

Biodiversity Conservation through Participatory Monitoring: A Case Study from People's Protected Area Dhamtari, Chhattisgarh

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ABSTRACT Biodiversity plays a significant role in maintaining the life support system of the people and provide them with livelihood opportunities. Forests are the repository of biodiversity. Often such biodiversity resources face the threats of degradation and extinction due to over exploitation and lack of monitoring mechanism. People living in the forest fringe areas can play important role in conservation of biodiversity provided they are properly oriented, their capacity is built and they are empowered to check the drivers of degradation. The present paper focuses on how the floral biodiversity resources of Dugli Jabarra and Sankra Chandanbehera PPAs under Dhamtari Forest Division in Chattisgarh are conserved through active participation of the Joint Forest Management Committee members. Forest fringe dwellers are organized in the form of Joint Forest Management Committees to protect and conserve the biodiversity, sensitized to adopt non destructive harvesting practices of biodiversity, their capacity is built for resource survey to measure the status of biodiversity at a regular interval and take corrective action to reverse the process of degradation. Such empowerment of people has brought positive changes in the status of biodiversity and the substantial increase in the income of the people through biodiversity based livelihood.

INTRODUCTION

Biodiversity provides the life support system of human being, but there has always been a challenge to negotiate the dichotomy between conservation of biodiversity and development. The answer could be a resilient and adaptive management which can reconcile the dichotomy of threat perceptions arising out of conservation. The role and importance of biodiversity have been focused globally through the Inter-

national Convention on Biodiversity (CBD). Through the agreement focus has been made to put effort on conservation of the biological species on the one hand and their sustainable use for creating livelihood opportunities on the other especially for the poor people living in the biodiversity rich forest fringe areas.

International Union for Conservation of Nature (IUCN) defined six associated management categories of protected areas among which Category VI is defined as *Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural resources* – area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while also providing a sustainable flow of natural products and services to meet community needs.

Chattisgarh Forest Department has established People's Protected Area (PPA) in Forest Divisions like Dhamtari, Jagdalpur, East Bhanu-pratapapur, Bilaspur, Marwahi, Raigarh, East Sarguja, Korea and Durg. The underlying philosophy of the People's Protected Areas (PPA) is evolving Sustainable Livelihood Approach with Biodiversity Conservation (SLAB). The PPA programme focuses to ensure achievement of the

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broad goals of conservation and sustainable utilization of the forest resources by building community institutions and developing their capacity to promote in situ and ex situ conservation and propagation, developing standards and norms for non destructive harvesting for wild collection of biodiversity and periodic monitoring by the community institutions to measure the changes of biodiversity to take strategic corrective actions for conservation and develop options for sustainable livelihood.

The present paper focuses on how through participatory monitoring the forest resources could be conserved in the PPA of Dhamtari Forest Division in Chattisgarh.

STUDY AREA

Dhamtari Forest Division Dhamtari Forest Division is located between 31°75' E and 32°15' E longitude and 20°0' N and 20°40' N Latitude. The division stretches about 58 kms from North to South and 39 km from East to West. The total geographical area of Dhamtari district is 4,081 sq kms, out of which the forest area comprises 21,25,540 km² (52.1% of total geographical area).

Forest Types of the Study Area The forests of this division are of two types viz. Sal and Mixed forests. The Sal (*Shorea Robusta*) forests are found concentrated in four ranges namely, Dugli, Nagri, Birgudi and South Singpur while those of the Dhamtari, Keregaon and North Singhpur ranges are of the mixed forest type.

Selection of Dugli-Jabarra and Sankra-Chandanbahera PPAs under Dhamtari Forest Division

To start with, the biodiversity rich areas have been delineated as Dugli-Jabarra and Sankra Chandanbahera. The PPAs are constituted in these two areas in consonance with IUCN chapter VI that is, i.e., *protected area managed mainly for the sustainable use of natural resources* to ensure long-term protection and maintenance of biological diversity, while also providing a sustainable flow of natural products and services to meet community needs.

With the consent and the help of the local people, 1,000 ha area with density of 0.5 and above, with a potential of rich biodiversity, less biotic pressure and already existing community

institution such as Joint Forest Management Committees (JFMC) for protection of forest, have been demarcated under each PPA unit for *in-situ* conservation every year, over a period of five years. These 5,000 ha areas have been protected from all kinds of biotic pressure like grazing, fire and illicit felling with active participation of JFMCs.

While seven villages namely Jabarra, Dinkarpur, Dugli, Kharka, Chargaon, Deogaon and Munaikera fall under Dugli Jabarra PPA there are eight villages viz., Basin, Belarbahera, Barpahar, Tumribahar, Arjuni, Daur, Theni and Ghoragaon under Sankra Chandanbahera PPA.

The Dugli-Jabarra PPA covers 27,457.24 ha forest area. Out of the total area under Dugli-Jabarra PPA, conservation and sustainable use of the species is carried on in 16,194.30 ha and 11,262.94 ha is kept for Nistar purpose from where villagers can get fuel, fodder, small timber and bamboo for their bonafide domestic use. Under Sankra-Chandanbahera PPA 24,255.19 ha area is covered, out of which 13,024.12 ha area is kept for in situ conservation and 11,231.07 ha is for Nistar purposes.

Each year, 1,000 ha area under each PPA is demarcated for protection and conservation purposes. Five such 1,000 ha areas are demarcated under each PPA which are named as P1, P2, P3, P4 and P5.

METHODOLOGY

The study is conducted based on the primary data collected from JFMC members on the social, institutional and economic aspects as well as the longitudinal data collected to capture the changes of forest vegetation through the grid survey by the survey team comprising of the JFMC members of Dugli – Jabarra and Sankra-Chandanbahera PPA was procured from the Office of the Divisional Forest Officer (DFO), Dhamtari. This was analysed to understand the impact of people's participation on the conservation of biodiversity. Interviews were conducted with the JFMC members in order to elicit their specific knowledge regarding the project objectives and activities, status of forest, benefits accrued by them etc. Retrospective recall method was used to get the past year data and status quo method was used to assess the current year data.

Sampling

A total of 1000 hectare of *in-situ* conservation area has been surveyed by the survey team members of Dhantari forest division to identify the flora over a period of five years. The various steps involved in resource survey were as follows.

1. First of all, North – South and East – West grid lines were drawn at an interval of 3 cm X 3 cm on a map of *in-situ* area of 1:15000 scale. A total of 50 grid points were established and the points were given symbol in order to avoid confusion or duplicity in resource surveying. After reaching at the grid point, four diagonals were laid out in all four directions (North, South, East and West) at a distance of 22.40 meter. A straight line, measuring 31.40 meters, joined all four corners such achieved (Fig.1). Thus, the total plot area became 0.1 ha. Wooden pegs were fixed on the ground to mark the area sample plot. Now in the center cross point and center of the line on each direction, a plot of 2 meter x 2 meter was established, 9 (Nine) plots on each grid point, 5 plots of 2x2 meter and, 4 plots of 5x5 meter measurement. The plots of 2x2 meter measurement were termed as Regeneration plot and the plots of 5x5 meter measurement were termed as Medicinal plots. In the regeneration plot, all the es-

tablished and new recruits of important species were counted. Similarly in the medicinal plots, number of all the medicinal plants has been counted (excepting *lantana*, *chhind* and the main spp. which have already been counted in the regeneration plot).

Regeneration Survey

The seedlings were counted in 5 plots of 2m X 2m each in 50 grids as mentioned above. All the regeneration calculations were done using the formula to identify the Regeneration Status = Established X 1 + Unestablished X 0.25 + One year old seedlings X 0

Data Analysis

For the data so obtained, density, relative density and regeneration status were calculated using formulae given by Curtis and McIntosh (1951).

Density is the number of individuals per unit area, which gives the numerical strength of the species. In general, density is the total number of individual of a species relative to the total area examined. Relative density is a proportion of total number of individuals of a species with the total number of all species with an area.

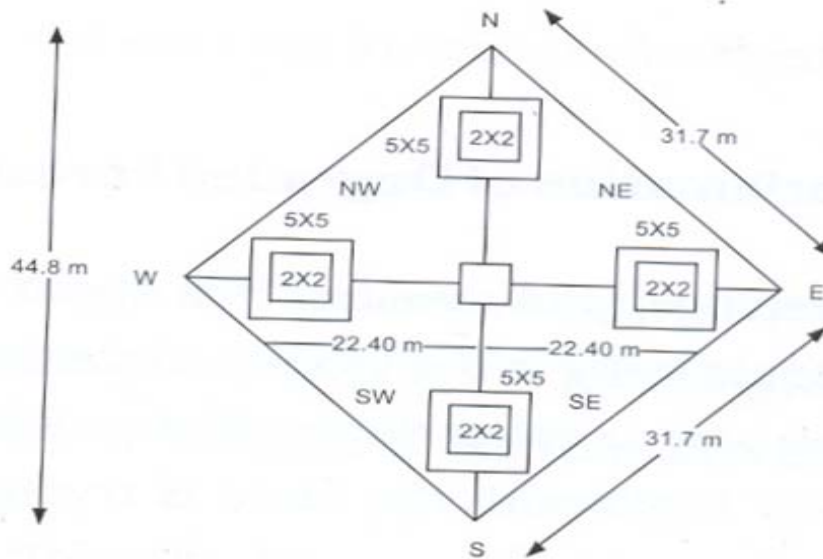


Fig. 1. Figure of the plot

Density

$$(D) \text{ stems/ha} = \frac{\text{Total no of individuals of species 'A' in all quadrates}}{\text{Total number of quadrates sampled} \times \text{X size of quadrates}} * 10000$$

Relative Density

$$(RD) \% = \frac{\text{Total no of individuals of species 'A'}}{\text{Total individuals of all species}} * 100$$

Calculation of Species Conservation Value (adopted from Ganeshaiyah et al. 2001)

$$SCV = \frac{\sum p_i^2}{\sum p_i}$$

Where,

SCV = Species Conservation Value

s = Species Diversity or number of species in a given plot

pi = population size of a species in a given plot

RESULTS

In the PPA of Dhamtari Forest Division, the method adopted for forest regeneration is Assisted Natural Regeneration which is characterized by enrichment planting, improved silvicultural practices and forest floor management along with soil and water conservation measures.

Regeneration Status

Regeneration status of P2 *Dugli* and P1 *Sankra* is considered as they have the data for consecutive five years (Tables 1 and 2).

Looking at the percentage increase in total regeneration we may infer that during the protection period maximum increase in regeneration has taken place in *Saja* followed by *Sal*. There has been an increase of 629.9% and 294.4% in the two species respectively. The presence of new recruits of all the species shows the signs of protection in the area.

The comparative assessment of the regeneration status between 2002-03 and 2006-07 says that regeneration status of *Tendu*, *Sal* and *Saja* has been quite good over the protection period. The established regeneration in *Tendu*, *Sal* and *Saja* has been 257, 262 and 169 respectively. The new recruits coming up in the different species are the clear evidence of protection in the area.

Status of Medicinal Plants in P2 *Dugli*

Shrubs: In the shrubs category the Relative Density varied from 1 to 40. In the shrubs category the commercial species like *Charota* and *Baibirang* have had a greater increase in comparison to the non-commercial species like *Salparni*, *Gursukri* and *Bankapas*. The overall density of the shrubs increased from 1918 shrubs/ha to 6164 shrubs/ha.

Herbs: The relative density under the herbs category ranged from 0.08 to 27.38. Under the commercial species *Kaali musli*, *Safed musli*, *dasmul* and *Kaalmegh* were the main species present in the area. In the commercial category *Kaali musli* had the maximum density of 13532 individuals per hectare followed by *Bada Dash-*

Table 1: Percentage increase in regeneration status in P2 *Dugli*

Species	Scientific name	Established regeneration			Total Regeneration		
		2002-03	2006-07	% Increase	2002-03	2006-07	% Increase
Sal	<i>Shorea robusta</i>	30	123	310.0	31.5	124.25	294.4
Bija	<i>Pterocarpus marsupium</i>	27	69	155.6	27.25	69.25	154.1
Saja	<i>Terminalia tomentosa</i>	57	432	657.9	60.25	439.75	629.9
Lendiya	<i>Lagerstroemia parviflora</i> (roxb)	16	28	75.0	16.75	31.00	85.1
Dhawda	<i>Anogeissus Latifolia wall</i>	135	355	163.0	135	359.25	166.1
Tendu	<i>Diospyros melanoxylon</i> (roxb)	138	153	10.9	140	155.25	10.9
Amla	<i>Phyllanthus emblica</i>	0	19	0.0	0	19.50	0.0
Karra		0	67	0.0	0	70.25	0.0
Harra	<i>Terminalia chebula</i>	0	3	0.0	0	3.25	0.0
Others		188	788	319.1	196.75	806.25	309.8
Total		591	2037	244.7	607.5	2078	242.1

Table 2: Percentage increase in regeneration in P1 Sankra

Species	Scientific name	Established regeneration			Total regeneration		
		2002-2003	2006-2007	% Increase	2002-2003	2006-2007	% Increase
Senha		1	33	3200.00	1	34.75	3375
Dhawda	<i>Anogeissus Latifolia wall</i>	6	87	1350.00	6	97	1516.67
Saja	<i>Terminalia tomentosa</i>	19	169	789.47	19	183	863.158
Sal	<i>Shorea robusta</i>	149	262	75.84	155.5	305.5	96.46
Bija	<i>Pterocarpus marsupium</i>	9	112	1144.44	9.25	118.75	1183.78
Tendu	<i>Diospyros melanoxylon</i> (roxb)	81	257	217.28	82.25	306	272.03
Others		92	886	863.04	100.25	998.25	895.76

mool (13298 individuals/ha). *Tikhur*, which though commercially important has not grown so well over the period. Under the non-commercial category species with highest density was *Genji* (9532 individuals/ha).

Climber: Under this category, *Karukandh* 1094.97 shows the highest increase in numbers over the span of 3 years from 378 individuals in 2002 to 2164 individuals in the year 2005. On the contrary, the maximum decrease is in the case of *Anantamul* with 125 in 2002 to 65 in 2006 showing a decrease of 4% over the period.

Some species that were absent in 2002 but are found in 2006 were *Baichandi*, *Satavar*, *Bhespar*, *Dotakandh*, *Gaypar*, *Jarkakand*, *Satavar* and *Suaokand*. Looking at the commercial importance of *Baichandi*, its growth over the span of 3 years is not so good hence it is important to promote its growth by weeding out the less useful species in the climbers category.

The overall density of climbers has increased from 2538 individuals per hectare to 9372 individuals per hectare

Status of Medicinal Plants in P1 Sankra

Shrubs: In P1 of *Sankra*, 8 species of shrubs with medicinal value were observed. The relative density of the shrub species ranged from 50.32 to 1.48. The highest RD was recorded in *Hasiyadpar* followed by *Bibirang* [44.76] and *Ghirgholi* [38.55]. *Dhawai* has economic importance but its presence in the P1 area is quite low. It is important to promote its development in the area.

Gudsukri had the highest percentage as earlier there was only 1 individual (2002-03) of the species present in the plot as compared to 55 in the next year [03-04] and 108 in the consecutive year [04-05] and 164 in 2006-07.

The density of the NTFPs having medicinal value under shrub category in the P1 area has increased greatly from 400 stems/ha to 2708 stems/ha during the protection period.

Species like *Bankapas* and *Hasiyadpar*, *Ghirgholi*, *Khuddu* were completely absent in the base year [2002-03] but then made good presence as 340 individuals in *Hasiyadpar*.

Herbs: The main species present in this category were *Safed musli*, *Bhuiamla*, *Kayukand*, *Kali musli*, *Tikhur*, *Chirayata*, *Lajjwanti* and *Jangli adrak*. The relative density of the herb species varied from 27.90 to 0.10.

There were certain species which were absent in the base year (2002-03) but have come up in large number in the next year worth mentioning are, *Lajvanti* [0-237], *Teenpaniya* [154] and *Bada Teenpaniya* [303],

There has been a promising increase in some species like *Bhui amla* [from 4 individuals to 1624 individuals in the plot], *Kalmegh* [176 to 1966 individuals] *Chirchira* [62 to 643 individuals] and *Ban Adrak* [1-49 individuals].

The highest density was recorded in *Kaali-musli* with 6076 stems/ha, followed by *Kalmegh* with 3932 stems/ha and *Bhui Amla* with 3248 stems/ha and with 1200 stems/ha. In the rare species like *Kamraj*, *Tejraj*, and *Sarpdasa* there has not been any improvement.

Climbers: The relative density of the species in this category ranged from 21.58 to 0.15.

In this category there were certain species which were absent in the base year but were found present in the next consecutive years. These species are namely *Dotokand*, *Gaypar* and *Satavar*. In the final year these species had 400, 228 and 118 individuals respectively.

The density in the climbers ranged from 1144 stems/ha to 8 stems/ha. The highest density was

recorded in *Maalkangini* (1144 stems/ha), *Karukand* (952), *Gaypar* (918 stems/ha) and *Dotakandh* (800 stems/ha). The lowest density was observed in *Baichandi* (8 stems/ha) followed by *Dokrakandh*.

The result of protection is clearly evident in P2 area of Sankra where the overall density of the climbers with medicinal value has increased from 684 Stems/ha to 5300 stems/ha during the protection period.

Species Conservation Value

The species conservation value in both the Ranges has shown exponential increase within the year of inception of the PPA programme and continued to grow in the second year as well. However, in its third year the SCV started to erode. However, once such data was shared it was stabilised and improved (Fig. 2). This trend has been observed in case of both the ranges.

As shown in the Figure 2, it could be concluded participatory conservation programme are very effective and efficient way of conserving biodiversity. It also strengthen the fact that if allowed, due to the resilience of nature the biodiversity regenerated exponentially in the initial stages and then slows and saturates reaching climax of its inherent ecological state, following the typical S shape curve. This phenomenon was observed in both the cases that is, in Dugli as well as in Sankara.

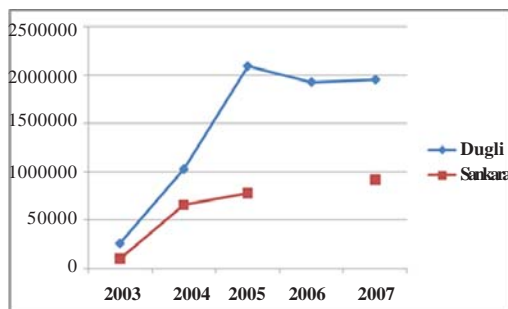


Fig. 2. Species conservation value trend in the sampled plots from 2003-2007 of Dugli and Sankara range

Comparatively it was observed that cumulatively Dugli Range SCV is higher than the Sankara Range (Fig. 3). There could be various reasons for the same including that the SCV of Dugli was higher since inception of the programme (Fig. 1).

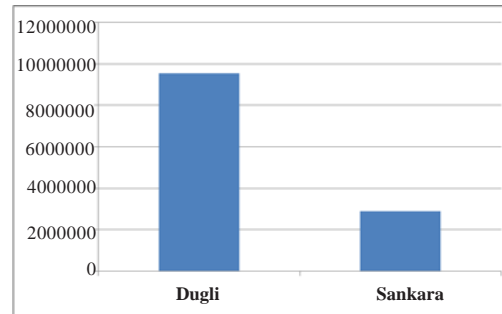


Fig. 3. Cumulative species conservation value of Dugli and Sankara range

DISCUSSION

Role of Community Institution in Conserving Biodiversity

Developing and Strengthening People's Institutions: The individual of human society interacts with the elements of forest ecosystem as per the social norm, structure and system. The social norms and cultural behaviour will determine the practices for conservation and harvesting of the forest resources.

Once the community institutions and government departments institutional procedures are matched, popularly known as *Bilateral Matching Institutions* (Roy 1992), it is expected that the members of the community will develop and follow the norms of sustainable harvesting of biodiversity in agreement with the forest department that would facilitate the process of biodiversity conservation.

The effective governance system developed by involving the local community, organized in the form of Joint Forest Management Committees to ensure protection of forest has yielded positive results in terms of species regeneration.

JFMC members have been orientated to promote in situ conservation of the forest. The villagers were sensitized to protect the forest from fire, grazing, illicit felling and they have been trained in techniques like creating fire line, controlling fire when it occurs etc. As a result, in the PPA there has been no incidence of forest fire in the past years. They have also controlled grazing in the PPA areas.

Identification of Drivers of Degradation and Taking Corrective Actions to Reverse the Process

Norms and Practices for Non-destructive Harvesting of NTFPS for Off Take and Ecosystem Sustainability: Villagers are being sensitized to identify the major drivers of degradation. It has been found that destructive harvesting practices to earn quick return as one of the major drivers of degradation. Non-destructive harvesting of the species is essential for biodiversity conservation and maintenance of ecosystem function. To promote non-destructive harvesting, the villagers are sensitized to adopt the practice of 'sustainable use' of different species.

Strong market forces can lead to a rapid loss of biodiversity through *commercial use*, whereas harvesting rates tend to be lower for *subsistence uses*, unless demand becomes very high for a particular product (or products). For example it has been found that over exploitation of Kalmegh by the people of Munaikera, has led to non-availability of the same species in the following year. The high demand for the plants in the market has caused over exploitation and near extinction of the species from the local forest.

On the other hand, people of Jabarra has shared that though they used to collect Safed *Musli* for two years, they have stopped collecting it now, as there is no market demand and on the other hand processing cost is very high. Thus, the lack of demand in the market has caused reduction of the extraction rate of the product.

Thus consumptive and commercial uses of biodiversity without considering its ecological implications are most likely to lead to unsustainable harvests (Freese et al. 1996; Freese 1997).

Under the PPA programme, efforts are being made to promote non-destructive harvesting by maintaining off take and eco-system sustainability.

The villagers have been sensitized for the timely collection of NTFPS. In the case of rhizome species like *Tikhur*, *Keokand* and *Baichandi*, they are given the option to choose one out of the three tubers, so that the regeneration is taken care of. Though uprooting of a whole tuber of *Tikhur* is easier than leaving 25% in the ground, the repeated practice however difficult of collecting 75% of the tuber, has increased the

regeneration and it's sustained availability. Therefore, the locals are now practicing non destructive harvest of *Tikhur*.

New rituals have been developed like "Aonla Navmi" and the villagers have been sensitized to harvest mature *Aonla* fruits only after *Aonla Navmi*. Mature fruits ensures better price. They have also been educated to leave some fruits in the plants for regeneration.

Through this non-destructive harvesting, there has been a greater regeneration of NTFPS especially *Kalmegh* and *Aonla* in the forest. As a result, people are getting more NTFPS and better prices for them. People have also stopped the felling of *Achar* and *Aonla* trees. The incidence of fire in *Mahua* trees has been reduced.

Controlled Grazing and Livestock Management: While the PPA emphasised on forest protection which involve controlled grazing it has also provided a way out for regulatory grazing through rotational basis and introduction of better quality of fodder.

Capacity Building of the Villagers on Participatory Monitoring

There exist-number of scientific research methods of monitoring the biodiversity resources, particularly that comes from the forest and human resources but the challenging task is to develop such criteria and indicators for monitoring which can be understood and adopted by the local people themselves so that people and the Forest Department can also make use of the findings to support their decision making process (Roy 2004). Participatory Vegetation Monitoring is such an innovation in the utilitarian or technological order in the sense that it endures the villagers to determine what would be the judicious amount for harvesting the forest products so that sustainability is ensured (Roy et al. 2000). Villager's capacity has been built so that they can used quadrature method for vegetation monitoring. Quadrature method is the most common method, which can be adopted if it is a homogeneous forest or a monoculture plantation.

In Dugli and Sankra PPA the selected persons from the villages are being trained on techniques on grid survey, data collection and analysis. They are conducting grid survey in the PPAs each year. They are acting as resource persons and in turn are training other villagers

for the survey. A team of 10 persons have been formed who are being trained to conduct grid survey for the five PPAs in Dugli Jabarra area.

Tradeoffs to Seek the Appropriate Balance Between, and Integration of Conservation and Use of Biological Diversity

Through the participatory monitoring the species having contemporary market demands are being identified and their present status is analysed. Based on the availability of the species and their market demand processing and value addition of certain species are planned. Local community, especially the women are organized in the form of Self Help Groups (SHGs). Forest department has organized training for them and has created the infrastructure facilities. Several processing units have been established in Sankra and Dugli. People are involved in preparation of herbal medicines, *Baichandi* chips, *Tikhur* powder, *Mahul* leaf plates, *Ketki* fibres etc. The net profit earned through *Mahul* leaf plate by the processing centre at Dugli, in the year 2002–2003 is Rs 1,811.75 in 2003-2004 it was Rs 12,583, in 2004-2005 it was Rs 11,173, in 2005-2006 it was Rs 29,205.

It has been observed that there has been an increase in the rate of small plates from Rs 50.00 per 100 in the year 2004-2005 to Rs 80.00 per 100 in the year 2005-06. In the same way, the rate of medium sized plates has been increased to Rs 60.00 per 100 from Rs 40.00 per 100 and the bowls from Rs 25 per 100 from Rs 20 per 100.

The JFM committees are provided with protection money at the rate of Rs 300 per ha to ensure protection of the PPA area from fire, grazing, illicit felling etc. This is unique in case of PPA whereas other JFM committees where PPA is not being practiced are not getting the protection money. The committee members decide about employing the watchers and fix the wage rate. They are also being empowered to utilize the funds received from the timber sharing as well as for development purposes as per the consensus of the committee.

CONCLUSION

The PPAs of Jabarra Dugli and Sankra Chandanbahera have been established in consonance with IUCN category VI where the focus has been on the management of the protected area to ensure long-term protection and maintenance of

biological diversity, while also providing a sustainable flow of natural products and services to meet the community needs.

The people in PPA have realized that to get the sustainable supply of any target species, they have to maintain other species as well and accordingly have developed social norms for conservation. Through in situ conservation protection against felling, grazing, and fire have been given to the forest area to conserve the rare and endangered species and increase their density in the forest area. Through the efforts made for in situ conservation visible changes have been found in the forest area in terms of regeneration status, density of the forest, species richness etc. JFMC members have been trained to conduct quadrat survey of the same sample plots on a yearly basis and prepare a resource inventory whereby the change in the status of the forest has been documented as well as areas of intervention has been identified especially for sustainable harvesting and management of NT-FPs for sustainable livelihood development.

It has become evident through the study that if local community members are involved through the process of participatory monitoring to measure the changes in the forest condition and status and are empowered to take corrective actions to reverse the process of degradation by identifying the drivers of degradation, the chances of conservation of forest increases. The regulatory mechanism designed, adopted and practiced to ensure non destructive harvesting of the species and equitable benefit sharing arrangements help conserving the forest on the one hand and exploring options for sustainable livelihood of the people on the other.

RECOMMENDATIONS

Though there has been encouraging results but to sustain the results efforts should be made to involve more members of the community for forest resource survey through sensitization on voluntary basis. A systematic market study should be conducted to explore market potentials of different non timber forest produces (NT-FPs). It is also important to involve community members in preparation of livelihood plan in consistence with the working plan and microplan and its implementation through identification of Common Interest Groups which could be developed as Common Enterprise Groups (CEGs). Capacity of the people should be made to mea-

sure other associated ecosystem services that the forest provides through their conservation efforts along with the improvement and sustainable use of biodiversity.

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