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# Ecological study of grasses in Mukundpur range of Satna forest division Madhya Pradesh with the assessment of threat and conservation status

**Prachi Singh, PK Singh, Sherendra Sahu, Anoop Singh, N Gaurav and Neeta Singh**

**Abstract**
Mukundpur forest range is situated in Amarpatan Tahsil of Satna district of Madhya Pradesh India. Thisstudy area is under high ecological stress for mining purposes. For assessment of biodiversity vegetation sampling was done. The calculation of frequency and IVI (Important value Index) for the species of grasses have been done. The threat and conservation status is assessed by Normal Distribution Principle. In the present study the 19 grass species have been found. The 6 species are in category-4 which requires highest degree of protection. These species are *Dichanthium annulatum, Phaseolus trilobus, Paspa lidium, Adaintum spp, Grewia hirsuta and Zizyphus oeroplia*. The 3 species are in the category-2. These are *Setaria intermedia, Ipomoea reniformis and Saccharum spontaneum. Setaria intermedia* is important species of food security for human life for future.

**Keywords:** IVI, Normal Distribution Principle, Frequency class, Raunkier's frequency law, Threat and Conservation Categories.

## 1. Introduction
India, a land of physical, cultural, social and linguistic diversity is endowed by nature with enormous biological diversity. As a result India ranks amongst one of the 12 mega biodiversity countries of the world and harbors 17,000 flowering plant species. It accounts for 8% of the global biodiversity with only 2.4% of the total land area & the world (Hajara and Mudgal 1997; Reddy 2008) [7, 23].

A complete picture of threatened status, vulnerability and microclimate are yet has been determined. Conservation status is not properly documented till now. The present work has been taken to assess all relevant information on this aspect. An Assessment of threatened plants of India has been made by Jain and Rao (1983) [8]. Biodiversity Threat assessment of Vindhyan region of Madhya Pradesh has been made by Myres (1988) [13]; Nayar and Sastry (1987, 1988 & 1990) [15-17]; *Nautiyal, et al.* (2003) [14].

Conservation of Threatened species is important for maintaining the ecological balance of the habitat. Conservation of rare and endangered species of India as well as in different parts of world had been popularized through the propagation and preservation of these plant species in the botanical gardens or in the natural habitat. Conservation and economic evaluation of Biodiversity has been done by Nayar, *et al.* (1997) [18]. Status and conservation of rare and endangered medicinal plant in the Indian Trans-Himalaya has been made by Bush (1996); Kala (2000) [10]; Ayyad, *et al.* (2000) [2]; Okigbo & Ogbogu (2008) [19]; Soetan & Aiyelaagbe, *et al.* (2009) [24]; Dubey, *et al* (2010) [4]; Oladele, *et al.* (2011) [20].

The studies on threatened medicinal plants of Andhra Pradesh and forest type have been made by Reddy, *et al.* (2001) [21] and Reddy (2007) [22]. National special biodiversity assessment and the use of forest inventory data for a national protected area strategy in Guyana have been made by Tersteege (1998) [25] and Turpie (2004) [26]. In Madhya Pradesh the forest are of various types and they provide diversity of vegetation. The varied nature of forests needs a thorough investigation of the soil, climate, bio-geochemical nature and Characteristics of vegetation.

The central Indian state of Madhya Pradesh is one of the richest repositories of biological diversity. In Satna district of the Madhya Pradesh, observation of Medicinal Importance of Sacred Plants of Chitrakoot Region Satna (M.P.) Bala and Singh (2015) **[11].**

This study discussed the 13 sacred plants species which are medicinally used by the tribes of Chirtakoot region district Satna Madhya Pradesh. The local people believe in the efficacy of these herbs along with some divine power, but the knowledge is restricted to very few elderly folks only.

The headquarters of Mukundpur range is in Mukundpur village, situated in Amarpatan Tahsil of Satna district in the state of Madhya Pradesh, India. The first white tiger safari is established at this village.

The one of the mandate of this zoo and safari is to establish a small research centre for identification and propagation of various species of medicinal plants naturally occurring in adjoining forest areas.

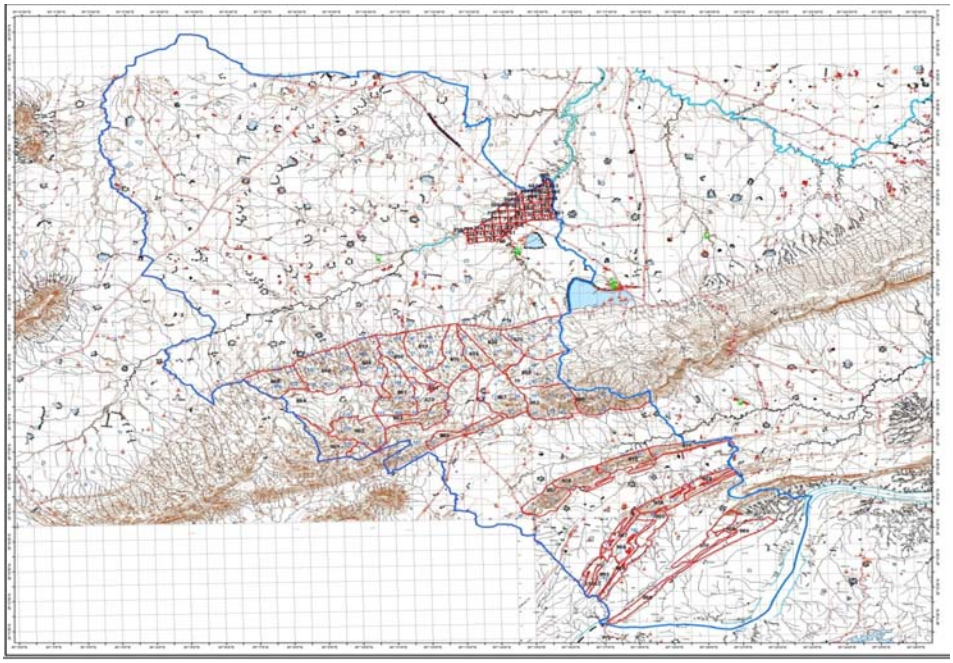
The Mukundpur range is surrounded by mining areas of bauxite, limestone. The nearby located cement factories are always in search of new areas, besides exploiting existing known areas. These houses may obtain non forest land as compensatory forest land in other district of Madhya Pradesh for diversion. The emission of $CO_2$ in cement manufacturing across the world accounts for 5% of global $Co_2$ emission due to intensive and extensive mining activities. Thus area is encountering impact of temperature rise, industrialization, desertification, shifting in the growing seasons of plants, loss of pollinators and seed dispersers, causing extinction of precious plants. Thus area of Mukundpur range will confines to be remained under high ecological stress zone in near future.

Ramification and Widening of old roads will cause vehicular pollution, fragmenting the habitat, opening the area for plunder at certain species like *Gymnema sylvestre* (Gudmar) and *Tinospora cardifolia* (Giloy) with excessive commercial exploitation posing a threat to eco-system. Again these activities and excessive grazing is creating problem to grass species.

Looking at the above reasons, objectives is the identification, characterization, documentation and compilation of data base of threatened and endangered plant and their study of taxonomy, ecology and physiology, exploration of basic and commercial utility of endangered plants.

## 2. Study Area

Mukundpur region mainly comprises the present area of Mukundpur range of Satna forest division. The range has geographical area of 589.71 km2 with forest area 111.55 km2. The area lies between north latitude of $24^0$11'35" to $24^0$26'25" and east longitude of $81^0$6'35" to $81^0$22'20". The famous world white tiger safari is also situated in northern side of this range.



The forest area of this range exists in 7 forest blocks namely Mand, Govindgarh extension, Papra, Jhinna, Sarhai, Kokahansar and Mankesar. The forest blocks of Govindgarh extension and papra extend in Satna and Rewa forest districts. The part of Mankesar forest block lies in submerged area of Bansagar dam.

Northern boundary lies with Beehar River demarcating Satna and Rewa district. The forest of Mand reserve is situated in this area. Eastern boundary lies mainly with the district boundaries bifurcating Rewa and Satna districts. The famous Charaki ghati forms one of its boundaries. Southern boundary lies mainly with submerged area of Son River and it extends to district boundaries of Shahadol and Satna districts.

## 3. Material and Method

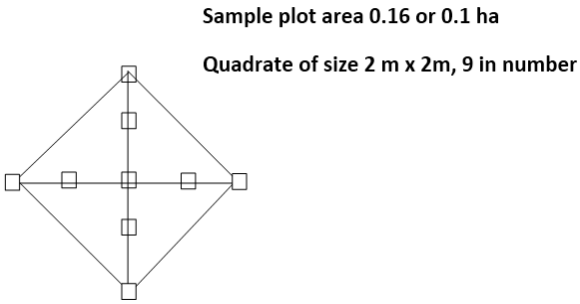
For the assessment of biodiversity of Mukundpur region, the vegetation sampling was done for the trees, shrubs, herbs, climbers, grasses and tubers. Stratified systematic random sampling method was used for sampling the vegetation (Anon, 1996) [1]. For determining minimum number of sample points, the formula used is $n = z^2 pq / E^2$ where E= difference between population proportion mean and sample proportion average, p = population proportion, q= 1- p, z=1.96 for a level of significance of 95% (Elhance, 1994) [5, 6].

Based on the secondary data from Mukundpur range and Satna forest division, the sample size for various tree parameters i.e. number of trees per hectare, volume per hectare and established regeneration per hectare was calculated at 10% error (E) between population and sample proportion at 95% level of significance keeping in view time and other resources (Jain, 2008) [9].

Minimum 95 numbers of sample points were calculated from the above formula to assess the vegetation. The forest maps of

Mukundpur range is on survey of India topo sheet of the scale of 1:15000. The grids at 35"x 35" and 30"x30" intervals are drawn by trial and error, for systematic random sampling. The 111 and 151 random points were recorded on above grid. The 151 sample points at 30"x 30" were selected on safer side, so that points may fall in river bed, submergence and encroachments. The longitudes and latitudes of 151 points were noted and listed from topo sheets.

Each sample points were located on ground with the help of GPS.




At each sample points, the layout of sample plot of 0.16 hectare with 9 quadrate of 2mX2m on ground was done with the help of prismatic compass (Anon, 1996) [1]. At these points recording of data of the girth and species of the trees, along with species of shrubs, climbers and tubers (numbers) were taken on whole sample plot of 0.16 hectare and data for species of herbs, grasses and established regeneration was recorded at each 9quadrate of 2mX2m. The Microsoft access program was developed to calculate the number, regeneration of trees per hectare and volume in m3 per hectare by using local volume table, prepared for Satna forest division, the results were analyzed with this program. For the grasses, only the names of the species and their presence were recorded, in each quadrate. The calculation for the frequency and IVI of the all species of grasses was done with same program (Mishra, 1968) [5, 6]. All the IVI for all the species was summarized in decreasing order and analyzed further to assess the conservation and protection status of species by using the normal distribution principle (Elhance, 1994) [5, 6].

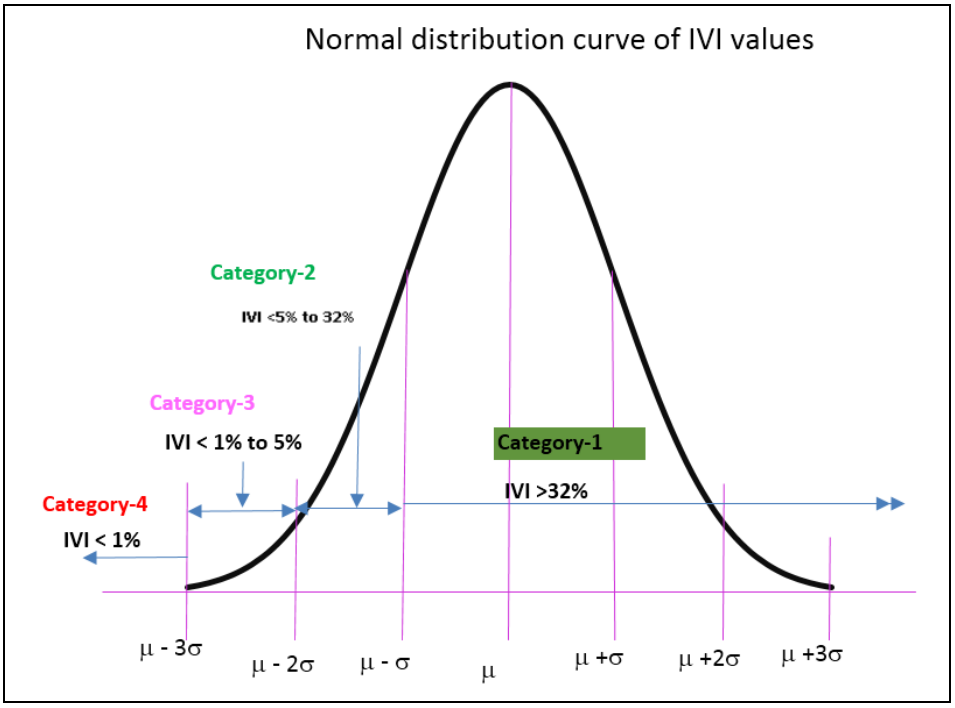
Principle is as under:

$\mu$ = mean of IVI of all species, $\sigma$= standard deviation of IVI,

Then normal distribution principal states that there should be:-

a) 68% of total number of species whose IVI is between $\mu + \sigma$and $\mu - \sigma$.
b) 95% of the total number of species whose IVI is between $\mu + 1.96\sigma$ and$\mu - 1.96\sigma$.
c) 99% of the total number of species whose IVI is between $\mu + 2.58\sigma$ and $\mu - 2.58\sigma$.

For safer evaluation for IVI, for conditions (b) and (c) $\mu - 2\sigma$to $\mu + 2\sigma$and $\mu - 3\sigma$to $\mu + 3\sigma$have been calculated and used in further study. Now again here, $\mu$ is the population mean and is equivalent to sample average and $\sigma$is population standard deviation and here for sample it is replaced by $\sigma/\sqrt{n}$ i.e. standard error(SE).




Now, with the help of this principle, categorization is done as follows:

IVI <$\mu - 3\sigma$ (species having IVI less than 1%) - category 4.

$\mu - 3\sigma \leq$ IVI <$\mu - 2\sigma$ (species having IVI between 1 to 5%) - category 3.

$\mu - 2\sigma \leq$ IVI <$\mu - \sigma$ (species having IVI between 5 to 32%) - category 2.

IVI $\geq \mu - \sigma$ (species having IVI greater than 32%) - category 1.

The species in category 4 require highest degree of protection. The species in category 3 require lesser protection than category 4. The species in category 2 require lesser protection than category 3. The species in category 1 require least protection and are available in plenty and they are available for harvesting.

## 4. Result and Discussion

### 4.1 Analysis of frequency status of grasses

Presence of grasses is recorded in 9 quadrates of 2mX2m at 143 grid points. So there are total 1287(9X143) quadrates in area surveyed and results are recorded in table 1.

**Table 1**

| S. N. | Species | Botnical Name | Presence | Total Plots | Frequency |
|---|---|---|---|---|---|
| 1 | Jarga | *Dichanthium amulatum* | 146 | 1287 | 11.34 |
| 2 | Fulera | *Cenchrus ciliaris* | 354 | 1287 | 27.51 |
| 3 | Doob | *Cynodon dactylon* | 177 | 1287 | 13.75 |
| 4 | Kans | *Saccharum spontaneum* | 31 | 1287 | 2.41 |
| 5 | Chirchita | *Eragrostes tenella* | 76 | 1287 | 5.91 |
| 6 | Mushakarni | *Ipomoea reniformis* | 35 | 1287 | 2.72 |
| 7 | Bhojraj | *Adaintum spp* | 2 | 1287 | 0.16 |
| 8 | Chapri | *Paspalum spp* | 151 | 1287 | 11.73 |
| 9 | Chakoda | *Cassia tora* | 87 | 1287 | 6.76 |
| 10 | Chhoti Dudhi | *Euphorbia thymifolia* | 207 | 1287 | 16.08 |
| 11 | Tin Patiya | *Oxalis spp* | 162 | 1287 | 12.59 |
| 12 | Latyari | *Paspa lidium* | 2 | 1287 | 0.16 |
| 13 | Van Udad | *Phaseolus trilobus* | 2 | 1287 | 0.16 |
| 14 | Barari | *Zizyphus oeroplia* | 1 | 1287 | 0.08 |
| 15 | Lapusari | *Eraoostin* | 189 | 1287 | 14.69 |
| 16 | Lampa | *Heteropogon Contortus* | 542 | 1287 | 42.11 |
| 17 | Gud Sakari | *Grewia hirsute* | 2 | 1287 | 0.16 |
| 18 | Sama | *Setaria intermedia* | 51 | 1287 | 3.96 |
| 19 | Gunai/Marbel | *Dichanthium annulatum* | 7 | 1287 | 0.54 |
| | | | | Total : | 172.82 |

The table1 shows that there are 19 species of grasses. The 5 top presences are Lampa (*Heteropogon Contortus*), Fulera (*Cenchrus ciliaris*), Chhoti dudhi (*Euphorbia thymifolia*), Lafusri (*Eraoostin*) and doob (*Cynodon dactylon*) in 1287 quadrates. The number and basal area was neither easy to record nor practical in large scale area of Mukundpur range.

In order to check the Raunkier's frequency law, the various frequency classes are presented in table below:

**Table 2**

| Frequency Class | Number of species in Class | Percentage of species in a class from total number of species |
|---|---|---|
| A frequency $\leq$ 20% | 17 | 90% |
| B frequency 21 to 40% | 1 | 5% |
| C frequency 41 to 60% | 1 | 5% |
| D frequency 61 to 80% | 0 | 0 |
| E frequency 81 to 100% | 0 | 0 |
| Total | 19 | 100% |

Raunkier's frequency law does not hold good as this law state that (A > B>C$\geq$D<E). Because here A>B=C>D=E.

### 4.2 Evaluation of IVI of each grass species

Table 3 shows the IVI distribution of 19 grasses species written is decreasing order with highest IVI of Lampa (*Heteropogon Contortus*) and lowest IVI of Barari (*Zizyphus oeroplia*) species.

**Table 3**

| Type | S.N. | Local Name | BotnicalName | IVI | Cat |
|---|---|---|---|---|---|
| GRASS | 1 | Lampa | *Heteropogon Contortus* | 24.4 | CAT-1 |
| GRASS | 2 | Fulera | *Cenchrus ciliaris* | 15.9 | CAT-1 |
| GRASS | 3 | Chhoti Dudhi | *Euphorbia thymifolia* | 9.3 | CAT-1 |
| GRASS | 4 | Lapusari | *Eraoostin* | 8.5 | CAT-1 |
| GRASS | 5 | Doob | *Cynodon dactylon* | 7.96 | CAT-1 |
| GRASS | 6 | Tin Patiya | *Oxalis spp* | 7.29 | CAT-1 |
| GRASS | 7 | Chapri | *Paspalum spp* | 6.79 | CAT-1 |
| GRASS | 8 | Jarga | *Dichanthium amulatum* | 6.56 | CAT-1 |
| GRASS | 9 | Chakoda | *Cassia tora* | 3.91 | CAT-1 |
| GRASS | 10 | Chirchita | *Eragrostes tenella* | 3.42 | CAT-2 |
| GRASS | 11 | Sama | *Setaria intermedia* | 2.29 | CAT-3 |
| GRASS | 12 | Mushakarni | *Ipomoea reniformis* | 1.57 | CAT-3 |
| GRASS | 13 | Kans | *Saccharum spontaneum* | 1.39 | CAT-3 |
| GRASS | 14 | Gunai/Marbel | *Dichanthium annulatum* | 0.31 | CAT-4 |
| GRASS | 15 | Van Udad | *Phaseolus trilobus* | 0.09 | CAT-4 |
| GRASS | 16 | Latyari | *Paspa lidium* | 0.09 | CAT-4 |
| GRASS | 17 | Bhojraj | *Adaintum spp* | 0.09 | CAT-4 |
| GRASS | 18 | Gud Sakari | *Grewia hirsuta* | 0.09 | CAT-4 |
| GRASS | 19 | Barari | *Zizyphus oeroplia* | 0.05 | CAT-4 |
| | | | Average : | 5.26 | |
| | | | Std : | 6.33 | |
| | | | Sqrt : | 4.36 | |
| | | | StdErr : | 1.45 | |

**4.3 Assessment of grass species for conservation and threat status**

The average IVI growth is 5.26 and the standard error is 1.45. Using normal distribution principle, various conservation categories are analyzed and results are summarized below:

1. Species of grass having IVI > 32% (Category-1). There are 9 species in this category. These are Lampa (*Heteropogon Contortus*), Fulera (*Cenchrus ciliaris*), Chhoti dudhi (*Euphorbia thymifolia*), Lapusari (*Eraoostin*), Doob (*Cynodon dactylon*), Tin patiya (*Oxalis spp*), Chapari (*Paspalum spp*), Jarga (*Dichanthium amulatum*) and chakoda. These species do not require any protection and found in abundance. Though Chakoda (*Cassia tora*) is herb species it is classified grass due to counting problem.
2. Species of grass having IVI between 5 to 32% (Category-2). There are only one species are found in this category i.e. Chirchita (*Eragrostes tenella*). This is the species which require more protection than category-1 species.
3. Species of grass having IVI between 1 to 5% (Category-3). There are 3 species in this category. These are Sama (*Setaria intermedia*), Mushakarni (*Ipomoea reniformis*) and Kans (*Saccharum spontaneum*). These species require more protection than category-2 but less protection than category 4.
4. Species of grass having IVI less than 1% (Category-4). There are 6 species under this category which require highest degree of protection. These species are Gunai (*Dichanthium annulatum*), Vanudad (*Phaseolus trilobus*), Latiyari (*Paspa lidium*), Bhojraj (*Adaintum spp*), Gudsakri (Grewia hirsute) and Barari (*Zizyphus oeroplia*).

**5. Conclusion**

There are no criteria suggested by MP Biodiversity board for grass species.

Though, IVI results of grasses indicate that the 6 species i.e. Gunai (*Dichanthium annulatum*), Vanudad (*Phaseolus trilobus*), Latiyari (*Paspa lidium*), Bhojraj (*Adaintum spp*), Gudsakari (*Grewia hirsuta*) and Barari (*Zizyphus oeroplia*) are under the threat and conservation status of category 4. These species of grasses are under critically endangered state and likely to be extinct in wild. These species require highest degree of protection in the Mukundpur forest as their IVI value too low.

Sama (*Setaria intermedia*) is important species of food security for human life for future. This species also exists in Mukundpur forest and comes under threat and conservation status of category 3. This species also need special protection and management as it will be a source for future food supply for human.

The other grass categories are not in endangered or vulnerable condition in Mukundpur forest.

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**7. References**

1. Anon. working plan code published by Chief Conservator Forests, working plan Satpuda Bhawan Bhopal, Madhya Pradesh Forest department, 1996.
2. Ayyad MA, Fakhry AM, Moustafa ARA. Plant biodiversity in the saint Catherine area of the sinai Peninsula, Egypt Biodiversity and Conservation; 2000; 9(2):265-281.
3. Bush MB. Amazonian Conservation in a changing world. Biological Conservation. 1996; 76(3):219-228.
4. Dubey KP, Kumud Dubey. Conservation of medicinal plants and poverty Alleviation, national conference on biodiversity, development and poverty Alleviation, 2010. 22.
5. Elhance DL. Book Estimating sample size for population proportion, Page No. 21.14 published by kitabmahal, 22-A, Sarojaini Naidu marg, Allahabad, 1994.
6. Elhance DL. Properties of normal distribution, book of Fundamentals of Statistics. 1994; 18:32.
7. Hajara PK, Mudgal V. An overview, BSI India, 1997.
8. Jain SK, Rao RR. (Ed.) An assessment of threatened plants of India, Botanical survey of India, Culcutta, 1983.
9. Jain Atul Kumar. IFS, Forest resource survey, Part-1, Page 47 to 53, working plan of Satna revised for 2008-09 to 2017-18, Government of Madhya Pradesh Forest Department, Chapter of Forest resource survey, 2008.
10. Kala CP. Status and conservation of rare and endangered medicinal plant in the Indian trans-Himalaya. Biol. Conserv. 2000; 93:371-379.
11. Lipika Devi Bala, Ravindra Singh. faculty of Science & environment, MGCGV, Chitrakoot, Satna (M.P.), India Medicinal Importance of Sacred Plants of Chitrakoot Region Satna (M.P.), International Journal of Science and research (IJSR) ISSN (Online): 2319-7064 on 2015; 4(8).
12. Mishra R. Ecology work book, Page (36 to 48) Professor and head of Department of Banaras Hindu University Varansi India, published by Oxford & IBH Co. 17, Park street Calcutta-16, 1968.
13. Myres N. Threatened Biotas: 'Hotspots' in tropical forests, the Environment 1988; 8(3):987-208.
14. Nautiyal, Sunil. Plant Biodiversity and its Conservation in Institute for Social and Economic change (ISEC) campus, Banglore; A case study. J. Biodiversity. 2003; 2(1)9-26.
15. Nayar MP, Sastry ARK. Red data book of Indian plants, Botanical survey of India, Culcutta, CAMP, CAMP Workshop, Shimla, 1987, 1,
16. Nayar MP, Sastry ARK. Red data book of Indian plants, vol.2, Botanical survey of India, Culcutta, CAMP, CAMP Workshop, Shimla, 1988.
17. Nayar MP, Sastry ARK. Red data book of Indian plants, Botanical survey of India, Culcutta, CAMP, CAMP Workshop, Shimla, 1990, 3.
18. Nayar MP, Puspangadan P, Ravi K, Santosh V. Conservation of rare and endangered species of Indian flora: strategies for botanic gardens. In (eds) conservation and economic evaluation of biodiversity, Oxford &IBH publishing co. New Delhi. 1997; 1:47-57.
19. Okigbo, Eme UE, Ogbogu S. Biodiversity and Conservation of medicinal and aromatic plants in Africa, Biotechnology and molecular Biology Reviews. 2008; 3(6):27-134.
20. Oladele AT, Alade GO, Omobuwajo OR. Medicinal plants conservation and cultivation by traditional medicine practitioners (TMPs) in Aiyedaade Local Government Area of Osun state, Nigeria, Africa, Biol. J.N. Am. 2011; 2(3):476-487.
21. Reddy CS, Reddy KN, Jodhav SN. EPTRI. Hyderabad. 2001,

22. Reddy, C.S. Forest types of Andhra Pradesh. Paryavaranam. EPTRIENVIS (SOEAP) New letter: 1 (land): 2007, 1-8.
23. Reddy CS, Life Sci J. 2008; 5(2):84-89.
24. Soetan KO, Aiyelaagbe OO. The need for bioactivity safety evaluation and conservation of medicinal plants- A review, Journal of medicinal plants research. 2009; 3(5):324-328.
25. Tersteege H. The use of forest inventory data for a national protected area strategy in Guyana. Biodiversity and conservation; Hill, A.F. Economic Botany. A Textbook of useful plants and plant products, 2nd edn. 1998; 7(11):1457-1483.
26. Turpie JK. National spatial Biodiversity Assessment Technical report. Estury component. South African National Biodiversity institute Pretoria, 2004, 3.