

# VEGETATION AND NON-TIMBER FOREST PRODUCTS ASSESSMENT UNDER JFM IN EASTERN GHATS OF ANDRHA PRADESH, INDIA.

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The conventional forest management system in India established by the British and continued till recently has failed to combat forest degradation despite several checks, controls and afforestation activities (Kameswara Rao 1995). The recent National Forest Policy (Govt. of India, 1988) envisages development of the degraded forest through peoples' participation and has advocated a major shift from the earlier timber oriented, state control management system to biodiversity oriented people's friendly system. Consequently, 17 Indian states have initiated Joint Forest Management (JFM) programmes permitting partnerships in the forest management with local people to ensure the subsistence needs of the forest dwellers are satisfied through the development and conservation of the forests.

The JFM programme has assumed greater importance in the Eastern Ghats region of India, where the forests were severely fragmented, degraded and decimated because of enormous pressures from various sectors. Nearly 60% of the Eastern Ghats Forests have been degraded to less than 0.1 crown cover, while the remaining existed in small and scattered patches. The situation is still worse in the southern parts of the ghats region, especially in Andhra Pradesh (A.P.), where the denuded hills have lost the rich soil layer, resulting in siltation of the wet lands and water courses, causing heavy losses to the agriculture in the coastal plains.

Eastern Ghats (13° to 20°N latitudes and 78° to 84°E longitudes) are a long chain of broken hills and elevated plateaus, running along the Indian east coast and passes through the states of Orissa, Andhra Pradesh and Tamila Nadu. The region has a megathermal regime of climate that favours luxurious growth of vegetation and forest (Subrahmanyam, 1984).

More than a half of the Eastern ghats chain, runs through the state of Andhra Pradesh which is the 5th largest state in India, with about 65,000 km<sup>2</sup> of forest area accounting for 23.6% of the total geographical area. A little more than 50% of the forest area of AP region lies in the Eastern Ghats (Krishna Murty, 1984).

Of the 33 scheduled tribes in the Andhra Pradesh, 27 groups inhabit the Eastern ghats tracts, whose culture is an out come of their interaction with nature, and mostly can be regarded as '*ecosystem people*'. Agriculture; livestock rearing and Non-Timber Forest Products (NTFPs) collections, are their main activities until recently (Brahma, 1984). Many tribal development schemes are being implemented in the state though various departments like Integrated Tribal Development Agency (ITDA); Girijan Co-operative Corporation (GCC); and now the state Forest Department, through the JFM programme.

This paper, after presenting a brief note on JFM in AP, delineates the impacts of JFM activities on the vegetation and development of an Eastern Ghats region of A.P. and presents the case of four villages representing four forest divisions. The forests of the study region mainly include tropical dry and moist deciduous types with few patches of semi-evergreens existing in association with high lands. Various floristic surveys, carried out at district and zonal levels reported nearly 2000 species of flowering plants in the Eastern Ghats region (Rao *et al.*, 1984).

## **JFM in Andhra Pradesh**

Consequent to a resolution issued by the Government of India, Ministry of Environment and Forests, on June 1, 1990, the Andhra Pradesh State Government has adopted the JFM programme in 1993, as one of the three major components of the World Bank supported “Andhra Pradesh Forestry Project” (APFP). The other two components of the APFP are (1) Production Forestry; and (2) Community and Private forestry. The JFM component under the APFP envisages to develop 173 thousand hectares of degraded forests through Village Forest Societies, specially formed for the purpose. This programme which receives support for six years, from 1994 to 2000 A.D., covers only 11% of the total forest area that needed rehabilitation. Thus, in 1996, the state chief Minister, Mr. N. Chandra Babu Naidu, has extended this programme to the remaining parts of the degraded forests, through a special campaign called “Vana Samrakshana Udyamam” (VASU) which is being gradually extended to cover another 1 million hectares of the forest area.

The schemes of formation, management, functioning, duties and responsibilities of the village forest societies which are called “*Vana Samrakshana Samithies*” (VSS), were broadly defined in a govt. order (Govt. of Andhra Pradesh, 1993).

In the study region of this paper (Visakhapatnam Forest Circle), in a span of 3 years, nearly 409 VSSs (183 under APFP, and 226 under VASU) are functioning to deal with more than 55 thousand hectares of degraded forests, involving nearly 35,000 forest dwellers.

## **Study Villages**

This paper presents the case of the following four tribal villages; (a) Vondrujola (VJL); (b) Juttadapalem (JPL); (c) Chandrayyapalem (CPL); and (d) Kannaram (KRM). Salient features of these villages, their communities and forests are shown in Table 1. With the exception of JPL, all the other villages are with homogeneous community of a single dominant tribe. In all the four villages, the community depends to a considerable extent on the forests, especially for firewood, fodder; housing, and even for income generation.

Of the four villages, two villages (VJL and JPL) are having VSSs recognised by the forest department (FD) under APFP programme; and another village (CPL) is a VSS under VASU programme; While Kannaram has not opted for being a partner with the FD, and have started their own forest protection committee called “**Noorinti Adavi**” (NAC). All the four villages are being guided and motivated by NGOs located nearby, while the FD is playing a key role in the first three villages, VJL, JPL and CPL. FD has taken several measures to motivate and involve the people in the management activities. The forest department has allotted a part of the reserve forest area near to these villages, while in the case of the fourth village (KRM), the villagers themselves have selected a surrounding forest area which they used to enjoy earlier.

## State of the Forests

All the forest sites protecting and managing by the four villages were considered as degraded forest areas in 1994. The state of the forest during 1995 is presented in Table 2 for the 4 villages. In all the sites, the crown cover was less than 0.2 and the land was exposed. Prior to the protection, the areas were used for fire-wood collection and cattle grazing.

As shown in Table 2, the flora of the four sites varied from 74 species at CPL to 98 species at KRM. The species richness at these sites is very low when compared to the earlier reports for the near by areas (Rao & Sreeramulu, 1986; and Kameswara Rao, 1992). The floral similarity index between any two of these sites never exceeded 30% indicating distant relationship between these plant communities. Tree species accounted for 19.6% at VJL; 33.8% at CPL; 35.7% at KRM and 46.5% at JPL. The distribution of trees in terms of numbers and ground occupancy varied considerably from site to site.

**Species Important Value Index :** The importance value indices (IVI) for tree species were obtained from their relative values of frequency, density and dominance. The IVI for different species at the four villages were shown in Table 3. *Lannea coromandilica*, a timber species used for agricultural implements, ranked 1st with an IVI of 45.27 followed by *Securinega virosa* (39.68) and *Sterculia urens*, a gum yielding plant (32.20) at CPL.

*Holarrhena antidysenterica*, a medicinal plant, ranked 1st at KRM with an IVI of 53.46 was followed by *Chloroxylon sweitenia*, a woody species much used for cabinet works (24.99) and *Alstonia venenata*, a medicinal plant (18.90). At the remaining two sites, the first three species with top IVI ranks have no remarkable difference. At JPL, *Sterculia urens* topped the list with an IVI of 27.93 and was closely followed by *Pterospermum heyneanum* (26.47) and *Bauhinia vahlii*, a tree climber the leaves of which are used for plate making (24.74). At VJL *Phoenix sylvestris*, an edible fruit species, was ranked 1st with an IVI of 37.9 followed by *Chloroxylon sweitenia* (34.61) and *Ixora pavetta*, a small tree (25.41). The contribution to the total IVI by the first three rank species was 26.28% at JPL; 39.05% at CPL; 34.64% at VJL and 32.45% at KRM. Among all the species of the four villages, *Chloroxylon sweitenia* appear to be the most prominent and was ranked 2nd at KRM and VJL villages and, 4th and 5th at JPL and CPL villages, respectively.

**Density and ground dominance of tree species :** The density of tree species was very high at JPL and was estimated at 6625/ha, the same at KRM was 5000 /ha followed by 2812 /ha at CPL and a very low of 54 /ha at VJL. The same trend was found in case of the ground dominance also. The total ground dominance of trees at JPL, VJL, CPL and KRM were 65.1 m<sup>2</sup>/ha, 1.1 m<sup>2</sup>/ha, 16.8 m<sup>2</sup>/ha and 49.1 m<sup>2</sup>/ha, respectively.

The distribution of the tree species into different DBH and height class groups was computed from tree-quadrat samples, where in a total of one hectare was sampled per site. The trees were classified into two DBH classes and four height classes. The distribution of trees in different size classes (Table 4) revealed that in all the sites, there were very few large trees which have larger DBHs and greater height. Thus, in three of the four sites, the forest is considered as a developing forest. However, at VJL the tree stand was insignificant and thus, is a scrub jungle.

**Regeneration** : After a simple protection of two years with the exception of one site (VJL), the remaining three sites have exhibited good regeneration capacity as was evident from the following facts:

1. the tree stand was dominant and accounts for a major share of the total basal area;
2. presence of greater number of trees in lower DBH classes; and
3. presence of greater number of tree seedlings of different species.

At VJL, the tree stand was insignificant because the area has low root stock, poor species diversity, low density of trees and greater dominance of herbs and shrubs. All these indicate that the forests at VJL have degraded beyond their resilience capacity and require greater intervention for their development.

The species regenerating through seedlings and through copices have also varied from site to site. Of the total regenerating individuals, those which have of copices origin accounted for 11% at JPL, 16% at CPL, 9% at KRM and 4% at VJL. The copices regeneration was low at VJL and supports the fact of poor root stock available, further the density of trees regenerating through seeds was also very low when compared to the other three sites.

**Forest Succession** : The forests of JPL and VJL belong to dry deciduous type while those of CPL and KRM are of moist deciduous types. However, the presence of evergreen species like *Diospyros sylvatica* and *Albizia odoratissima* at JPL, have IVI ranks of 6 and 8, respectively, indicates the transition of the forest to moist type. On the otherhand, both the sites with moist forests though were dominated by dry deciduous type are closely intermixed with smaller number of evergreen shrubs and herbs and also with some zingiberaceae and ferns. The vegetation appears lush green particularly along the moist shady areas.

**Impact of protection** : The age of protection through participatory approach is quite recent in Andhra Pradesh and is more or less of same age (around 3 years) at all sites including the four CSS. However, the existing data indicate several positive signs to confirm the beneficial effects of the protection. A comparison of the tree populations of protected sites and unprotected sites, revealed that protected areas have relatively good regenerating stands. The density of seedlings of the trees was high in the protected areas of all the four villages. Similarly, the density of the aged trees (DBH > 20 cm & Ht > 10 m) also was relatively high in the protected sites suggesting effective protection.

**Standing wood biomass and harvests** : The standing wood biomass (SWB) was calculated using the density of dry wood and wood volume estimates (Kameswara Rao, 1995). The SWB of the four case study villages were estimated and the data (Table 5) indicated that JPL and KRM sites have relatively greater SWB. Assuming that the annual increment in wood biomass as 2.84% of the SWB, and a half of it as the maximum permissible limit for annual harvest, the harvestable wood biomass level was suggested to the communities. Compared to this figure, the present demand for firewood and hardwoods (for domestic and sale purposes) are low in all the villages, excepting VJL (Table 5). Since this is only a rapid assessment made for general planning purposes, detailed long term studies are being made.

## NTFP Studies

Under JFM arrangements, local communities are permitted to collect NTFPs and enjoy the benefits from them. Besides NTFPs, the communities are given a share in the harvest of timber. As the NTFPs have played a major role in the economy and life of the tribal people of the region, and also the share from the timber harvests is not of immediate nature, the villagers showed greater interest in maximising the NTFP productivity. Similar situation exists in most parts of India (Saigal et al., 1996). In India NTFPs are potentially obtainable from around 3000 species found in the Indian forests, but only 126 have developed marketability (Maithani, 1994). Compared to these figures, in the Eastern Ghats of the present study area, nearly 58 species of NTFPs were identified, of which only 35 species have demand in the market.

As in many other states, in A.P. also, the State Govt. plays an important role in controlling the extraction and trade of many NTFPs. A Govt. undertaking by name "Girijan Cooperative Corporation" (GCC) is established for the purpose. The GCC purchases the NTFPs directly from the collectors and also market them directly. This is to help the NTFP collectors by eliminating the large profit margins of the middle men and to pass on the benefits directly to collectors in terms of money; rations; soft loans and better living conditions.

**NTFPs of the region :** Only some selected NTFPs are being collected by the tribals, while a good number of them are ignored. On the whole, the tribals of the four case study villages, are collecting 13 varieties of NTFPs which include Bamboo and fire-wood also. Of these, Tamarind (*Tamarindus indica*); Gum (*Sterculia urens*); Dinner leaves (*Bauhinia vahlii*); Bamboo (*Bambusa arundinacea* and *Dendrocalamus strictus*); fire-wood and Hill-brooms grass (*Thysanolaena maxima*) are important types which are commercial products with high returns.

**Classification of NTFPs :** Of the 13 NTFPs being collected, two are herbs; two are shrubs and eight are trees. Honey is an indirect product. Based on the plant parts collected, the NTFPs are classified into five groups. Leaf products; fruit/seed products; wood products, whole plant products; plant extracts. Of the 13 important NTFPs of the region, 2 each are leaf products, wood products; whole plant products, and plant extracts. The remaining five are fruit and seed products.

**Collection groups :** NTFPs collections are made house-hold wise. With regard to major NTFPs which have good demand and value in the market, irrespective of the community type or economic class, most of the Households (HHs) are involved in the collection. However, some specific NTFPs like emblica which has low financial value, Honey which requires skill to handle the bees; Hill brooms grass which is low in abundance and labour intensive, are being collected by very few HHs, who are usually landless or poorest families. Depending upon the demand for work in the season, degree of labour requirement; skill and need, the age-sex composition of the collection teams vary. Highly labour intensive harvests/collections like fresh fire-wood, Bamboo, and skilled harvests like extraction of gum, and honey collection, are made by adult male members of the family. Semi-skilled and laborious harvests, like collection of dinner leaves; cutting of thatched grass are made by adults of both the sexes. In all other cases, depending upon the need and abundance, all age-sex classes are involved in the collection. Usually, tribes will go for collection of NTFPs in teams consisting of at least two individuals.

**Collection areas :** In all the four case study villages, the NTFP collections are generally made from the unprotected forests of the region. This is mainly because, the protected patches allocated under JFM are usually degraded forests and have low stocking. On average, the NTFP collections from the protected patches at the four villages accounted for 15-20% of their total collections. The only exception to this is the gum extraction at JPL, where the bulk is collected from the protected patch. Some of the products like tamarind, emblica are being collected from the village margins or commons.

**Seasonality :** The natural boon to the tribals was that most of the NTFPs have their harvest seasons during winter (Nov-February) and early summer (March-April) at which time the agricultural activities are at their low. Some of the products like gum, fire-wood etc., are harvested throughout the year depending upon their availability. The seasons of harvests are more or less similar in all the four case-study villages. At all these villages, March was the month when the income from NTFPs was very high and accounted for 15.2% at VJL; 17% at CPL and at KRM, it was 25.8% of the total annual NTFP income.

**Employment and income generation :** Detailed information on the seven major NTFPs which provided considerable income to the communities at two or more sites, was delineated in Table 6. It is evident that these major NTFPs playing a major role in the life of the tribal communities. The data indicate that the dependence on the NTFPs varied among different case study villages. Relatively, KRM village appears to have generating greater income and employment through NTFP collection. On the whole, the average income per man-day was highest (Rs. 58.54) at KRM; followed by VJL (Rs. 52.93), CPL (Rs. 43.09) and was minimum (Rs. 30.65) at JPL. The average number of mandays of employment provided to individual household was also minimum at JPL with 26 mandays / HH; while it was 52 md/HH for VJL; 142md/HH for CPL and KRM. Among the major NTFPs, Gum and fire-wood are very important with respect to employment generation, while in case of income generation, KRM villagers are getting relatively higher price for a man-day effort than those of other three villagers.

Of all the NTFP varieties collected, Tamarind, gum, soapnut and Dinner leaves are the NTFPs, the trade of which are monopolised by the GCC. The GCC will purchase these products from the tribals, if necessary adopts value addition processing, and then conduct sales in the market. The GCC purchase and sale prices of some of the NTFPs are presented in Table 7.

An analysis of the purchase and sale price of the NTFP products by the GCC reveal that most of the NTFPs are steadily increasing every year, and the rate of increase, in most of the cases it is on par with the changes in the general price index. Thus, the tribal communities can confidently rely upon the NTFPs for their subsistence needs. However, it is essential that the NTFP productivity is to be maximised as the present levels of production in very low because of their low abundance and poor genetic vigour. Further, in all the four villages, the NTFPs are sold without any processing or value addition. If such things are carried out at the collection sites, a better price can be obtained and there by generate additional employment in the form of several mandays. For instance, the raw tamarind is now being sold at nearly Rs 5/- per kg. If the same is sold after deveining and deseeding, it will be purchased by the GCC at Rs 8/- kg. Thus, per every ton of value addition processing, Rs 3000/- of income and 40 mandays of employment, providing Rs 75/- per manday, can be generated which is lucrative compared to their present average income per manday.

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Table 1 : Salient features of the JFM villages of Eastern Ghats of Andhra Pradesh, India

<b>Salient features</b>	<b>VJL</b>	<b>JPL</b>	<b>CPL</b>	<b>KRM</b>
Grid references	18° N & 83° 45' E	80° N & 82° 55' E	17°35'N & 82° 30' E	17°29' N & 81°40' E
Forest Division	Srikakulam	Vizianagaram	Narsipatnam	Kakinada
Total population	178	145	185	188
No. of House holds	46	38	42	40
Dominant Tribal Community	Savara	Bagatha Kondadora Mannemdora	Bagatha	Koyadora
JFM Started	1994	1994	1994	1994*
NGO Co-ordinating	<i>Janavikasa</i>	<i>Harita Mitra</i>	<i>TDSC</i>	<i>SAKTI</i>

VJL : Vondrujola; JPL : Juttadapalem; CPL : Chandrayyapalem; KRM : Kannaram

\* Forest Protection Committee with no recognition from Govt.

Table 2 : State of the forest sites at the four case study villages - Sept. 1995.

<b>State</b>	<b>VJL</b>	<b>JPL</b>	<b>CPL</b>	<b>KRM</b>
Available forest area (ha)	200	105	500	100
Forest type	Dry deciduous	Dry deciduous	Mosit deciduous	Moist deciduous
Total number of species	92	86	74	98
No. of tree species	18	40	25	35
Density of trees (no./ha)	54	6625	2812	5000
Basal area of trees (m <sup>2</sup> /ha)	1.1	65.1	16.8	49.1
Crown cover (Proportional)	0	< 0.10	0.14	0.17



Table 3 : IVI ranking and values of various tree species at four case study villages

S. No	Sp. code	Name of the species	Species Importance Value Index @300			
			VJL	JPL	CPL	KRM
1	5	<i>Adina cordifolia</i>		4.02 <sup>20</sup>		8.01 <sup>15</sup>
2	6	<i>Aegle marmelos</i>				8.66 <sup>12</sup>
3	9	<i>Alangium species</i>	7.98 <sup>16</sup>		4.15 <sup>16</sup>	
4	10	<i>Albizia odoratissima</i>		11.16 <sup>8</sup>		
5	11	<i>Alossia arostia</i>				6.91 <sup>20</sup>
6	12	<i>Alstonia venenata</i>				18.90 <sup>3</sup>
7	15	<i>Annona sqamosa</i>		2.75 <sup>28</sup>		
8	16	<i>Anophallus sps</i>				5.27 <sup>22</sup>
9*	23	<i>Azadirachta indica</i>	8.87 <sup>15</sup>	10.62 <sup>9</sup>		3.66 <sup>24</sup>
10	25	<i>Bauhinia racemosa</i>				10.08 <sup>9</sup>
11*	26	<i>Bauhinia vahlii</i>		24.74 <sup>3</sup>		
12	33	<i>Butea frondosa</i>				6.74 <sup>21</sup>
13	34	<i>Callicarpa viscosum</i>		4.89 <sup>18</sup>		
14	42	<i>Cassia fistula</i>	13.96 <sup>10</sup>	4.13 <sup>19</sup>	10.24 <sup>12</sup>	7.05 <sup>18</sup>
15	47	<i>Chemilifolia sps</i>		2.98 <sup>26</sup>		
16	49	<i>Chloroxylon swietenia</i>	34.61 <sup>2</sup>	14.29 <sup>4</sup>	19.11 <sup>5</sup>	24.99 <sup>2</sup>
17	53	<i>Cleistanthus collinus</i>	17.14 <sup>7</sup>	3.48 <sup>24</sup>	11.93 <sup>9</sup>	7.99 <sup>16</sup>
18	59	<i>Cordia monoica</i>				2.75 <sup>27</sup>
19	76	<i>Dalbergia latifolia</i>	14.34 <sup>9</sup>	8.89 <sup>12</sup>		13.61 <sup>5</sup>
20*	86	<i>Diospyros melanoxylon</i>	9.80 <sup>13</sup>	12.76 <sup>5</sup>		9.83 <sup>11</sup>
21	87	<i>Diospyros sylvatica</i>		12.64 <sup>6</sup>		
22	88	<i>Diospyros sps</i>		5.20 <sup>17</sup>	10.00 <sup>13</sup>	
23*	91	<i>Emblica officinalis</i>	14.76 <sup>8</sup>	3.06 <sup>25</sup>		2.73 <sup>29</sup>
24	100	<i>Garuga pinnata</i>			19.70 <sup>4</sup>	
25	101	<i>Gmelina arborea</i>		6.44 <sup>15</sup>		
26	106	<i>Grewia tilaefolia</i>				9.60 <sup>10</sup>
27*	113	<i>Holarrhena antidysenterica</i>	24.74 <sup>4</sup>	3.54 <sup>22</sup>		53.46 <sup>1</sup>
28	117	<i>Ixora pavetta</i>	25.41 <sup>3</sup>			
29	119	<i>Jatropha gossipifolia</i>			11.73 <sup>10</sup>	
30	122	<i>Lannea coromandelica</i>	6.84 <sup>18</sup>		45.27 <sup>1</sup>	
31	126	<i>Limonia elephantum</i>				13.49 <sup>6</sup>
32	129	<i>Madhuca longifolia</i>	12.58 <sup>11</sup>	3.79 <sup>21</sup>		7.28 <sup>17</sup>
33	133	<i>Mimusops sps</i>		2.66 <sup>31</sup>		
34	135	<i>Morinda tinctoria</i>		9.75 <sup>11</sup>		
35	136	<i>Moringa concanensis</i>			11.51 <sup>11</sup>	
36	137	<i>Naringa crenulata</i>				6.99 <sup>19</sup>
37	139	<i>Ochna obtusa</i>		2.73 <sup>29</sup>		
38	153	<i>Phoenix sylvestris</i>	37.90 <sup>1</sup>			
39	160	<i>Pterospermum heyneanum</i>		26.47 <sup>2</sup>	13.79 <sup>8</sup>	
40	161	<i>Pterospermum xylocarpum</i>				10.71 <sup>7</sup>
41*	168	<i>Sapindus emarginatus</i>		8.45 <sup>13</sup>		8.13 <sup>13</sup>
42	169	<i>Schleichera oleosa</i>		6.35 <sup>16</sup>		
43	175	<i>Securinega virosa</i>			39.68 <sup>2</sup>	15.49 <sup>4</sup>
44	176	<i>Semecarpus anacardium</i>	24.36 <sup>5</sup>	10.26 <sup>10</sup>		
45	177	<i>Sesbania grandiflora</i>		2.73 <sup>30</sup>		
46	183	<i>Soymida febrifuga</i>	1011 <sup>12</sup>			
47	184	<i>Spermedictyon suaveolens</i>			4.30 <sup>14</sup>	
48*	186	<i>Sterculia urens</i>		27.93 <sup>1</sup>	32.20 <sup>3</sup>	3.29 <sup>25</sup>

contd ...

Table 3 contd ...

S. No	Sp. code	Name of the species	Species Importance Value Index @300			
			VJL	JPL	CPL	KRM
49	187	<i>Streblus asper</i>		7.47 <sup>14</sup>		
50*	189	<i>Strychnos potatorum</i>			14.67 <sup>7</sup>	8.11 <sup>14</sup>
51*	191	<i>Tamarindus indica</i>				3.83 <sup>23</sup>
52	194	<i>Terminalia alata</i>	6.93 <sup>17</sup>			
53	195	<i>Terminalia bellirica</i>	8.96 <sup>14</sup>	3.51 <sup>23</sup>		
54*	196	<i>Terminalia chebula</i>				3.07 <sup>26</sup>
55	208	<i>Wrightia tinctoria</i>	20.71 <sup>6</sup>	11.68 <sup>7</sup>	16.29 <sup>6</sup>	
56	209	<i>Xylia xylocarpa</i>		2.77 <sup>27</sup>		10.35 <sup>8</sup>
57	210	<i>Zizyphus mauritiana</i>			4.22 <sup>15</sup>	
58	212	<i>Zizyphus xylopyros</i>			4.11 <sup>17</sup>	
59	213	<i>Zizyphus sps</i>				3.29 <sup>25</sup>
60		<i>Other species (Unidentified)</i>	0/0	37.86/9	27.10/8	5.73/6

VJL : Vondrujola; JPL : Juttadapalem; CPL : Chandrayyapalem; KRM : Kannaram

\* NTFPs having marketability.

Table 4. Distribution of trees in different DBH and Height classes in managed forests.

Village	DBH Classes (% trees)		Height classes (% trees)			
	< 10 cm	> 10 cm	a	b	c	d
Juttadapalem	91	9	79	11	7	3
Chandrayyapalem	96	4	65	32	3	0
Vondrujola	87	13	61	22	13	4
Kannaram	93	7	52	36	8	4

a = below 5 m

b = 5 to 10 m

c = 10 to 15 m

d = 15 m and above

Table 5. Standing wood biomass - suggested harvest limits

	standing wood biomass (t/ha)	Total standing wood biomass (tons)	Mean annual increment (tons)	Suggested Harvest limit (tons/annum)	Demand for fire wood (tons/annum)		
					Domestic	Sale	Total
VJL	6.20	1240	35.23	17.62	95	26	121
JPL	337.61	35449	1006.75	503.37	74	nil	74
CPL	62.23	28002	795.27	397.64	103	41	144
KRM	294.65	29465	836.81	418.40	97	36	133

VJL : Vondrujola; JPL : Juttadapalem; CPL : Chandrayyapalem; KRM : Kannaram

Table 6 . A summary of the information of major NTFPs at four case study villages

NTFP/ Village	1	2	3	4	5	6	7	8
<b>Tamarind</b>								
Vondrujola	03-04	Kg	25 kg	1000 kg	10/kg	10000	565	17.70
Juttadapalem	03-04	Kg	40 kg	1040 kg	10/kg	10400	241	43.15
Chandrayapalem	03-04	Kg	44 kg	1750 kg	8/kg	14000	486	28.81
Kannaram	03-04	Kg	35 kg	1400 kg	10/kg	14000	460	30.43
<b>Gum</b>								
Juttadapalem	01-12	Kg	24 kg	336 kg	60/kg	20160	756	26.67
Chandrayapalem	01-06	Kg	7 kg	294 kg	60/kg	17640	924	19.09
Kannaram	01-12	Kg	47 kg	1889 kg	60/kg 90/kg	120000	2417	49.65
<b>Beedi Leaf</b>								
Chandrayapalem	03	100 l/b	775 b	31400 b	0.35/b	11000	1000	11.00
Kannaram	03-04	100 l/b	1332 b	53333 b	1.50/b	80000	1480	54.05
<b>Dinner leaves</b>								
Vondrujola	04-08	200 l/b	200 b	8000 b	2/b	16000	550	29.09
Chandrayapalem	04-09	500 l/b	18 b	704 b	8/b	5632	186	30.28
<b>Soap nut</b>								
Chandrayapalem	01-02	Kg	100 kg	4000 kg	5/kg	20000	768	26.04
Kannaram	01-02	Kg	38 kg	1275 kg	8/kg	10200	313	32.59
<b>Bamboo</b>								
Vondrujola	03-05	p in no.	96 p	4000 p	3/p	12000	236	50.85
Chandrayapalem	01-12	p in no.	400 p	16800 p	3/p	50400	988	51.01
<b>Fire wood</b>								
Vodrujola	01-12	k	41 k	1025 k	60/k	61500	1025	60.00
Chandrayapalem	01-12	k	45 k	1620 k	80/k	129600	1620	80.00
Kannaram	01-12	k	36 k	1440 k	80/k	115200	1440	80.00

1 - Season (Month no.)

4 - Total quantity collected by the entire village

7 - Total no. man days/vill./season (md/sea.)

2 - Unit of measure

5 - Unit price (Rs.)

l - leaves

p - poles

3 - Seasonal total of HH collection (Qty.)

6 - Total value of entire village (Rs.)

k - pair of shoulder load

8 - Average income /man day (Rs./md)

01 - 12 : Jan - Dec    b - bundle

Table 7 : Sale and purchase prices of Girijan Cooperative Corporation for NTFPs.

NTFP	Purchase price			Sale price		
	1991-92	1996-97	annual rate of increase (%)	1991-92	1996-97	annual rate of increase (%)
Gum	23.95	67.45	20.07	43.02	108.11	18.4
Tamarind	2.41	5.15	15.2	2.66	6.34	17.4
Dinner leaves	1.19	2.50	14.8	1.60	4.05	18.6
Soap nut	6.70	7.42	2.0	10.09	8.11	- 4.4