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Research Article

STATUS AND DIVERSITY OF TREE, SEEDLINGS AND SAPLINGS IN TROPICAL DRY DECIDUOUS FOREST OF NORTH GUJARAT REGION (NGR) GUJARAT INDIA

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ABSTRACT
Here we enumerated the status and ongoing disturbance of Dry Deciduous Forest in North Gujarat Region (NGR). A total of 81 trees, 74 seedlings and 62 species of saplings were recorded. Comparatively, mature trees exhibited maximum richness.Density and diversity showed seedlings were high than the mature trees and saplings. Further, more numbers of tree species fall under the poor regeneration classes. The reason behind this could be the low productivity and over exploitation of tree species for multiple uses by local community.

Key Words: *Dry Deciduous, North Gujarat, Establishment, Disturbance and Forest fragments*

INTRODUCTION
Tropical dry deciduous forests are not considered species – rich, when compared with tropical moist deciduous forests (Gentry, 1995), but do have a good species richness and diverse life-forms (Medina, 1995). These forests occur under varied climatic conditions with alternating wet and dry periods. However, the structure, composition and functioning of deciduous forests undergo changes with the length of wet period, amount of rainfall, latitude, longitude and altitude (Uma Shankar, 2001) as well as human and livestock effects (Bhat *et al.,* 2000). This influences the resources availability and leads to variation in species growth.

As a result, there is a lot of spatial and temporal variation in species richness, composition and productivity across this dry deciduous forests.The endurance of any species in the forest becomes microhabitat dependant. It consequently influences the richness, diversity, density, growth and survival rate of the tree species in their habitat. This determines the habitat differentiation and habitat specialization of tree species (Kobe, 1999; Pearson *et al.,* 2003).Thus the tropical deciduous forests assume unusual significance for conservation since they are the most used and threatened ecosystems (Janzen, 1998) especially in India (Uma Shankar, 2001).

Western region of India periphery with Aravalli hill ranges, historically oldest hills, and predominated forest types is Dry Deciduous Forest (DDF). The North Gujarat Region (NGR), in Gujarat is a starting point of Aravalli hill ranges. This forest region is facing continuous habitat degradation in the form of encroachment for agricultural, mining and other small scale industrial activities.

Further, tree species in this region are used by local people for constructing house furniture fuel wood and fodder for cattle has added to the degradation. As a result, significant numbers of woody species have lost their regeneration capacity and most of the indigenous species were destroyed from instinctive habitat.

To stop this destruction and to conserve the habitat there is a need for a study, which deals about species regeneration, species establishments and the factors preventing the establishments. Hence, an attempt was made to achieve the above said goals with the following objectives

To know the status of tree, seedlings and saplings of tree species

To find out the density and diversity of trees, seedlings and saplings

To assess the establishment ratio among tree, seedlings and saplings

To identify factors which limitsthe establishment of tree species in DDF of NGR

MATERIALS AND METHODS

Study Area

The NGR lies between 23° 35' 13.0" to 24° 30' 57.0" N and 72° 10' 28.0" to 73° 24' 47.0" E and falls under three administrative districts *viz.*Banaskantha, Sabarkantha and Meshsana. It extends to about 8.7% (1638 km^2) of the total forest cover of Gujarat state (18,868.28 km^2) and includes protected areas *viz.*Jessore Sloth Bear Wildlife Sanctuary (JSBWS), BalaramAmbaji Wildlife Sanctuary (BAWS), Taranga hill and Vijaynagar forest.

Forest was the most predominant land use type of the study area covering 1638 km^2, followed by agriculture land use largely in the valleys. Third major land use is rocky barren surface, while mining areas cover over 15 km^2. Only 8 km^2 areas are in the form of water bodies or wetlands (Joshua *et al.*, 2007). Although major forest types are found in the study area, they have been classified into two major sub-groups *viz.*5A - Southern Tropical Dry Deciduous Forest and 6B - Northern Tropical Thorn Forest(Champion and Seth, 1968). The dominant soil of this region is classified as alluvial sandy soil mixture of sandy and coarse particles. Further, sandy loame and black soil are distributed in Banaskantha and Sabarkantha districts. In Meshana, 90% of the area is covered by light sandy soil and at some patches where sandy soil is mixed with black soil, the cultivation is possible. The pure sandy soil usually distributed in the forest region of Meshana districts, mainly Taranga hill and Abarkantha forest, have good natural thorn forest (Chavan and Lal, 1984).

Methods

Stratified grid based assessment of biodiversity was used following Joshua *et al.*, (2005). Initially the entire NGR area was grided into 5' X 5' (c 8km X 8km) on the SOI maps of 1:50,000 scales and these were further sub divided into 30'' X 30'' (c 800m X 800m) and the diagonal of 1.1 km was used as transect. Random plots were laid along the transect to assess the status of tree, seedlings and saplings in DDF of NGR. The numbers of plots were depending on the extent of each vegetation types. So care was taken to have adequate sampling in each altitudinal range and plots were distributed spatially along the vegetation type. Nested plots were used to enumerate trees and its components. A total of 416 plots were sampled in the entire dry deciduous forest of NGR during the period of Jan - Dec 2008. The size of the plots varied from 10m radius for trees to 8m radiusfor regeneration and recruitment.

The name of the species under each category and the abundance were recorded. The criteria for each category were:

Tree - $\geq$ 20cm Girth at Breast Height (GBH) at 1.3m height
Seedling - seedlings of tree species with < 50 cm height
Sapling - < 20 cm GBH at 1.3m height and $\geq$ 50 cm height

Stastical analysis

The diversity of three category was calculated by using Shannon Wiener Index (Shannon and Wiener, 1949), and considered useful for describing the ecological trends of the forest (Lewis *et al.*, 1988; Magurran, 1988)

Shannon Wiener Index $$H = -\sum P_i \log_e P_i$$

Where Pi = ni / Ni (ni is the number of individuals of the species i, and N is the total number of individuals.

Density was estimated as 'number of individuals /ha

Density (tree/sapling/seedling) = number of individuals of the species i / Area (ha)

Area (ha) = πr^2 X Total number of plots/10000

π - 22/7 or 3.14; r - plot size

In addition, species in the sampled plots were classified into five groups (Uma Shankar, 2001) as follows:

(a) 'good' - regeneration > recruitment > mature tree
(b) 'fair' - regeneration > recruitment < mature tree
(c) 'poor' - no regeneration, recruitment <> mature trees
(d) 'none' - no regeneration, no recruitment, only in mature trees

(e) 'new'- recruitment and / or regeneration, no mature trees

The proportion of the establishment between tree and regeneration and recruitment were calculated by dividing values of regeneration/mature tree, recruitment/mature tree, regeneration/recruitment.

RESULTS AND DISCUSSION

Species Richness, Diversity and Density

A total of 81 species of mature trees belonging to 57 genera and 35 families were recorded from DDF. The regenerations showed 74 species under 52 genera and 32 families while recruitments were 62 species belonging to 50 genera and 31 families (Table 1).

Under trees class, a total of 7,540 individuals were recorded with a density of 483 trees/ha and a diversity index of 2.65. The dominant tree species were *Wrightiatinctoria* (128/ha), *Diospyrosmelanoxylon* (80/ha), *Buteamonosperma* (53/ha), *Tectoniagrandis* (32/ha) and *Holarrhenapubscens* (31/ha).The regenerations were 14,709 individuals with a density of 1,500/ha and a diversity of 2.67. The dominant species were *Holarrhenapubscens*(329/ha), *Miliusatomentosa*(196/ha), *Buteamonosperma* (192/ha), *Diospyrosmelanoxylon*(186/ha) and *Wrightiatinctoria*(151/ha). Similarly, the recruitments were 9,693 individuals with a density of 988/ha and a diversity value of 2.67. The dominant species were *Holarrhenapubscens* (204/ha), *Wrightiatinctoria* (149/ha), *Buteamonosperma* (130/ha), *Diospyrosmelanoxylon* (95/ha) and *Tectoniagrandis* (60/ha).

Comparatively, mature trees exhibited the maximum richness and the sapling the minimum richness.In the case of density and diversity, regenerations were higher than the others (recruitment and mature trees). It is often related to community dynamics, stability, productivity, integration and structure of forest (Enoki and Abe, 2004).

The richness, diversity and density of DDF is because of represented species and the auspicious environment (edaphic conditions, extent of area, availability of microhabitat and on-going disturbances) Givnish, 1999; Nagaike *et al.,* 2003. Simultaneously, the compositional changes among mature trees, seedling and sapling depend on microclimatic gradient and adjacent land use (Godefroid and Koedam, 2003).The seedling and sapling patterns of woody species are also affected by distribution pattern of mother tree, seed dispersion (Nanami *et al.,* 1999; Plotkin *et al.,* 2000), seed viability and site preferences of tree species (Enoki and Abe, 2004).

In addition, presence or absence of trees (i.e. adult stage) might be determined by the disturbance factors, slope and soil variables (i.e. early life stage) (Rodriguez *et al.,* 2005). Moreover, it has also been recorded that the seedling and sapling species were significantly affected by fire (Murthy *et al.,* 2002; Sukumar *et al.,* 1997), grazing, light density, canopy density, soil moisture, soil nutrients, other anthropogenic threats (Chauhan *et al.,* 2008) and internal community process (Barker and Patrik, 1994). The significance of soil variables has been proved already by Webb and Peart (2000) in the tropical Bornean rain forest and by Rodriguez *et al.* (2005) in Mexican tropical dry forest. Hence, it can be concluded that the response of plants to the above said heterogeneous factors may be crucial for determining the composition of trees, regenerations and recruitments in a community.

Transformation among mature trees, regenerations and recruitments

The results show that among the 94 tree species in the DDF, 26 species were under 'good' regeneration class, followed by 38 'fair', 4 'poor', 13 'none' species and 13 species appear to be 'new' to DDF of NGR (Table 6.8 and Figure 1).

The overall proportion between mature trees and regenerations in DDF was 1: 3.1 followed by mature trees and recruitments 1: 2.0 recruitments and mature trees 1: 1.5 in DDF (Table 2). In general, the overall regeneration capacity of DDF seems to be 'good' at present conditions (Annexure 1).

The number of species was more under the 'fair' regeneration class than the others. The reason behind this could be the low productivity and over exploitation of tree species for multiple utility (fuel wood, fodder, furnishing home, home stuffs, fruits, seeds) by local communities for their personal needs and selling (Joshua *et al.,* 2007). The use of natural resources at a pace greater than the pace of regeneration

together with of restorative effort in the natural ecosystem has resulted in the environmental maladies of most of the tree species (Khoshoo, 1988). The progression of the 'fair' regeneration classes can thus be explained.

Table 1: Status and diversity of mature trees, regenerations and recruitments in Dry Deciduous Forest of North Gujarat Region

DDF	Mature Tree	Regeneration	Recruitment
Family	35	32	31
Genus	57	52	50
Species	81	74	62
Total no of individual	7540	14709	9693
Density/ha	483	1500	988
Shannon Weaver index (H)	2.65	2.67	2.67
Establishment of tree species			
DDF	Mature tree → Regeneration	Mature tree →Recruitment	Recruitment → Mature tree
Species Ratio	1:3.1	1:2.0	1:1.5

The second dominant regeneration class was 'new'. In this class most of the listed tree species were specific to the particular microhabitat. This condition would be the result of the availability of resources at a particular season and its unavailability during the other seasons in the different forest types of NGR.

Few other species were recorded in 'none' category (the absence of regeneration and recruitment). This is due to less supportive microclimatic conditions. However, the factors *viz*. germinability, viability of seeds, presences and absences seeds, predators and seed dispersing agents also affect the regeneration and recruitments.

The landscape structure in NGR has largely been victimized to human activities. Most land use changes are caused by the intensive land use by human intervention, resource extraction and land clearing for agriculture. There are numerous examples of interactive effects of disturbance in forest ecosystems, particularly following transformative change (Clarke and Schedvin, 1999; Schefler *et al.*, 2001). Alteration of disturbance regimes results in shifts in species composition, with the loss of less tolerant native species, a decrease in native diversity and increase in the exotic diversity (Mcintyre and Lavorel, 1994; Prieur-Richard and Lavorel, 2000). This fundamentally alters the structure and function of the ecosystem (Groves and Burdon, 1986; Bridgewater, 1990, Michael, 1994).

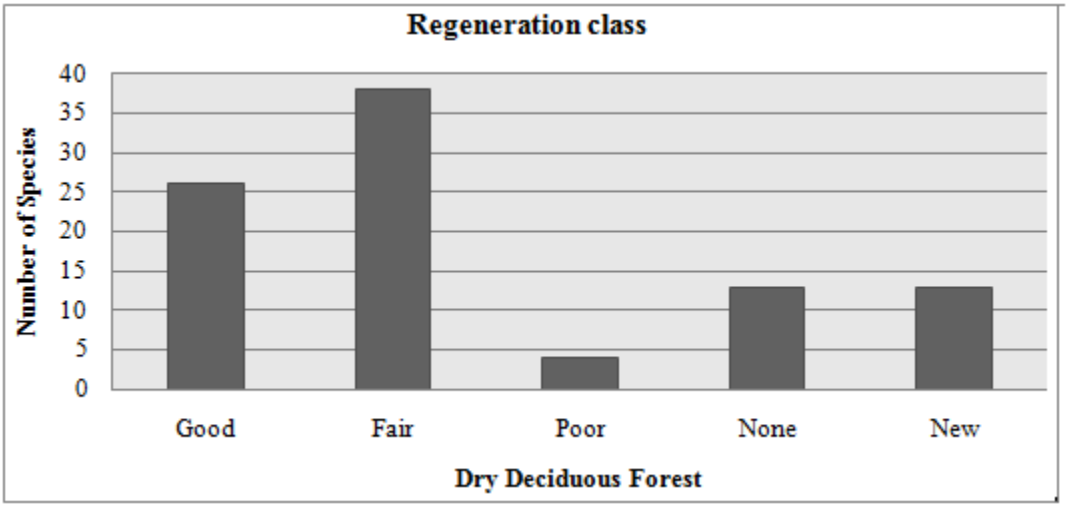

Figure 1: Regeneration class of different forest types of North Gujarat Region

On-going disturbance and human interventions in NGR fragments the wooded habitats. Due to this, the determination in species richness, poor regeneration, low establishments and absence of new individuals of tree species were recorded in a DDF of NGR. So the conservation of native species, restriction of many fragments and improvement of forest remnants would provide the natural colonization and regeneration of the original vegetation. The area needs proper fortification, creation of series, protected area or regeneration plots for at least certain period. It would help, the locally important species to adapt those environments to retain their originality for a long time and NGR would clutch on to the natural mechanism of restoration.

CONCLUSION

Changes in composition of trees, regenerations and recruitments are obvious amongthe different habitats present in DDF.

The numbers of regenerations and recruitments are more against trees present in DDF.

Human related disturbance in DDF supports the dominance and establishments of invasive and alien species, which destabilize the native species and its regeneration potential.

The conservation of native species of DDFis one of the important conservation strategies through the creation of series, protected area or regeneration plots for at least certain period. It will restore the uniqueness of DDF and improve the vegetative cover.

Annexure -1: List of tree species recorded from Dry Deciduous Forest of North Gujarat Region

S. No	Scientific Name	M-1	RC-1	RE-1	M-2	RC-2	RE-2	RE/M	RC/M	RE/RC	RE C
1	Acacia auriculiformis Cunn. ex Benth.	0	**0**	12	0.0	0.0	1.2	0.00	0.00	0.00	New
2	Acacia catechu (L. f.) Willd.	25	89	180	1.6	9.1	18.4	11.46	5.67	2.02	Good
3	Acacia chundra (Roxb. ex Rottler.) Willd.	7	0	0	0.4	0.0	0.0	0.00	0.00	0.00	None
4	Acacia farnesiana(L.)Willd.	3	0	0	0.2	0.0	0.0	0.00	0.00	0.00	None
5	Acacia leucophloea (Roxb.) Willd.	11	39	41	0.7	4.0	4.2	5.93	5.64	1.05	Good
6	Acacia nilotica (L.) Del. subsp. Indica(Bth.) Brenan.	25	29	10	1.6	3.0	1.0	0.64	1.85	0.34	Fair
7	Acacia raddianaSavi.	244	207	203	15.6	21.1	20.7	1.32	1.35	0.98	Fair
8	Acacia senegal(L.) Willd.	0	5	8	0.0	0.5	0.8	0.00	0.00	1.60	New
9	Adina cordifolia (Willd. ex Roxb.) Hook. f. ex Brandis.	50	5	7	3.2	0.5	0.7	0.22	0.16	1.40	Fair
10	Aeglemarmelos(L.) Corr.	120	243	379	7.7	24.8	38.6	5.03	3.22	1.56	Good
11	Ailanthus excelsaRoxb.	1	0	0	0.1	0.0	0.0	0.00	0.00	0.00	None
12	Alangium salvifolium (L. f.) Wangerin	251	287	168	16.1	29.3	17.1	1.07	1.82	0.59	Fair
13	Albizialebbeck(L.) Benth.	2	0	2	0.1	0.0	0.2	1.59	0.00	0.00	Fair
14	Albizia odoratissima (L. f.) Benth.	12	42	506	0.8	4.3	51.6	67.10	5.57	12.05	Good
15	AnnonasquamosaL.	0	20	0	0.0	2.0	0.0	0.00	0.00	0.00	New

16	Anogeissus latifolia (Roxb. ex DC.) Wall. exGuill. &Perr.	356	248	476	22.8	25.3	48.5	2.13	1.11	1.92	Good
17	AnogeissuspendulaEdgew.	90	230	311	5.8	23.5	31.7	5.50	4.07	1.35	Good
18	Anogeissus sericea Brandis var. nummularia King ex Duthie	1	0	10	0.1	0.0	1.0	15.91	0.00	0.00	Fair
19	AzadirachataindicaA. Juss.	10	7	51	0.6	0.7	5.2	8.12	1.11	7.29	Good
20	Balanitesaegyptiaca (L.) Del.	9	7	6	0.6	0.7	0.6	1.06	1.24	0.86	Fair
21	Bauhinia purpureaL.	2	0	1	0.1	0.0	0.1	0.80	0.00	0.00	Fair
22	Bauhinia racemosa Lam.	16	23	32	1.0	2.3	3.3	3.18	2.29	1.39	Good
23	BombaxceibaL.	17	9	10	1.1	0.9	1.0	0.94	0.84	1.11	Fair
24	Bauhinia variegataL.	0	0	5	0.0	0.0	0.5	0.00	0.00	0.00	New
25	Boswellia serrata Roxb. ex Cocls.	48	2	51	3.1	0.2	5.2	1.69	0.07	25.50	Fair
26	Brideliaretusa (L.) Spreng.	4	3	1	0.3	0.3	0.1	0.40	1.19	0.33	Fair
27	Buteamonosperma(Lam.) Taub.S	826	1278	1882	52.9	130.3	191.9	3.63	2.46	1.47	Good
28	Capparisgrandis L. f.	6	6	2	0.4	0.6	0.2	0.53	1.59	0.33	Fair
29	CasearíaellipticaWilld.	1	0	1	0.1	0.0	0.1	1.59	0.00	0.00	Fair
30	Cassia fistula L.	50	65	104	3.2	6.6	10.6	3.31	2.07	1.60	Good
31	Cassia roxburghiiDC.	2	0	0	0.1	0.0	0.0	0.00	0.00	0.00	None
32	Clerodendrummultiflorum(Burm. f.) O. Ktez.	7	15	5	0.4	1.5	0.5	1.14	3.41	0.33	Fair
33	CordiadichotomaForst. f.	0	1	1	0.0	0.1	0.1	0.00	0.00	1.00	New
34	Cordiaperrottetii Wt.	0	6	4	0.0	0.6	0.4	0.00	0.00	0.67	New
35	CordiasebestenaL.	1	0	3	0.1	0.0	0.3	4.77	0.00	0.00	Fair
36	Crateva nurvala Buch.-Ham. Var. nurvala.	5	9	37	0.3	0.9	3.8	11.78	2.86	4.11	Good
37	DalbergialatifoliaRoxb.	7	6	65	0.4	0.6	6.6	14.78	1.36	10.83	Good
38	DalbergiapaniculataRoxb.	8	13	2	0.5	1.3	0.2	0.40	2.59	0.15	Fair
39	Derris indica (Lam.) Bennet.	17	17	8	1.1	1.7	0.8	0.75	1.59	0.47	Fair
40	DiospyroschloroxylonRoxb.	1	0	1	0.1	0.0	0.1	1.59	0.00	0.00	Fair
41	DiospyrosmelanoxylonRoxb.	1251	936	1824	80.2	95.4	186.0	2.32	1.19	1.95	Good
42	EhretialaevisRoxb.	19	41	71	1.2	4.2	7.2	5.95	3.43	1.73	Good
43	EmblicaofficinalisGaertn.	6	6	35	0.4	0.6	3.6	9.28	1.59	5.83	Good

44	Erythrina variegata L. var. orientalis (L.) Merr.	0	1	0	0.0	0.1	0.0	0.00	0.00	0.00	New
45	Feronialimonia(L.) Swingle	15	6	9	1.0	0.6	0.9	0.95	0.64	1.50	Fair
46	FicusbenghalensisL. var.benghalensis	11	0	0	0.7	0.0	0.0	0.00	0.00	0.00	None
47	FicusracemosaL.	30	0	12	1.9	0.0	1.2	0.64	0.00	0.00	Fair
48	FicusreligiosaL.	4	0	0	0.3	0.0	0.0	0.00	0.00	0.00	None
49	Firmianacolorata(Roxb.) R. Br.	1	0	0	0.1	0.0	0.0	0.00	0.00	0.00	None
50	Flacourtia indica (Burm. f.) Merrill	4	9	18	0.3	0.9	1.8	7.16	3.58	2.00	Good
51	FlacourtiamontanaGrah.	13	84	149	0.8	8.6	15.2	18.24	10.28	1.77	Good
52	Gardenia turgida Roxb. var. Turgida	0	0	3	0.0	0.0	0.3	0.00	0.00	0.00	New
53	Garuga pinnata Roxb. Hort. Beng.	0	0	2	0.0	0.0	0.2	0.00	0.00	0.00	New
54	GmelinaarboreaRoxb.	4	1	0	0.3	0.1	0.0	0.00	0.40	0.00	Poor
55	Holarrhenapubscens(Buch.-Ham.) Wall. ex G. Don	479	1997	3224	30.7	203.6	328.7	10.71	6.63	1.61	Good
56	Holopteleaintegrifolia (Roxb.) Planch.	78	577	311	5.0	58.8	31.7	6.34	11.77	0.54	Fair
57	Hymenodictyonexcelsum (Roxb.) Wall.	2	0	2	0.1	0.0	0.2	1.59	0.00	0.00	Fair
58	Ixora arborea Roxb. ex J. E. Sm	1	0	0	0.1	0.0	0.0	0.00	0.00	0.00	None
59	Lagerstroemia lanceolata Wall.	7	3	10	0.4	0.3	1.0	2.27	0.68	3.33	Fair
60	Lanneacoromandelica(Houtt.) Merrill	187	71	156	12.0	7.2	15.9	1.33	0.60	2.20	Fair
61	Madhuca indica J. F. Gmelin	23	2	25	1.5	0.2	2.5	1.73	0.14	12.50	Fair
62	Manilkarahexandra(Roxb.) Dub.	1	0	1	0.1	0.0	0.1	1.59	0.00	0.00	Fair
63	Maytenusemarginatus(Willd.) Ding Hou	18	37	37	1.2	3.8	3.8	3.27	3.27	1.00	Fair
64	Miliusa tomentosa (Roxb.) J. Sinclair	295	577	1922	18.9	58.8	196.0	10.37	3.11	3.33	Good
65	Mitragynaparvifolia(Roxb.) Korth.	23	32	63	1.5	3.3	6.4	4.36	2.21	1.97	Good
66	Morinda tomentosa Heyne ex Roth	9	4	0	0.6	0.4	0.0	0.00	0.71	0.00	Poor
67	Moringa concanensis Nimmo ex Dalz. &Gibs.	3	1	2	0.2	0.1	0.2	1.06	0.53	2.00	Fair
68	Oroxylumindicum(L.) Vent.	1	3	0	0.1	0.3	0.0	0.00	4.77	0.00	Poor
69	Phoenix dactylifera L.	1	0	0	0.1	0.0	0.0	0.00	0.00	0.00	None

70	Phoenix sylvestris (L.) Roxb.	7	27	46	0.4	2.8	4.7	10.46	6.14	1.70	Good
71	SapindusemarginatusVahl	6	4	5	0.4	0.4	0.5	1.33	1.06	1.25	Fair
72	SapinduslaurifoliusVahl	5	0	7	0.3	0.0	0.7	2.23	0.00	0.00	Fair
73	Schleicheraoleosa(Lour.) Oken.	3	0	0	0.2	0.0	0.0	0.00	0.00	0.00	None
74	SchreberaswieteinoidesRoxb.	3	0	1	0.2	0.0	0.1	0.53	0.00	0.00	Fair
75	Soymida ferbrifuga (Roxb.) A. Juss.	4	4	11	0.3	0.4	1.1	4.38	1.59	2.75	Good
76	SterculiaurnesRoxb.	1	2	29	0.1	0.2	3.0	46.15	3.18	14.50	Good
77	Strychnospotatorum L.	4	0	0	0.3	0.0	0.0	0.00	0.00	0.00	None
78	Syzygiumcumini(L.) Skeels	1	0	5	0.1	0.0	0.5	7.96	0.00	0.00	Fair
79	Syzygiumheyneanum (Duthie) Wall. ex Gamble	3	0	0	0.2	0.0	0.0	0.00	0.00	0.00	None
80	Syzygiumrubicundum W. & A.	1	2	0	0.1	0.2	0.0	0.00	3.18	0.00	Poor
81	TamarindusindicaL.	4	0	15	0.3	0.0	1.5	5.97	0.00	0.00	Fair
82	Tecomellaundulata(Sm.) Seem.	0	1	0	0.0	0.1	0.0	0.00	0.00	0.00	New
83	Tectoniagrandis L. f.	500	586	83	32.0	59.8	8.5	0.26	1.87	0.14	Fair
84	Terminalia arjuna (Roxb. ex DC.) Waight&Arn.	0	0	10	0.0	0.0	1.0	0.00	0.00	0.00	New
85	Terminaliabellirica(Gaertn.) Roxb.	51	23	48	3.3	2.3	4.9	1.50	0.72	2.09	Fair
86	Terminaliachebula(Gaertn.) Retz.	3	0	0	0.2	0.0	0.0	0.00	0.00	0.00	None
87	TerminaliacrenulataRoth	52	132	248	3.3	13.5	25.3	7.59	4.04	1.88	Good
88	VitexnegundoL.	0	27	1	0.0	2.8	0.1	0.00	0.00	0.04	New
89	VitextrifoliaL.	0	0	4	0.0	0.0	0.4	0.00	0.00	0.00	New
90	Wrightiaarborea(Denst.) Mabb.	44	9	29	2.8	0.9	3.0	1.05	0.33	3.22	Fair
91	Wrightiatinctoria(Roxb.) R. Br.	2001	1462	1481	128.2	149.1	151.0	1.18	1.16	1.01	Good
92	Zizyphus glabrata Heyne ex Roth.	2	8	1	0.1	0.8	0.1	0.80	6.37	0.13	Fair
93	Zizyphusmauritiana Lam.	119	79	206	7.6	8.1	21.0	2.75	1.06	2.61	Good
94	Zizyphusxylopyra(Retz.) Willd.	5	28	18	0.3	2.9	1.8	5.73	8.91	0.64	Fair
	Total	**7540**	**9693**	**14709**	**483.2**	**988.4**	**1499.9**	**3.1**	**2.0**	**1.5**	**Good**

M – Mature Tree; RE – Regeneration; RC – Recruitment; 1– Abundance (Number of Individuals); 2 – Density/ha; REC - Regeneration Category

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