding Dehradun city. All these resulted in a severe impact on the local populace and environment.

The Forest Department and the local non-government organizations lodged several protests at different forums including the judiciary and as a result, several mines were closed in 1983 and almost all were closed down in 1985 on the order of the Supreme Court. The apex court also formed a special committee to assess the activities in the region. The Forest Department took up the initiative and started reclamation activities of closed mines and they successfully did reclamation of 64 closed mines. To aid in the plantation



Lime rich area of Lower Himalayas

RFO Trainee, 2014-15

Species Used for Treatment

- Timber species: *Pinus roxburghii, Grevillea robusta, Shorea robusta, Cupressus torulosa, Jacaranda mimosaefolia, Acacia spp. etc.*
- Fodder species: *Bauhinia variegata, Albizia spp., Coriaria nephalensis.*
- Grass species: *Vetiveria zizanoides, Chrysopogon fulvus, Pennisetum purpureum,Desmonthus viviantus, etc.*
- Soil binders: *Equatorium and Combretum decandrum, Bauhinia vahilli,Rumex hastatuts.*

activities, an eco-task force was set up in 1985. The eco-task force constituted of 127 Infantry Battalion, (Garhwal rifles) ex-servicemen. It consisted of retired army personnel who undertook everything from reforestation to local educational programmes on such things as wildlife diversity, erosion control and water management.

The ecological task force was entrusted with rehabilitation work in 25 closed mines, in Gram Samaj land in Kyarkulli micro watershed of Doon valley under the technical guidance of the Forest Department.

In the initial phase, an experimental plot was taken up by the department. Mine No. 44 was selected on experimental basis and an area of about 20 ha was treated in 1989. Satisfied with the result, another 60 ha area was taken up in Mine No. 40(1). A full-fledged project for the treatment of 95 closed mines started from 1990-91. Of these, 69 were situated in Dehradun, and 24 outside. The total area of the project was 3,760 ha of which 1,624 ha was mined area and the rest 2,136 ha was outside the mined area but heavily damaged by mining activity.

Treatment of the Area

The forest department identified four major regions for reclamation and rehabilitation:

1. Mined face: The steep, exposed,

Mine area after reclamation

Pre-Reclamatation

- Loss of vegetative cover and disappearance of fauna
- Soil erosion
- Depletion and drying up of natural water springs
- Choking up of streams, river and canals by rolling debris and mine spoils
- Loss of grazing area
- Loss of agricultural land and drastic reduction in crop production
- Increased pollution
- Insecurity due to blasting and noise pollution

Post Reclamation

- Screes are stabilized
- Well flourishing vegetation
- No soil erosion along the slopes
- Soil is rich in organic matter with improved moisture regime
- Good diversity of flora and fauna
- Healthy ecosystem

rocky area devoid of soil and vegetation

2. **Scree areas:** These had been formed as a result of rolling scree from the mined areas completely destroying the vegetation below.
3. **Nalas, channels and streams:** These were small or big streams/nalas in and around the mined area which either were over burdened with scree damaged by mining operations were extremely sensitive to erosion.
4. **Denuded and degraded forest areas:** These areas were near mined areas and affected by mining operation. Soil varied in depths and some vegetation was present.

Treatment Activities

- **Mine face:** Only suitable sites were selected for planting. Initially, only grasses and bushes were planted to bind the soil and for improvement of the site. At some places, the face was so steep that they used ladders for carrying out planting activities.
- **Scree areas:** Soil conservation and vegetative measures were taken up.
- **Treatment of stream/ nalas/ drains:** Check dams on debris, basins at suitable places were constructed.
- **Treatment of degraded and denuded area:** About 1,250 plants per hectare were planted.

Impact

The region has been successfully restored and rehabilitated and is a major tourist hub in the country. The main reasons for the success of the project is timely intervention of the Forest Department, involvement of other stakeholders, direct intervention of the Supreme Court of India, use of native species and effective planning and execution by the Forest Department. For reclamation of mines in other parts of the country, the techniques can be replicated from this success story.

SUNDARBANS / WEST BENGAL

The Roar of Sundarban Tiger

Sundarban in the Bengali language literally means 'beautiful forest'. This mangrove forest spread over 10,000 sq. km. is largest of its kind in the world.

Shweta. T. Rathod

Sundarbans in the Indian state of West Bengal is the estuarine phase of the Ganga as well as of the Brahmaputra river systems. This littoral forest is a unique ecological habitat of the tiger and is not found elsewhere in the world. The mangrove forest of the Sundarbans is home to a number of tree species which have adapted to the peculiar estuarine condition of high salinity, lack of soil erosion and daily inundation by high tides. The Sundarban tiger reserve provides a habitat suitable for animals inhabiting the vast tidal swamp area, because of their intimate association with the estuarine environment. A sizeable portion of aquatic and semi aquatic communities are inter-related with the animals inhabiting the terrestrial areas. The uniqueness of the habitat is said to have contributed to certain behavioural trends of the Sundarbans tigers and these are not found elsewhere. Though spotted deer, wild boar and the Rhesus macaque are the main prey species of tiger, aquatic animals like the crabs and fishes are

Nylon net fencing in STR

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Nylon net fencing in STR

Nylon net fencing in STR

also eaten by Sundarbans tiger. The Sundarban tiger thus occupies the apex of both, terrestrial as well as the aquatic food web. The mangrove forest is home to a number of endangered and globally threatened species. During the monsoon season and then in the winter season a number of heronries form here. The reserve is also home to several species of Trans-Himalayan migratory birds.

Sundarban Tiger – A maneater

Sundarban tigers have always been ill-famed as man eaters. The earliest known reference to the man eating nature of the Sundarban tiger is found in the letters of Portuguese Jesuit

missionaries, Francis Fernandez and Melchoir Fronseca, who travelled to Bengal in 1598 and 1599. They were the first to report on the fondness for human flesh of the tigers of the Gangetic delta. This behaviour of tigers does not have any intra-specific or intra-generic similarity with any of the *Panthera*species from anywhere in the world. The various groups of human beings falling victim to tiger include honey collectors, fishermen including crab collectors, tiger prawn seed collectors. Some of the reasons that have been put forward for this behaviour are salinity, vegetation, prey density and biotic interference and straying of tigers into areas inhabited by humans.

Research on the Sundarban tigers has indicated that there is an increased percentage of human kills by tigersin high salinity zones. Killing of humans in high salinity zones is significantly higher than those in medium and

Members of TSCF

Trap cage in STR

low salinity zones. Other researchers have put forward the theory that the physiology of Sundarban tigers is affected by high salinity which causes irritation resulting in killing of humans by tigers this however is not backed by scientific proof. Histological studies of inner organs like liver, kidney can perhaps be used to substantiate this theory and this is carried out in the in case of any tiger deaths.

Research has also indicated that habitats comprising of pure *Ceriops* & *Phoenix* vegetation account for the highest human kills by tiger. It can perhaps be attributed to the fact, that dense vegetation of *Ceriops* & *Phoneix* may influence the tiger to explore a different preying strategy which may be successful for killing of human being after following them and assessing the chance of stalking by getting closest to them.

The frequency of human beings being killed by tigers is highest in areas during periods of heaviest concentration of people. Researchers have also concluded that increased utilization of forest by human beings resulted in higher casualties. Other researchers have put forwards the theory that a fall in the prey density might also trigger the phenomenon of tigers preying on humans when the biotic interference is the most. However, tiger density, prey density, kind and frequency of human activities and human casualties cannot be co-related as long as sufficient data are not available.

One of the major issues in managing man animal conflict in the Sundarban Tiger Reserve (STR) is the straying of tiger into fringe villages and the rescue of the same without causing any harm on either side. It is worth noting that STR's north - western boundary has an interface with 25 fringe villages which are densely populated with human and cattle. Usually the staff and local villagers to drive the tiger back to the forest by using drums, crackers and lighting fires. Sometimes the tiger too goes back to the forest on its own.

These straying incidents are termed as temporary and in case of any repeated phenomenon, trap cage with live bait is used to trap the tiger and then relocate the same. However in cases of permanent straying, when the tiger takes refuge in a cattle shed or inside a hut, tranquilization is used to rescue the animal. Female tigers sometimes litter in paddy fields as they want to avoid the danger of cubs being killed by the male tigers. Old and diseased tigers like the ones with broken canines also stray because it is difficult for them to hunt the prey in forest.

Managing the Tigers

The Sundarban Tiger Reserve has received protection under Project Tiger since its creation. Protection against poaching and theft of forest produce is ensured through intensive patrolling by staff in motorboats and launches. The offices and camps are located at strategic points to keep a watch over the area. There also exists an effective communication network for protection. Eco-development, education, training and research are other thrust areas. Mud flats on the periphery of the Reserve are artificially regenerated with mangrove plants to meet local fuel wood demand and reduce the pressure on the buffer. Non-mangrove plantations are also raised along the roads and embankments of the fringe area to cater the needs of the people residing on the fringe. Soil conservation is taken up to stabilize vulnerable sites. To facilitate the availability of sweet water for animals, ponds have been dug at several places in the forest. The other main activity is mitigation of man tiger conflicts. The number of casualties has been reduced from more than 40 per year to less than 10 per year.

This has been made possible by maintaining a strict control over the movement of people inside the Reserve, providing for alternative income generation and awareness building among people. These include eco-development and livelihood opportunities like pisciculture,crab and ornamental fish culture, honey collection, raising mangrove forests

on the periphery,smokeless *chullahs*, development of water harvesting structures and formation of self-help groups and joint forest management committees. Villagers and school children are taken on study tours and a number of events like *Aranya Saptah*, *Sundarban Divas*, wildlife week celebration are undertaken to create awareness among rural people. Use of human-masks and electric human dummies are believed to have also contributed in controlling attacks by tigers.

Other precautions like erection of branches of *Ceriops*, nylon net fencing at forest side and solar illumination at village side at night have helped reduce the incidents of tiger straying. For rescuing a strayed tiger, tranquilization using a dart gun is carried out when driving the tiger back to the nearby forest is not possible. The youth in the villages have also been imparted training to enable them to play an appropriate role in controlling the straying of the tigers into the habitation.

"Human Kind have not woven the web of life
We are but one thread within it."

SATARA TUKUM VILLAGE / MAHARASHTRA

Joint Forest Management with Difference

Involving villagers in the management of forests in association with the forest department can be the solution to protect our forests while ensure livelihoods.

Sudhir Vinayak Sonawale

Sometimes I wonder whether we are part of the same system. We are protecting forests on one hand, jointly with the government, and on the other side the government itself is felling forests." These agitated words by Pravin Chichdhare, a village youth from Satara Tukum village in Vidarbha, Maharashtra, conveyed the collective sense of despair of his whole community. We were on our central India tour as part of Range Forest Officer Training to see the forests being protected by the village under the Joint Forest Management scheme. To our left was lush green vegetation that had regenerated and flourished under this arrangement; to our right,the Forest Development Corporation (FDC) was busy cutting down the existing natural forest. Villagers accompanying us were obviously upset about this felling carried out on a rotational basis for revenue generation.

"You can't protect forests and wildlife in small patches when areas around are fast degrading" was Pravin's explanation. "Destruction of forests in the surrounding areas adds pressure on our forests from both human and wildlife populations dependent on that forest". Disillusionment with the double standards of the government is, however, more than made up for by the excited enthusiasm with which the villagers show us their protected forest. Parts of it are just regenerating, but others are dense with a diversity of trees and bushes, some so thick that walking through is difficult. At any time, we expect to come across a wild animal or two,the birdsong of a number of birds can be heard and it is obvious that the area has rich biodiversity. As we walk along a stream, the forest's water harvesting value also becomes obvious. Residents point us to a number of fruiting trees, and plants with medicinal properties. Clearly, the forest is a lifeline for the local people and many plant and animal species.

Satara Tukum is a small tribal hamlet in Pombhurna Tahsil, about 25kms from Chandrapur District Headquarters in eastern Maharashtra. The forests around the village stretch to the Tadoba-Andhari Tiger Reserve. These forests were rich in wild animals till the 1970s. Subsequently, extensive disturbance from various sources caused habitat degradation and loss of wildlife. In 1997, Satara Tukum was brought under the World Bank sponsored forestry programme. Mr. Chapekar, the then Divisional Forest Officer persuaded the villagers to join

the Joint Forest Management (JFM) scheme. A portion of the reserved forests -285ha - were allotted to the village community for regeneration, plantation and protection. The villagers saw the benefit in the scheme as it would mean greater availability of resources as also a share from harvesting of planted trees. For the Department, this was an interesting departure from the usual practice of allotting only degraded lands to villages for JFM, to place standing Reserve Forests into the hands of a community is a rare phenomenon in most parts of India. As the Range Forest Officer accompanying told us "we were failing in protecting the forests from outside forces, and saw in this arrangement a potential to strengthen our own hands". At village meeting, a committee was formed to carry out protection activities. The committee currently includes 96 members, one representative each from the village's households, including 84 men and 12 women. The executive committee consists of 12 members, 3 of which are women. The committee has undertaken several steps for forest protection, including daily patrolling in rotational groups of seven people each. The patrolling teams used persuasion rather than force, to check those involved in hunting, felling of trees for sale as timber or firewood, and other illegal activities. They appointed a forest guard, and prohibited indiscriminate grazing, allowing it only in certain zones. A number of income generating activities were also carried out, including plantations of useful trees, and soil and moisture conservation programmes. The committee started an account in the local bank, which is used to give loans to farmers during the lean period. A Nagpur based NGO, Vidharbha Nature Conservation Society, helped form a Nature Club with the village youth.

Impacts of Community Initiative

Effective patrolling and protection resulted in quick natural regeneration and villagers began to notice return of wild animals such as herbivores and subsequently tigers and leopards. Formation of the nature club, regular patrolling, and involvement of the youth in patrolling has reduced the incidents of hunting to a negligible number. Encroachment of forest land, which was one of the major problems, has completely stopped. Animals like wild dogs, leopards, sloth bears, spotted deer, and barking deer are sighted regularly. About four to five incidents of wild animal attacks on human beings are reported every year, an increase from the past. Regulated grazing has resulted in availability of abundant grass since 1998. The grass extracted from the forests has even been supplied to the flood hit areas of Orissa, and other institutions, after meeting the village requirements. Prior to JFM, farmers were exploited by money-lenders from whom they were compelled to borrow money during the lean periods. The Forest Protection Committee now has its own revolving fund which is used to help farmers out in the times of need. The interest thus generated is ploughed

back into the fund. Availability of daily wage labour, even though irregular, is also seen as a benefit by the villagers. The forest department is trying a unique experiment under which funds available for controlling fires come to the village fund. The Range Forest Officer explained that "since villagers are protecting the forests against fire, this money therefore rightfully belongs to the village". The greatest impact of JFM has been that the villagers have a greater stake in conserving the forest, and there is a sea change in the relationship between the forest department and the villagers. The fear and antagonism that the villagers once felt of the department, is not felt anymore.

The Flip Side

Unfortunately, Satara Tukum's success story is now marred by a number of problems. The village received much attention from national and international community till the programme was running under World Bank funds. Once the funding ended, various employment generating schemes could not be supported anymore. The forest department's involvement with the village and its protection activities has also gone down substantially. The local Range Forest Officer confesses: "This is the best village in my range, but I don't have funds to encourage them." For a village, where landholdings are very small and the people depend on daily wages for subsistence, it has become difficult for villagers to forego a day's wage to go for forest patrolling. Villagers also fear that they may not get the benefits from harvesting the forests. Till June 2014, there was no written Memorandum of Understanding signed between the villagers and the department. Another area of concern are policy changes in the JFM resolution that the state government makes. Yet another major issue is that of institution building. In 1997, when the JFM committee was formed, only one member per household was included in the committee. This immediately excluded women from the decision-making process. Over the years the constitution of the committee has remained the same. However, since 2004, some young people have become quite active, and want to be members of the Forest Protection Committee. But older members are reluctant to admit them, concerned that this may reduce the per capita share of benefits from harvested forest produce. There are also concerns about the lack of transparency in the functioning of the Forest Protection Committee. Clearly, not enough attention has been paid towards building institutional capacity and systems of conflict resolution. Experiences with community initiatives elsewhere have shown that transparent functioning, availability of impartial information, and regular open discussions within the community, as also social movements against vices such as alcoholism, constitute the backbone of a strong decision-making process.

Solution

Given the current status of the forest conservation initiative at Satara Tukum, villagers and forest officials feel that some major steps will be

needed to sustain the effort. Clearly, since dependence on outside sources of funding such as the World Bank is unsustainable, community-based forest conservation needs to become an integral part of the government's own programmes. One possibility is to bring the village under the Forest Development Authority, in which case Central Government funds for development activities are pooled together at the District level and can be allocated directly to the village institutions for implementation. An additional boost in putting together developmental funds could be obtained from a circular, recently issued by the Chief Secretary of Maharashtra, asking all line agencies to give priority to JFM villages. The village also has its own fisheries tank, benefits from which could be enhanced with some help in marketing. Our talks with the local RFO brought up another interesting issue. In Maharashtra,7 per cent of sales from forest produce is deposited by the forest department with the state government. The state government then distributes this money to Zilla Prishads. The Zilla Parishads are expected to use this money for development of forests under their jurisdiction. This however, often doesn't happen. The Maharashtra Range Forest Officer's Association has made an intervention in the High Court, arguing for this money to be returned to the forest department. Through this tax the state government earns about Rs. 50 crores every year. The RFO felt if this money could be returned to the Department, it would be possible to sustain programmes like JFM in villages like Satara Tukum. Finally, as our own study tour visit demonstrated, regular dialogues are critical. During our discussions with many of the men and women, we realised that they had no information about recent laws and policies. The villagers themselves stated that information on government schemes relating to employment often reaches them very late. A forum of discussion in which outside government and non-government persons could participate, would help strengthen the village initiative. The residents of Satara Tukum provide a critical service for the benefit of society at large, by conserving precious forests, water resources, and wildlife. The forests that they tend to are even an important corridor for the wildlife of the nearby Tadoba-Andhari Tiger Reserve. Yet, this yeoman service provided by the villagers is largely ignored by most agencies. With some imaginative development related interventions, and the continued commitment of the villagers, this could be a success story in the long term that would be worth replicating across the country.