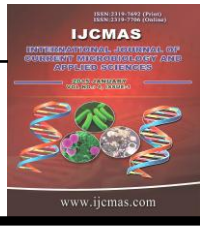
*International Journal of Current Microbiology and Applied Sciences*
***ISSN: 2319-7706*** **Volume 4 Number 1 (2015) pp. xx-xx**
**http://www.ijcmas.com**




**Case Study**

# An inventory of degraded forests – a case study

**Ch. Bhavannarayana[1], V.Saritha[2*], K. Sarala[3], P. Brahmaji rao[4]**

[1]Professor, GIET Engineering College, Rajahmundry, A.P, India. bhagavan_2000@yahoo.com
[2] Assistant Professor, Department of Environmental Studies, GITAM University, A.P, India.
[3] Principal Scientist, Division of Crop Improvement, CTRI, Rajahmundry, A.P, India.
[4]Professor, Department of Environmental Science, Acharya Nagarjuna University, Guntur
**Corresponding author email id: vsjr08@gmail.com*

**A B S T R A C T**

The prime objective of the study is to understand the forest diversity in the degraded forests of Burna, Baliagam reserve forests of Srikakulam and Mallavaram Reserve Forest of East Godavari districts of Andhra Pradesh, India. In Burna 16, Baliagam (11) and Pothavaram (16), Mallavaram (17) number of different species were found. *Terminalia tomentosa* species found in all the areas except in Baliagam and was uniformly distributed over the entire area. *Bridella retusa, Casearia elliptica, Wrightia tinctoria, Pterocarpus morsupium, Chloroxylon swietenia, Diospyros sylvatica, Dalbergia paniculata,* etc are the important species found in the sample plots. Shannon's and Menhinick's index values are more in Burna RF (3.896) (2.238) and Simpson's index value is more in Baliagam RF (0.226). Above all height and girth of all the species also recorded. Our study of TP-1 areas helped to identify present tree status and also to find the rare species in the miscellaneous forests. Based on this, measures can be taken up to protect the forest areas.

**Keywords**

Joint Forest Management (JFM), TP-1, Biodiversity.

## Introduction

Forests are potentially renewable resources, if used as per optimum needs and ensuring their security, known as sustainability. The protective, productive and accessory functions are the major uses of forests. Due to mainly human population pressure and activities, global biodiversity is getting reduced and particularly plant biodiversity is becoming at high risk of extinction. Consequently, many efforts have been deployed to develop conservation methods.

Participatory action involving the government and local communities for regeneration of degraded forests through effective protection, sharing of produce and improving the socio economic conditions of the forests communities was initiated by the Forest Department as a pilot project in Arabari, West Bengal in 1971-72. Subsequently, this has been institutionalized through the forest policy of 1988 and JFM (Joint Forest Management) circular of June 1990. The launching of this programme

has been a major break through in the involvement of local communities in the management of forests and has produced positive results in regenerating the degraded forests.

A need has arisen to evaluate the impact of the about new management tool in the degraded forests. Different workers studied the impact of such management systems on conservation of forests biodiversity. Kameswara Rao (1998) studied the impact of JFM activities on the vegetation and development of Eastern Ghats region of A.P, Varma *et al*., (2005) in the plantation forest and degraded forest of Surajpur block (Barotiwala) of Kuthar Forest Range in Kunihar Forest Division of Himachal Pradesh, Sahoo *et al.,* (2004) in Abhoya of Midnapore District of West Bengal (India), Ranjana Gupta (2004) in Dodsi and Talaichittor villages of Dahra Dun District and Chandrashekara and Jayaraman (2002) in natural forests of Kerala.

**Materials and Methodology:**

The areas where treatment practices are carried out for the improvement of degraded forest under APFP (Andhra Pradesh Forestry Project) were selected as the study area and sample plots were laid.

**Mallavaram RF**

This is also one ha miscellaneous forest selected in East Godavari District is Mallavaram R.F located in Mallavaram section, Sudikonda Range, Kakinada division. The area is dry mixed deciduous forest type. The trial plot laid in the compartment number 491 and the name of the V.S.S. is Kali Jolla. Compartment number 491 can be referenced with the Survey of India Topo Sheet number 65 G/15. Topography of the area is plain area. Rock type is Gneiss. Soil type is red. Laterate soil, soil texture is sandy loam and topsoil erosion is medium.

**Burna RF**

In Srikakulam district one ha miscellaneous forest of Burna R.F located at Burna North Beat, Veeragattam section, Palakonda Range and Srikakulam division was selected. The area is tropical dry mixed deciduous forest type and semi-evergreen sub-forest type. The trial plot is laid in the compartment number 211 and the name of the V.S.S. is Polla. Compartment number 211 can be referenced with the Survey of India Topo Sheet number 65 N/9. The elevation of the area is 300 m high. Soil type is red soil, soil texture is sandy loam and topsoil erosion is medium.

**Baliagam RF**

In Srikakulam district one ha miscellaneous forest of Baliagam RF located at Bogabanda Beat, Mandasa Section, Kasibugga Range and Srikakulam division was selected. The type of forest is dry deciduous forest and III quality type with 300 m elevation and North south aspect. Soil type is red soil, soil texture is sandy loam and top soil erosion is medium. Rock type is Granite. The trial plot is laid in the compartment number 218 and the name of the VSS is Sandur.

**Methodology**

To study the impact of TP-1, sample plots were laid out in selected reserve forests areas where TP-1 operations are

being carried out. One of the methods followed in laying sample plots was the stratified random sampling. In stratified random sampling the forest will be divided in to a number of zones or strata that are as homogeneous as possible. Within these strata, plots are located at random. Permanent sample plots (PSPs) are permanently demarcated areas of forest, typically of one hectare, which are periodically remeasured. In the present study, all the four locations of TP-1 areas, sample plots of one hectare area were permanently demarcated with stones. This one hectare plot was initially divided in to four quadrants. Randomly in each quadrant one 10 m x 10 m. sub plot and in the center of the four quadrants another 10 m x 10 m. sub plot were laid with permanent demarcation.

Data for the following parameter was collected from each sub plot in the TP – 1 areas: name and number of the species and their basal girth (cm), girth at breast height (cm) and height (m). From the recorded data all the species are classified according to girth-height class wise. The species composition, density, abundance and frequency of various species were calculated. Menhinicks index of species richness, Shannon-Wiener index of species diversity and Simpson's index of dominance of the community were also calculated.

## Result and Discussion

### Mallavaram RF

17 different tree species were observed in this area (Table 1) among them Cassia siamea (100%), Diospyros sylvatica (100%) and Holarrhena pubescens (100 %) found to be uniformly distributed over entire area. Chloroxylon swietenia, Dalbergia paniculata, Lagerstromia parviflora and Atlantia monophylla showed 50 % frequency. Cassia siamea, Diospyros sylvatica and Holarrhena pubescens recorded highest density (2-6), abundance (2-6), relative density (9.6-28.9) and relative frequency (13.3) values.

Cassia siamea (172.6) belongs to Caesalpinaceae family recorded highest IVI (172.6) value followed by Dalbergia paniculata (86.3) belongs to Fabaceae family and Diospyros sylvatica (79.1) belongs to Ebenaceae family. Terminalia tomentosa (6.3) and Pterospermum canescens (6.7) recorded lower IVI values. Lannea caromadelica, Vitex pinnata, Terminalia tomentosa and Pterospermum canescens are the species found in only one quadrate.

*Cassia siamea* found in all the height classes except above 10m (Table 5). Both the dominant species Cassia siamea and Diospyros sylvatica are found in highest height class (8 m). More number of species found in 2-4 m height class (26) followed by 0-2 m and 4-6 m classes (20). Most of the trees found to have 10-30 cm girth. In this location the Shannon's index value of diversity is 3.286. The simpson's index value of species dominance is 0.149 and the Menhinick's index value of species richness is 1.866 (Table – 7).

### Burna R.F

Among 24 tree species recorded at Burna RF, Terminalia tomentosa is uniformly distributed over entire area (100% frequency) followed by Bridella retusa (80%), Casearia elliptica (80%) (Table - 2).

**Table- 1:** Species composition, Relative density, Relative frequency, Relative dominance and important value index (IVI) at Mallavaram RF

| S.No. | ***Botanical name*** | **Frequency%** | **Frequency class *[1]** | **Density** | **Abundance** | **R.D[*2]** | **RFq[*2]** | **R.Dom[*2]** | **IVI[*2]** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | *Cassia siamea* | **100** | **E** | **6** | **6** | 28.9 | 13.3 | 130.4 | **172.6** |
| 2 | *Diospyros sylvatica* | **100** | **E** | **4** | **4** | 19.2 | 13.3 | 46.6 | **79.1** |
| 3 | *Holarrhena pubescens* | **100** | **E** | **2** | **2** | 9.6 | 13.3 | 13.0 | **35.9** |
| 4 | *Pterospermum canescens* | 25 | B | 0.5 | 2 | 2.4 | 3.3 | 1.0 | 6.7 |
| 5 | *Acacia leucophloea* | 25 | B | 0.25 | 1 | 1.2 | 3.3 | 27.4 | **31.9** |
| 6 | *Chloroxylon swietenia* | **50** | **C** | 1.25 | 2.5 | 6.0 | 6.6 | 6.6 | 19.2 |
| 7 | *Bridella retusa* | 25 | B | 0.5 | 2 | 2.4 | 3.3 | 2.6 | 8.3 |
| 8 | *Dalbergia paniculata* | **50** | **C** | 1.5 | 3 | 7.2 | 6.6 | 72.5 | **86.3** |
| 9 | *Albizia chinensis* | 25 | B | 0.25 | 1 | 1.2 | 3.3 | 11.2 | 15.7 |
| 10 | *Terminalia tomentosa* | 25 | B | 0.25 | 1 | 1.2 | 3.3 | 1.8 | 6.3 |
| 11 | *Xylia xylocarpus* | 25 | B | 0.25 | 1 | 1.2 | 3.3 | 3.4 | 7.9 |
| 12 | *Lagerstromia parviflora* | 50 | C | 1.25 | 2.5 | 6.0 | 6.6 | 17.3 | 29.9 |
| 13 | *Vitex pinnata* | 25 | B | 0.25 | 1 | 1.2 | 3.3 | 5.3 | 9.8 |
| 14 | *Atlantia monophylla* | 50 | C | 1.25 | 2.5 | 6.0 | 6.6 | 18.1 | 30.7 |
| 15 | *Lannea caromadelica* | 25 | B | 0.25 | 1 | 1.2 | 3.3 | 2.9 | 7.4 |
| 16 | *Sapindus emerginatus* | 25 | B | 0.5 | 2 | 2.4 | 3.3 | 8.8 | 21.9 |
| 17 | *Albizia odoratissima* | 25 | B | 0.5 | 2 | 2.4 | 3.3 | 4.2 | 9.9 |

***1** A = 0-20 Frequency %, B =21-40%, C =41-60%, D =61-80%, E =81-100 %

***2** ( R.D ) Relative density; (RFq) Relative frequency; (R.Dom) Relative dominance IVI=Important Value Index.

Table-2: Species composition, Relative density, Relative frequency, Relative dominance and Importance value index (IVI) at Burna RF

| S.No. | Name of the Species | Frequency | Frequency class *1 | Density | Abundance | R.D*2 | RFq*2 | R.Dom*2 | IVI*2 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | *Mallatus. phillippensis* | 40 | B | 0.4 | 1.00 | 1.7 | 4.1 | 0.03 | 5.83 |
| 2 | *Bridella retusa* | **80** | D | 3.4 | 4.25 | 14.7 | 8.3 | 1.00 | **24** |
| 3 | *Diospyros melanoxylon.* | 60 | C | 0.6 | 1.00 | 2.6 | 6.2 | 0.02 | 8.8 |
| 4 | *Croton lacciferus* | 40 | D | 1.2 | 3.00 | 5.2 | 4.1 | 0.15 | 9.45 |
| 5 | *Terminalia tomentosa* | **100** | **E** | 3.0 | 3.00 | 13.0 | 10.4 | 0.73 | **23.7** |
| 6 | *Pterocarpus morsupium* | 40 | B | 1.0 | 2.50 | 4.3 | 4.1 | 0.82 | 9.2 |
| 7 | *Bombax ceiba* | 20 | A | 1.0 | 1.00 | 0.8 | 2.0 | 0.1 | 2.9 |
| 8 | *Cleistanthus collinus* | 40 | B | 1.0 | 2.50 | 4.3 | 4.1 | 0.09 | 8.49 |
| 9 | *Dalbergia latifolia* | 20 | A | 1.0 | 1.00 | 0.8 | 2.0 | 0.12 | 2.92 |
| 10 | *Bauhinia racemosa* | 20 | A | 1.0 | 1.00 | 0.8 | 2.0 | 0.03 | 2.83 |
| 11 | *Wrightia tinctoria* | 60 | C | 4.8 | 8.00 | 20.8 | 6.2 | 0.16 | **27.1** |
| 12 | *Casearia elliptica* | 80 | D | 1.0 | 1.25 | 4.3 | 8.3 | 0.07 | **12.6** |
| 13 | *Atylosia limeata* | 40 | B | 0.4 | 1.00 | 1.7 | 4.1 | 0.40 | 6.2 |
| 14 | *Terminalia bellirica* | 20 | A | 1.0 | 1.00 | 0.8 | 2.0 | 0.10 | 2.9 |
| 15 | *Garuga pinnata* | 60 | C | 0.6 | 1.00 | 2.6 | 6.2 | 0.15 | 8.95 |
| 16 | *Diospyros sylvatica* | 40 | B | 1.8 | 4.50 | 7.8 | 4.1 | 0.09 | **11.9** |
| 17 | *Careya arborea* | 20 | A | 1.0 | 1.00 | 0.8 | 2.0 | 0.0 | 2.8 |
| 18 | *Osyris peltata* | 20 | A | 1.0 | 1.00 | 0.8 | 2.0 | 0.0 | 2.8 |
| 19 | *Emblica officianalis* | 20 | A | 0.4 | 2.00 | 1.7 | 2.0 | 0.0 | 3.7 |
| 20 | *Antidesma acidum* | 40 | B | 0.6 | 1.50 | 2.6 | 4.1 | 0.0 | 6.7 |
| 21 | *Dalbergia paniculata* | 20 | A | 1.0 | 1.00 | 0.8 | 2.0 | 0.07 | 2.87 |
| 22 | *Ficus hispida* | 20 | A | 0.6 | 3.00 | 2.6 | 2.0 | 0.06 | 4.66 |
| 23 | *Albizia stupulata* | 40 | B | 0.4 | 1.00 | 1.7 | 4.1 | 0.02 | 5.82 |
| 24 | *Syzygiumcumini* | 20 | A | 0.4 | 2.00 | 1.7 | 2.0 | 0.05 | 3.75 |

*1 A = 0-20 Frequency %, B =21-40%, C =41-60%, D =61-80%, E =81-100 %

*2 (R.D) Relative density; (RF) Relative frequency; (R.Dom) Relative dominance IVI=Important value index.

Table - 3: Species composition, Relative density, Relative frequency, Relative dominance and Importance value index (I.V.I) at Baliagam RF

| S.No | Name of the Species | Frequency | Frequency class*1 | Density | Abundance | R.D*2 | RFq*2 | R.Dom*2 | IVI*2 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | *Azardirachta indica* | 100 | E | 1 | 1 | 5 | 11 | 9 | 25 |
| 2 | *Cleistanthus collinus* | 100 | E | **4** | **4** | **15** | 11 | 9 | 34 |
| 3 | *Wrightia tinctoria* | 100 | E | **4** | **4** | 14 | 11 | 11 | **36** |
| 4 | *Diospyros sylvatica* | 100 | E | **13** | **13** | **43** | 11 | **23** | **77** |
| 5 | *Bignonia suberosa* | 100 | E | 1 | 1 | 5 | 11 | 3 | 19 |
| 6 | *Pterocarpus marsupium* | 100 | E | 1 | 1 | 5 | 11 | 16 | 31 |
| 7 | *Diospyros melonoxylon* | 100 | E | 1 | 1 | 3 | 11 | 11 | 25 |
| 8 | *Emblica officianalis* | 33 | B | 0 | 1 | 1 | 4 | 1 | 5 |
| 9 | *Osyris peltata* | 33 | B | 0 | 1 | 1 | 4 | 0 | 5 |
| 10 | *Xymenia americana* | 33 | B | 1 | 2 | 2 | 4 | **15** | 21 |
| 11 | *Persea macrnatha* | 100 | E | 3 | 3 | 11 | 11 | 6 | 29 |

*1 A = 0-20 Frequency %, B =21-40%, C =41-60%, D =61-80%, E =81-100 %

*2 (R.D) Relative density; (RF) Relative frequency; (R.Dom) Relative dominance IVI=Important Value Index.

Table 4: Soil analysis report of different Reserve Forest areas of North Coastal districts of Andhra Pradesh

| S.No | Reserve Forest | $p^H$ | Total Nitrogen (kg/ha) | Available Phosphorus (kg/ha) | Available Potassium (kg/ha) | Available zinc (ppm) | Available Manganese (Mn) (ppm) | Available Iron (ppm) | Available Copper (ppm) |
|---|---|---|---|---|---|---|---|---|---|
| **1** | **Mallavaram** | 7 | 390 | 18 | 290 | 0.9 | 31.1 | 16 | 26 |
| **2** | **Burana** | 7 | 315 | 10 | 385 | 0.9 | 30.1 | 12.2 | 0.822 |
| **3** | **Baliagam** | 7 | 290 | 13 | 256 | 0.26 | 27.76 | 6.69 | 0.473 |

Table 5: Height wise distribution of various species at different RF areas

| S.No | Name of the RF | Height classification (m) | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-2 m | 2-4 m | 4-6 m | 6-8 m | 8-10m | 10-12 m | 12-14 m | 14-16m | 16-18 m | |
| **1** | **Mallavaram RF** | 20 | 26 | 20 | 1 | 5 | 0 | 0 | 0 | 0 | **72** |
| **2** | **Burna RF** | 7 | 39 | 27 | 25 | 9 | 7 | 0 | 0 | 0 | **114** |
| **3** | **Baliagam R** | 76 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **89** |
| **Total** | | **103** | **90** | **74** | **38** | **17** | **8** | **0** | **0** | **0** | **330** |

Table 6: The Girth wise distribution of various species at different RF areas

| Girth classification | Mallavaram RF | Burna RF | Baliagam RF | Total |
|---|---|---|---|---|
| 1-10 cm | **0** | **0** | 39 | **39** |
| 10-30 cm | 62 | 85 | 44 | **191** |
| 30-50 cm | 9 | 24 | 6 | **39** |
| 50-70 cm | 1 | 4 | 0 | **5** |
| 70-90 cm | 0 | 1 | 0 | **1** |
| 90-110cm | 0 | 0 | 0 | **0** |
| Total | **72** | **114** | **89** | **275** |

Table. 7: Information on Vegetation with respect to tree community at different RF **areas**

| S.no | Location details | Total number of Individual species | H* | C* | R* |
|---|---|---|---|---|---|
| **1** | **Mallavaram RF** | 17 | 3.3 | 0.1 | 1.9 |
| **2** | **Burna RF** | 24 | 3.9 | 0.1 | 2.2 |
| **3** | **Baliagam RF** | 11 | 2 | 0.2 | 1.1 |

Note: H* = Shannon's index of diversity, R*= Menhinick's index of Species richness and C*=Simpson's index of species dominance

Though concentrated in some particular area only, Wrightia tinctoria (4.8) recorded higher density value, higher abundance (8) value and higher relative density (20.8). Bridella retusa (1.00) recorded higher relative abundance value followed by Pterocarpus morsupium (0.82). Wrightia tinctoria (27.16) belongs to the family Apocynaceae, recorded highest IVI value followed by Bridella retusa (24.0) belongs to the family Euphorbiaceae and Terminalia tomentosa (23.7) belongs to the family Combretaceae. Dalbergia paniculata (2.8) belongs to the family Fabaceae recorded lowest IVI value. Bridella retusa, Wrightia tinctoria and Terminalia tomentosa are the species distributed over entire area and dominant among all the other species.

Dalbergia latifolia, Dalbergia paniculata and Terminalia bellirica are the species found in only one quadrate out of five quadrates laid in one hectare and only one tree was observed. Terminalia tomentosa and Pterocarpus morsupium are found in highest height class (>10 m). Terminalia tomentosa is found in almost all the highest classes except above 14 m. More number of trees found in 2-4 m height class (39), followed by 4-6 m height class (27) and 6-8 m height class (25). Only one tree (Pterocarpus marsupium) was found in 14-16 m height class (Table – 5). More number of trees found in 10-30 cm girth class (85), followed by 30-50 cm girth class (24) (Table – 6). No trees were found in the girth class of 90-110 cm.

**Baliagam RF**

A total of 11 different tree species were observed (Table - 3). 8 species occupied entire area and only three species i.e. Emblica officianalis, Osyris peltata and Xymenia Americana found only in one quadrate with single digit number. Diospyros sylvatica (12.66) and Cleistanthus collinus (4.33) found to be having more density and abundance value. Diospyros sylvatica (43.18) and Cleistanthus collinus (14.77) found to have higher relative density value. Three species namely Emblica officianalis,

Osyris peltata and Xymenia Americana are having lesser value. Diospyros sylvatica (23.12) and Pterocarpus marsupium (15.75) found to be having more relative dominance value. Diospyros sylvatica (77.42) and Wrightia tinctoria (35.61) found to have high IVI value.

Out of ten plots, Persea macrnatha, Bignonia suberosa and Osyris peltata found only in this plot and these are not present in any other area. Their number is also very less, so it is necessary to conserve these species. Economical plant species Diospyros melonoxylon is found in this area. In this location the Shannon's index value of diversity is 2.01. The Simpson's index value of species dominance is 0.226 and the Menhinick's index value of species richness is 1.146 (Table – 7). More number of species found in the height class of 0-2 meters (88) and none of the species found above four meters. More number of species found in the girth class up to 30 cm (101) and above 30cm (Table – 6).

The need to prepare an inventory of an asset arises because of its perceived value (Divyabhanusinh, 2005) and it is applicable in case of plants also. It is a well-known fact that mapping and monitoring of biodiversity is the first step in systematic conservation planning (Margules and Pressey, 2000) and a thorough knowledge of living forms of a Conservation area is very essential for proper management (Das et al., 2011). For designing, implementing and evaluating the success of any conservation programme, it is imperative to monitor the status, distribution and trends in the population of target species (Jhala et al., 2008).

Distribution of forest types, structure, composition and nature are strongly correlated with environmental factors (Bongers *et al.*, 1999; Kherkwal *et al.*, 2005). An attempt was made in the present study to understand the biodiversity in three reserve forests of Andhra Pradesh. All the areas differ with respect to climate and topography. The number of tree species recorded in the present study was found to be lower than the number of species reported by several workers in other tropical forests (Chowdhury *et al.* 2000, 85 species; Fox *et al.* 1997, 94 species; Kadavul & Parthasarathy 1999, 89 species; Khera *et al.* 2001, 92 species).

With respect to density-distribution of trees, the present forest is similar to the tropical dry evergreen forests of south India (Parthasarathy & Sethi 1997; Visalakshi 1995) and Western Ghats (Ayyappan & Parthasarathy 1999). Similar results have been reported by Cao *et al.* (1996), Johnston & Gillman (1995) and Kellman & Tackaberry (1998) for other forest ecosystems (Nirmal Kumar et al., 2010).

Forest managers can use such information on rare and common tree species alike to help manage wildlife habitat as well as provide cultural resource values of these trees. The quantitative characters related with density, dominance and diversity of these trees could well act as indicators of changes and susceptibility to anthropogenic stressors among various vegetation categories and their formations, which could be further interpreted as distinct wildlife habitats (Ashish Kumar et al., 2006).

Tropical forests often are referred to as one of the most species-diverse terrestrial ecosystems. Their immense biodiversity generates a variety of natural resources which help sustain the livelihood of local communities. However, many tropical forests are under great anthropogenic pressure and require management intervention to maintain the overall biodiversity, productivity and sustainability. Understanding species diversity and distribution patterns is important for helping managers evaluate the complexity and resources of these forests. Biodiversity is essential for human survival and economic well-being and for the ecosystem function and stability.

Present study helped to understand the plant biodiversity, growth variation of different forest species in the East Godavari and Srikakulam districts of Andhra Pradesh, India. In our study except in Baligam RF, remaining areas are having almost same number of different species and *Terminalia tomentosa* species found in all the areas except in Baliagam and was uniformly distributed over the entire area. *Bridella retusa, Casearia elliptica, Wrightia tinctoria, Pterocarpus morsupium, Chloroxylon swietenia, Diospyros sylvatica, Dalbergia paniculata*, etc are the important species found in the sample plots. Our study provided information on the rare and threatened species of the particular area and also the intensity of biotic pressure and social conditions of different areas. This study indicated that deforestation can be stopped, if continuous work is provided to the local communities for their survival. Encouragement of JFM works not only improving the degraded forests but also reducing the biotic pressure in the forest areas. JFM works found to be effective in improving the growth and regeneration of the forests.

## Acknowledgements

Financial support extended by World Bank Fund, under "Andhra Pradesh Community Forest Management Project" (APCFM Project) for taking up this work is thankfully acknowledged. I thank the officials of Regional Forest Research Centre, Rajahmundry for giving me opportunity to work in the organization. I also acknowledge all the help rendered by Director, Central Tobacco Research Institute, Rajahmundry; Dr.Z.Vishnuvardhan, Professor and Head, Department of Environmental Science, Acharya Nagarjuna University, and Dr. AVVS Swamy, Professor, Department of Environmental Science, Acharya Nagarjuna University, Guntur.

## References

Ahmed Ajaz, 2002. Object-oriented forest management, Indian Forester, 128:313-315.

Ashish Kumar, Bruce G. Marcot and Ajai Saxena, 2006. Tree species diversity and distribution patterns in tropical forests of Garo Hills. Current Science, 91 (10), 1370 – 1381.

Ayyappan, N. & N. Parthasarathy. 1999. Biodiversity inventory of trees in a large-scale permanent plot of tropical evergreen forest at Varagaliar, Annamalais, Western Ghats, India. Biodiversity and Conservation 8: 1533-1554.

Bongers, F., L. Poorter, R.S.A.R. van Rompaey and M.P.E. Parren, 1999. Distribution of moist forest canopy tree species in Liberia and Cote

d'Ivoire: Response curves to a climatic gradient.

Cao, M.J., Z. Zhang, J.F. Deng & X. Deng. 1996. Tree species composition of a seasonal rain forest in Xishuangbanna, south west China. Tropical Ecology 37: 183-192.

Chandrashekera, U.M and Jayaraman, K. 2002. Stand structural diversity and dynamics in natural forests of Kerala, KFRI Research Report No: 232, 10-11.

Chowdhury, M.A.M., M.K. Auda & A.S.M.T. Iseam. 2000. Phytodiversity of Dipterocarpus turbinatus Gaertn. F. (Garjan) undergrowths at Dulahazara garjan forest, Cos'B Bazar, Bangladesh. Indian Forester 126: 674-684.

Dar, I.Y. Bhat, G.A. and Raina, A.K. 2013. Community organization, ecological distribution and diversity of trees and shrubs in selected areas of Branwar Forest of Kashmir Himalaya, International J. Biodiversity Conser. 5(12): 826-831.

Das, Sunit Kr. Anil Dashahare, Sanskruti Marathe, N. Kndu and R. Kesharwani, 2011. Status of Raptors with Special Reference to Vultures in Rajaji National Park, India. World J. Zoology, IDOSI Publication, 6(4): 350-356.

Divyabhanusinh, C., 2005. The story of Asia's Lions. Marg Publication, pp: 259.

Fox, B.J., E.T. Jennifer, D.F. Marelyn & C. Williams. 1997. Vegetation changes across edges of rainforest remnants. Biological Conservation 82: 1-13.

J.I. Nirmal Kumar, Rita N. Kumar, Rohit Kumar Bhoi & P. R Sajish, 2010. Tree species diversity and soil nutrient status in three sites of tropical dry deciduous forest of western India. Tropical Ecology 51(2): 273-279.

Jhala, Y.V., R. Gopal and Q. Qureshi 2008. Status of Tigers, Co-predators and prey in India. National Tiger Conservation Authority and Wildlife Institute of India. TR08/001 pp: 164

Johnston, M. and M. Gillman. 1995. Tree population studies in low-diversity forests, Guyana. I. Floristic composition and stand structure. Biodiversity and Conservation 4: 339-362.

Kacholi, D.S. 2014. Analysis of structure and diversity of the Kilengwe forest in the Morogoro region, Tanzania, International J. Biodiversity. 2014 (2014): Article ID 516840, pp 8.

Kadavul, K. & N. Parthasarathy. 1999. Structure and composition of woody species in tropical semievergreen forest of Kalayan hills, Eastern Ghats, India. Tropical Ecology 40: 247-260.

Kameswara Rao, K. 1998. Vegetation and Non-Timber forest products assessment under JFM in Eastern Ghats of Andhra Pradesh, India, Presented at "Crossing Boundaries", In: The Seventh Annual Conference of the International Association for the Study of Common Property, Vancouver, British Columbia, Canada, 10-14 June 1998.

Kellman, M.R. and L.R. Tackaberry. 1998. Structure and function in two tropical gallery forest communities, implication for forest conservation in fragmented system. Journal of Applied Ecology 35: 195–206.

Khera, N., Kumar, A., Ram, J., and Tewari, A. 2001. Plant biodiversity assessment in relation to disturbance in mid elevation forest of central Himalaya, India. Tropical Ecology 42: 83-95.

Kherkwal, G., Poonam, M., Yaswant, S.R and S.P.Yaspal, 2005. Phytodiversity and growth form in relation to altitudinal gradients in the Central Himalayan (Kumaun) region of India. Curr. Sci., 89: 873 – 878.

Krahl and Henderson, 1998. Uncertain steps towards community forestry: A case study in Northern New Mexico, Nature Research Journal, 38: 54-84.

Kushwah, R.B.S. and Kumar, V. 2002. Status of flora in protected areas: The case studies of eight PA's of Madhya Pradesh (India), Indian Forester, 128: 271-288.

Mandal, R.N. and Naskar, K.R. 2008. Diversity and classification of Indian mangroves: a review, Tropical Ecology, 49(2): 131-146.

Margules, C.R. and R.L. Pressey, 2000. Systematic conservation planning. Nature, 405: 243-253

Margurran, A.E. 1988. Ecological Diversity and its Measurement, Croom Limited, London.

Munesh Kumar, C.M. Sharma and Govind. S. 2004. A study on community structure and diversity of a sub-tropical forest of Garhwal Himalayas, Indian Forester, 130: 207-213.

Pande, P.K. Negi, J.D.S. and Sharma, S.C. 1996. Plant species diversity and vegetation analysis in moist temperate Himalayan Forests, Abstracts of First Indian Ecological Congress, New Delhi: 51.

Pande, P.K. Negi, J.D.S. and Sharma, S.C. 2002. Plant species diversity, composition, gradient analysis and regeneration behavior of some tree species in a moist temperate Western Himalayan forest ecosystem, Indian Forester, 128:869-886.

Parthasarathy, N. & P. Sethi. 1997. Tree and liana species diversity and population structure in a tropical dry evergreen forest in south India. Tropical Ecology 38: 19-30.

Pratima and Jattan, S.S. (2002). Emerging issues in participatory forest management, Indian Forester, 128:863-868.

Prem Kumar, J. H. A. and Uma, N. 2003 Biodiversity measurement in forests of various canopy density, Indian Forester, 129: 1391-1394.

Ranjana Gupra, Shivendu, K. Srivastava, A. K, Mahendra, I. R, Pundir, A and Dinesh Kumar. 2004. Impact of participatory forest management on socio-economic development of rural people: A case study in Kodsi and talaichittor villages of Dahra dun district, Indian Forester, 130: 243-252.

Ravi Prasad Rao, B. Suresh Babu, M.V. Sridhar Reddy, Madhusudhana Reddy, M.A. Srinivasa Rao, V.S. Sunitha, V.S. and Ganeshaiah, K.N. 2011. Sacred groves in southern eastern ghats, India: Are they better managed than forest reserves? Tropical Ecology, 52(1): 79-90.

Sahoo, T. K, Mishra T. K, Avinash Jain and Banerjee. 2004. Impact of different management systems on Biodiversity conservation: A case study, Indian forester, 130: 991-1007.

Sudha, P. Reka, P.V. Gunaga, V.S. Patagar,S. Naik, M.B. Indu, K.M. and Ravindranath, N.H. 1998. Community forest management and joint forest management: An ecological, economic and institutional assessment in Western Ghats, India. In: "Crossing Boundaries", the seventh annual conference of the International Association for the Study of Common Property, Vancouver, British Columbia, Canada, 10-14 June 1998.

Varma, R. K. Kapoor, K. S. Rawat, R.S. Subramani, S.P. Surinder Kumar. 2005. Analysis of plant diversity in degraded and plantation forests in Kunihar forest division of Himachal Pradesh, Indian Journal of Forestry, Vol.28 (1): 11-16.