FOREST RESOURCE SURVEY OF CHHOTAUDEPUR FOREST DIVISION, GUJARAT STATE WITH SPECIAL REFERENCE TO TREES

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Introduction

It was in the year of 1967 that a detailed survey Anon. (1972) of Forest Resources was conducted in Gujarat State by the forest department. Tree species, their number in different girth classes, their total number and density, percentage of species and volume occupied by different girth classes could be known at that time from the survey. Since then, almost forty years have passed. There has been lot of changes in composition of forests as a result of increasing influence of abiotic and biotic pressure. There is no current assessment of forest resource. Survey of Forest Resource was, therefore, taken up. Chhotaudepur Forest Division was selected for the study. The trees were enumerated during the survey.

Study area

Chhotaudepur Forest Division falls in Vadodara District of Gujarat State. The district is surrounded on east by Jhabua District of Madhya Pradesh on south by Khandesh District of Maharashtra and Narmada District. On north, lies Dahod District, on west side lies Bharuch District. The total geographical area of the district is 7,54,900 ha. It consists of 7 talukas which are constituted in nine forest ranges. Administratively, Chhotaudepur taluka covers three forest ranges, which are Chhotaudepur, Dolariya and Rangpur. Kawant taluka covers two forest ranges i.e. Panvad and Kawant. Naswadi taluka covers two forest ranges i.e. Naswadi and Boriyad. While Vadodara, Vaghodia, Padra and Sankheda taluka collectively form Vadodara Forest Range. The forest area of Chhotaudepur Division is 75,349 ha which is 9.98 % of geographical area of the district. North east of the division falls into 5A/ cib Dry Teak forest type. Teak is the major species there. South east of the division falls under type 5A/C3 southern dry mixed deciduous forests. Major portion of the area is alluvium of recent origin. Soil in general is sandy. In hilly areas it is very shallow and poor in nutrients. In most of the area heavy grazing and unauthorized cultivation has further deteriorated the quality of the soil. Climate is subtropical. Seasonal variations in temperature are very wide. The temperature ranges 9°C in winter to 46°C in summer. The average annual rainfall of the area is 1327 mm. Winds are generally light in post monsoon and winter months and increase in strength during summer and monsoon season (Agarwal *et al.*, 2003).

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Methodology

The stratified random sampling method was adopted for selecting the villages in the division Chacko (1965). The total forest area of 75,349 ha of the division consisting of 401 villages was stratified in 58 strata on the basis of density of the forests. From each stratum one sample village was taken up for the study. Thus total 58 villages out of 401 villages i.e. 14.46% of villages were studied having total area of 17387.13 ha, which makes 23.08 % of divisional area. Ten percent of it i.e. 1738.17 ha was physically surveyed on ground, which makes 2.31% area of the division (Table 1). The survey was done from November 2004 to March 2005. Trees were enumerated laying 20 metres wide strips at an interval of 200 metres thus enumerating 10% of the area in each village. A base line running along the general direction of the contour was first drawn up on the map and then in the field, passing through such a point which could be easily located in the field and cruise lines were drawn 200 metres at right angles to the base line. Trees on 10 metres on both the sides of the cruise lines were counted and noted in the strip enumeration form according to their girth class. The form was changed at every 250 metres length in the strip. Thus, 10% of the total forest area of each village was enumerated. The samples of different parts of tree species encountered in the strips and nearby were also collected, identified by scientific names, Cook (1901-1908), (Patel, 1984 and Shah, 1978) and their herbarium was also prepared for reference.

The data was analyzed. Strip wise, species wise and girth wise data of each surveyed village was computerized. Total stock of each village was calculated. It was then extrapolated to get the data of strata. The data of all strata were combined to get species wise and girth-wise total stock for range and similarly for the Division as a whole. Density i.e. number of trees per ha, percentage distribution of total stock of a species over different girth classes and percentage of a stock of a species in a girth class to the total stock in that particular girth class were also calculated. Species wise stock position was also analyzed with respect to above all parameters. For species wise stock position analysis, the species were divided into two groups i.e. group 'A' and group 'B'. All important species having economic importance were grouped in group 'A' while rest of the species were grouped in group 'B'.

The present data was taken up for comparison with that of 1967, already in the records[1]. Out of 58 villages taken up for the present study, 21 villages (5.23% of total villages) having total area of 7666.46 ha (10.17% of total forest area), distributed in 7 ranges of the division and having almost the same area and boundaries, as in 1967 (Table 2) were taken up for comparison of total stock and other associated parameters so as to know the change, taken place in a span of forty years.

Comparison of present stock density was made with normal stock density for different ranges and the division so as to know the percent of space occupied by the present stock. Present stock density of 0-30 cm girth class was considered as young girth class density, while that of 31-60 cm girth class was considered as middle girth class density. All other higher classes from 61 cm and above were merged into a single mature girth class alongwith their stock density called as higher girth class stock density. For comparing the present stock density with the normal stock

Table 1

Range wise total number of villages, their area, per cent, the number of surveyed villages, their area, per cent, strip area and per cent

Sr. No.	Range	Total number of Villages	Area of all Villages	Per cent of area of the ranges	Number of surveyed Villages	Per cent of surveyed Villages	Total area of surveyed Villages	Per cent of surveyed area of Villages	Physically surveyed strips area of the Villages	Per cent of physically surveyed strips area of the Villages
1	Boriyaad	61	6709.6	8.9	5	8.2	1195.18	17.81	119.518	1.78
2	Chhotaudepur	46	10000.58	13.27	11	23.91	3440.09	34.4	344.009	3.44
3	Dolariya	28	7424.93	9.85	6	21.43	3348.4	45.1	334.84	4.51
4	Kawant	20	10068.62	13.36	3	15	888.88	8.83	88.888	0.88
5	Naswadi	45	8994.72	11.94	6	13.33	1486.81	16.53	148.681	1.65
6	Panvad	50	5898.63	7.83	7	14	1129.44	19.15	112.944	1.91
7	Pavijetpur	76	12820.64	17.02	10	13.16	3561.47	27.78	356.147	2.78
8	Rangpur	46	8353.37	11.09	5	10.87	1087.41	13.02	108.741	1.3
9	Vadodara	29	5077.58	6.74	5	17.24	1249.45	24.61	124.945	2.46
	Total Area	401	75348.67	100	58	14.46	17387.13	23.08	1738.713	2.31

Table 2

Range wise list of villages taken up for comparison of stock of 1967 and 2005 alongwith their area in both the years.

Sl. No.	Range	Village	Area (ha)	
			1967	2005
1	Chhotaudepur	Badvav	79.45	73.46
2		Gabadiya	526.28	523.43
3		Luni	93.75	93.75
4		Runwad	275.10	273.89
5	Dolariya	Dhadagam	1507.73	1498.90
6		Gadola	409.93	409.00
7		Jamli	567.98	566.22
8		Mithibor	399.87	399.87
9	Kawant	Kakanpur	166.23	160.30
10		Khasra	228.81	227.15
11	Panvad	Kharamda	161.63	161.63
12	Pavijetpur	Bordha	894.60	867.57
13		Dhanpur	228.33	224.10
14		Kalarani	296.30	296.47
15		Karali	124.41	124.41
16		Mudhiyari	446.10	446.50
17	Rangpur	Bandla	216.02	215.71
18	Vadodara	Dharola	459.62	459.00
19		Kothiya	95.02	95.18
20		Songir	189.26	189.27
21		Zand	360.65	360.65
	Total		7727.07	7666.46

density, in above three classes, published yield Table data of Teak was taken as a base for normality[5,6].

Total growing stock in terms of volume per ha for different species in different girth classes was also calculated. Published data on general volume Tables available for different species was taken as the basis of calculation. For the species for which no such data was available, available data of comparable species was taken as the basis of calculation considering the general rate of growth of such species. Where negligible volumes were expected from a species, the data on volume was ignored. After calculating species wise volume of the growing stock, calculations were made for the division[5,7,8].

Results

Area wise as well as species wise stock position in 2005, area wise growing stock in terms of density and volume, comparison of present stock with that of 1967, is discussed below one by one.

Total stock of trees in Chhotaudepur Forest Division is 3,40,34,667, out of which 2,58,52,498 trees are in 0-30 cm girth class, 57,42,962 trees are in 31-60 cm girth class, 15,75,425 trees are in 61-90 cm girth class, 4,78,429 trees are in 91-120 cm girth class, 2,17,518 trees are in 121-150 cm girth class and 1,67,835 trees are in 150 cm and above girth class. Thus, the numbers of trees in young girth class are more than that in higher girth-class. Among different ranges, maximum numbers of trees occur in the Pavijetpur Range (70,21,537), followed by Chhotaudepur Range (65,40,311), Vadodara Range (46,03,181). Minimum number of trees are in Boriyaad Range (10,30,553) (Table 3).

Data of density has revealed that Division has density 451.70 trees per ha. Maximum density lies in 0-30 cm girth class, which is 343.10 trees per ha. It is only 76.22 trees per ha in 31-60 cm girth class, 20.91 trees per ha in 61-90 cm girth class, 6.35 trees per ha in 91-120 cm girth class, 2.89 trees per ha in 121-150 cm girth class and only 2.23 trees per ha in more than 150 cm girth class. Among the ranges, density varies from 906.57 trees per ha to 153.59 trees per ha. Maximum density of tree is in Vadodara range i.e. 906.57 trees per ha. Highest density is in girth classes of 0-30 cm, 31-60 cm and 61-90 cm in the range contributes towards it. In higher girth classes i.e. 61-90 cm, 91-120 cm and 150 cm and above maximum density is in Dolariya range compared to other ranges (Table 4).

Table 3

Range-wise total stocks in different girth classes.

Sl. No.	Range	Total number of trees in different girth classes						Year 2005
		Girth classes (cm)						
		0-30	31-60	61-90	91-120	121-150	151 and above	Total
1	Pavijetpur	5502770	1176425	231722	73192	25945	11483	7021537
2	Chhotaudepur	5609103	516571	230481	93841	50205	40110	6540311
3	Vadodara	2876494	1339318	322005	39407	10299	15657	4603181
4	Kawant	3236285	408452	38997	8550	4542	8862	3705689
5	Dolariya	1739755	737503	366663	163196	62785	63501	3133403
6	Panvad	2452779	298664	13404	1057		990	2766894
7	Naswadi	1648979	672521	253405	56032	7829	2422	2641188
8	Rangpur	2053591	402704	40778	26954	48682	19202	2591911
9	Boriyaad	732742	190803	77970	16199	7231	5608	1030553
	Total of Divisions	25852498	5742962	1575425	478429	217518	167835	34034667

Table 4

Range wise stock density (trees per ha) in different girth classes

Sl. No.	Range	Number of trees in different girth classes						Year 2005
		Girth classes (cm)						
		0-30	31-60	61-90	91-120	121-150	151 and above	Total
1	Pavijetpur	429.21	91.76	18.07	5.71	2.02	0.90	547.67
2	Chhotaudepur	560.88	51.65	23.05	9.38	5.02	4.01	653.99
3	Vadodara	566.51	263.77	63.42	7.76	2.03	3.08	906.57
4	Kawant	321.42	40.57	3.87	0.85	0.45	0.88	368.04
5	Dolariya	234.31	99.33	49.38	21.98	8.46	8.55	422.01
6	Panvad	415.82	50.63	2.27	0.18	0.00	0.17	469.07
7	Naswadi	183.33	74.77	28.17	6.23	0.87	0.27	293.64
8	Rangpur	245.84	48.21	4.88	3.23	5.83	2.30	310.28
9	Boriyaad	109.21	28.44	11.62	2.41	1.08	0.84	153.59
	Total of Divisions	343.10	76.22	20.91	6.35	2.89	2.23	451.70

At division level 75.96 % of the stock lies in only 0-30 girth class. In 61-90 cm girth class it is only 16.87 %. Rest of the stock i.e. 7.17% lies in higher girth class above 61 cm. In Pavijetpur, Chhotaudepur, Kawant Panvad, Rangpur and Boriyaad Ranges much more percentage of stock lies in lower girth classes only. Stock is well distributed over different girth classes only in Dolariya Range followed by Vadodara and Naswadi. In Panvad and Dolariya Ranges, graphical form of data is more or less 'J' shaped. The Dolariya Range is an interior range and its stock seems to be very close to natural, undisturbed and virgin forest (Table 5).

The percentage of stock of a species in a girth class to the total stock in that particular girth class in the division and in different ranges was calculated. More than 60% of total stock in 0-30 cm girth class lies in Pavijetpur, Chhotaudepur, Vadodara and Kawant Ranges. Higher coverage under plantations in the recent years and effective protection from grazing in these ranges seem to be the main reason. In 31-60 cm and also in 61-90 cm girth classes more than 60% stock lies in Pavijetpur, Vadodara, Dolariya and Naswadi Ranges. In 91-120 cm girth class more than 70% stock lies in Pavijetpur, Chhotaudepur, Dolariya and Naswadi. In 121-150 and above more than 70% stock lies in Dolariya, Chhotaudepur and Rangpur Ranges only. It shows that these ranges could preserve more trees in higher diameter classes with respect of time (Table 6).

Species wise stock position in year 2005

The total number of tree species in the division was 133.

Out of these thirty eight species having economic importance were grouped in

Table 5

Range-wise percentage of stock over different girth classes

Sl. No.	Range	Percentage of stock						Year 2005
		Girth classes (cm)						
		0-30	31-60	61-90	91-120	121-150	151 and above	
1	Pavijetpur	78.37	16.75	3.30	1.04	0.37	0.16	100.00
2	Chhotaudepur	85.76	7.90	3.52	1.43	0.77	0.61	100.00
3	Vadodara	62.49	29.10	7.00	0.86	0.22	0.34	100.00
4	Kawant	87.33	11.02	1.05	0.23	0.12	0.24	100.00
5	Dolariya	55.52	23.54	11.70	5.21	2.00	2.03	100.00
6	Panvad	88.65	10.79	0.48	0.04		0.04	100.00
7	Naswadi	62.43	25.46	9.59	2.12	0.30	0.09	100.00
8	Rangpur	79.23	15.54	1.57	1.04	1.88	0.74	100.00
9	Boriyaad	71.10	18.51	7.57	1.57	0.70	0.54	100.00
	% of Division	75.96	16.87	4.63	1.41	0.64	0.49	100.00

Table 6

Range wise percentage of stock in different girth classes to the total stock in that particular girth class.

Sl. No.	Range	Percentage of stock						Year 2005
		Girth classes (cm)						
		0-30	31-60	61-90	91-120	121-150	151 and above	
1	Pavijetpur	21.29	20.48	14.71	15.30	11.93	6.84	20.63
2	Chhotaudepur	21.70	8.99	14.63	19.61	23.08	23.90	19.22
3	Vadodara	11.13	23.32	20.44	8.24	4.73	9.33	13.52
4	Kawant	12.52	7.11	2.48	1.79	2.09	5.28	10.89
5	Dolariya	6.73	12.84	23.27	34.11	28.86	37.84	9.21
6	Panvad	9.49	5.20	0.85	0.22		0.59	8.13
7	Naswadi	6.38	11.71	16.08	11.71	3.60	1.44	7.76
8	Rangpur	7.94	7.01	2.59	5.63	22.38	11.44	7.62
9	Boriyaad	2.83	3.32	4.95	3.39	3.32	3.34	3.03
	% of Division	100.00	100.00	100.00	100.00	100.00	100.00	100.00

group 'A'. The details for group 'B' species are not given species wise. Only total number of plants in different girth classes is given. The details of species wise number of trees in different girth classes in mentioned in Table 7.

Table 7

Species wise total stock in different girth classes

Sl. No.	Species	Number of trees in different girth classes						Year 2005
		Girth classes (cm)						
	Group 'A'	0-30	31-60	61-90	91-120	121-150	151 and above	Total
1.	*Acacia catechu* Wild.	557952	79184	10245	1859	698	750	650688
2.	*Acacia nilotica* (L.) Del.	266817	12097	2836	1206		258	283213
3.	*Adina cordifolia* (Roxb.) Bth. and Hk. f. ex Brand.	1928	1588	340	109	298	234	4498
4.	*Aegle marmelos* (L.) Corr.	97922	41352	12755	1948	467	1035	155480
5.	*Albizia procera* (Roxb.) Bth.	45649	10787	4374	1279	739	410	63237
6.	*Annona squamosa* L.	678815	5070	111				683997
7.	*Anogeissus latifolia* (Roxb.) Wall. ex Bedd.	1380286	426726	125969	18977	4572	2182	1958711
8.	*Azadirachta indica* A. Juss.	439447	34264	6673	2171	1444	874	484872
9.	*Bauhinia racemosa* Lam.	37350	6693	389	342	206		44980
10.	*Bombax ceiba* L.	31584	12665	7871	2028	1244	1228	56621
11.	*Borassus flabellifer* L.	4103	1019	819	2405	2029	1988	12363
12.	*Boswellia serrata* Roxb.	124977	116749	96555	48150	13932	6506	406869
13.	*Buchanania lanzan* Spr.	114694	49167	15686	5444	1150	728	186869
14.	*Butea monosperma* (Lam.) Taub.	2951341	538530	126099	39507	6043	2143	3663663
15.	*Cassia fistula* L.	40711	22016	7723	1117	289	218	72075
16.	*Dalbergia sissoo* Roxb.	31532	16824	8581	2431	436	157	59963
17.	*Diospyrus melanoxylon* Roxb.	2610660	234289	44118	10655	3741	1892	2905354
18.	*Emblica officinalis* Gaertn.	82095	2059	424	58		60	84695
19.	*Gmelina arborea* L.	54012	3424	683	42			58162
20.	*Holoptelia integrefolia* (Roxb.) Planch.	274605	73928	20129	5058	1204	1104	376027
21.	*Lagerstroemia parviflora* Roxb.	2940364	814915	192902	32468	5251	4036	3989935

contd. ...

Sl. No.	Species	Number of trees in different girth classes						Year 2005
		Girth classes (cm)						
	Group 'A'	0-30	31-60	61-90	91-120	121-150	151 and above	Total
22.	*Lannea coromandelica* (Houtt.) Herrill	203637	181078	118786	53321	14744	6413	577979
23.	*Madhuca indica* J. F. Gmel.	34296	16895	28289	54427	92900	92576	319383
24.	*Miliusa tomentosa* (Roxb.) Sinclair	351707	121899	30633	7926	2191	834	515189
25.	*Mitragyna parvifolia* (Roxb.) Korth.	68322	35503	20417	10590	3713	3984	142529
26.	*Morinda tomentosa* Heyne ex Roth	1303484	329847	71224	8255	892	1211	1714913
27.	*Ougeinia oogeinensis* (Roxb.) Hochreut.	19194	8801	2658	554		309	31516
28.	*Pongamia pinnata* (L.) Pierre	39440	18380	5932	1135	852	332	66071
29.	*Pterocarpus marsupium* Roxb.	11439	6271	1997	739	612	370	21427
30.	*Schleichera oleosa* (Lour.) Oken.	152736	106619	51313	18512	7468	2890	339539
31.	*Sterculia urens* Roxb.	29887	9106	2702	907	105		42706
32.	*Syzygium cumini* (L.) Skeels	22083	6919	5480	2871	1984	2007	41343
33.	*Tamarindus indica* L.	110235	5248	3556	1384	629	510	121563
34.	*Tectona grandis* L. f.	4361844	1385209	280462	67506	18166	8879	6122066
35.	*Terminalia bellirica* (Gaertn.) Roxb	30005	30821	22467	7838	3647	2543	97321
36.	*Terminalia crenulata* Roth.	870777	321614	87402	21444	7499	3690	1312425
37.	*Wrightia tinctoria* R. Br.	2030636	252839	39576	6307	1205	993	2331556
38.	*Zizyphus mauritiana* Lam.	215778	7481	1175	244			224678
	Group A total	22622344	5347876	1459351	441214	200350	153344	30224476
	Group B total	3230154	395086	116074	37215	17168	14491	3810188
	Division total	25852498	5742962	1575425	478429	217518	167835	34034667

The results indicated that 3.02 crores trees (i.e. 88.80% of total) lie in group 'A' while 38.10 lakh tress lie in group 'B'. In group 'A', maximum stock is of *Tectona grandis*, followed by *Lagerstroemia parviflora, Butea monosperma, Diospyrus melanoxylon, Wrightia tinctoria*, and *Anogeissus latifolia* etc. In all girth classes, *Tectona grandis* is remarkably performing well than other species. *Lagerstroemia parviflora* is also showing the same pattern. In higher girth classes *Madhuca indica* trees are performing better. (Table 7).

In group 'A' total density is very high i.e. 401.13. It is also high in 0-30 cm girth class where it is 300.24. Total density is maximum of *Tectona grandis* (81.25), followed by *Lagerstroemia parviflora* (52.95), *Butea monosperma* (48.62), *Diospyros melanoxylon* (38.56), *Wrightia tinctoria* (30.94), *Anogeissus latifolia* (26.00), *Morinda tomentosa* (22.76), *Terminalia crenulata* (17.42), *Annona squamosa* (9.08), *Acacia catechu* (8.64). In 0-30 cm girth class order of density is: *Tectona grandis* (57.89) followed by *Butea monosperma* (39.17), *Lagerstroemia parviflora* (39.02). In 31-60 cm density of *Tectona grandis* (18.38) is again more followed by *Lagerstroemia parviflora* (10.82), *Butea monosperma* (7.15). In 61-90 cm girth class density of *Tectona grandis* (3.72) is again more followed by *Lagerstroemia parviflora* (2.56), *Butea monosperma* (1.67) etc. In 91-120 cm girth class situation changes. Though density of *Tectona grandis* (0.90) is more but it is followed by *Madhuca indica* (0.72), *Boswellia serrata* (0.64). In 121-150 cm girth class density of *Madhuca indica* (1.23) is maximum followed by *Tectona grandis* (0.24), *Lannea coromandelica* (0.20). In more than 150 cm girth class density of *Madhuca indica* (1.23) is maximum followed by *Tectona grandis* (0.12), *Lannea coromandelica* and *Boswellia serrata* (0.09) (Table 8).

Table 8

Species wise stock density (trees per ha) in different girth classes

Sl. No.	Species	Number of trees in different girth classes						Year 2005
		Girth classes (cm)						
	Group 'A'	0-30	31-60	61-90	91-120	121-150	151 and above	Total
1.	*Acacia catechu* Wild.	7.40	1.05	0.14	0.02	0.01	0.01	8.64
2.	*Acacia nilotica* (L.) Del.	3.54	0.16	0.04	0.02		0.00	3.76
3.	*Adina cordifolia* (Roxb.) Bth. and Hk. f. ex Brand.	0.03	0.02	0.00	0.00	0.00	0.00	0.06
4.	*Aegle marmelos* (L.) Corr.	1.30	0.55	0.17	0.03	0.01	0.01	2.06
5.	*Albizia procera* (Roxb.) Bth.	0.61	0.14	0.06	0.02	0.01	0.01	0.84
6.	*Annona squamosa* L.	9.01	0.07	0.00				9.08
7.	*Anogeissus latifolia* (Roxb.) Wall. ex Bedd.	18.32	5.66	1.67	0.25	0.06	0.03	26.00
8.	*Azadirachta indica* A. Juss.	5.83	0.45	0.09	0.03	0.02	0.01	6.44
9.	*Bauhinia racemosa* Lam.	0.50	0.09	0.01	0.00	0.00		0.60
10.	*Bombax ceiba* L.	0.42	0.17	0.10	0.03	0.02	0.02	0.75

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Sl. No.	Species	Number of trees in different girth classes						Year 2005
		Girth classes (cm)						
	Group 'A'	0-30	31-60	61-90	91-120	121-150	151 and above	Total
11.	*Borassus flabellifer* L.	0.05	0.01	0.01	0.03	0.03	0.03	0.16
12.	*Boswellia serrata* Roxb.	1.66	1.55	1.28	0.64	0.18	0.09	5.40
13.	*Buchanania lanzan* Spr.	1.52	0.65	0.21	0.07	0.02	0.01	2.48
14.	*Butea monosperma* (Lam.) Taub.	39.17	7.15	1.67	0.52	0.08	0.03	48.62
15.	*Cassia fistula* L.	0.54	0.29	0.10	0.01	0.00	0.00	0.96
16.	*Dalbergia sissoo* Roxb.	0.42	0.22	0.11	0.03	0.01	0.00	0.80
17.	*Diospyrus melanoxylon* Roxb.	34.65	3.11	0.59	0.14	0.05	0.03	38.56
18.	*Emblica officinalis* Gaertn.	1.09	0.03	0.01	0.00		0.00	1.12
19.	*Gmelina arborea* L.	0.72	0.05	0.01	0.00			0.77
20.	*Holoptelia integrefolia* (Roxb.) Planch.	3.64	0.98	0.27	0.07	0.02	0.01	4.99
21.	*Lagerstroemia parviflora* Roxb.	39.02	10.82	2.56	0.43	0.07	0.05	52.95
22.	*Lannea coromandelica* (Houtt.) Herrill	2.70	2.40	1.58	0.71	0.20	0.09	7.67
23.	*Madhuca indica* J. F. Gmel.	0.46	0.22	0.38	0.72	1.23	1.23	4.24
24.	*Miliusa tomentosa* (Roxb.) Sinclair	4.67	1.62	0.41	0.11	0.03	0.01	6.84
25.	*Mitragyna parvifolia* (Roxb.) Korth.	0.91	0.47	0.27	0.14	0.05	0.05	1.89
26.	*Morinda tomentosa* Heyne ex Roth	17.30	4.38	0.95	0.11	0.01	0.02	22.76
27.	*Ougeinia oogeinensis* (Roxb.) Hochreut.	0.25	0.12	0.04	0.01		0.00	0.42
28.	*Pongamia pinnata* (L.) Pierre	0.52	0.24	0.08	0.02	0.01	0.00	0.88
29.	*Pterocarpus marsupium* Roxb.	0.15	0.08	0.03	0.01	0.01	0.00	0.28
30.	*Schleichera oleosa* (Lour.) Oken.	2.03	1.42	0.68	0.25	0.10	0.04	4.51
31.	*Sterculia urens* Roxb.	0.40	0.12	0.04	0.01	0.00		0.57
32.	*Syzygium cumini* (L.) Skeels	0.29	0.09	0.07	0.04	0.03	0.03	0.55
33.	*Tamarindus indica* L.	1.46	0.07	0.05	0.02	0.01	0.01	1.61
34.	*Tectona grandis* L. f.	57.89	18.38	3.72	0.90	0.24	0.12	81.25
35.	*Terminalia bellirica* (Gaertn.) Roxb.	0.40	0.41	0.30	0.10	0.05	0.03	1.29
36.	*Terminalia crenulata* Roth.	11.56	4.27	1.16	0.28	0.10	0.05	17.42
37.	*Wrightia tinctoria* R. Br.	26.95	3.36	0.53	0.08	0.02	0.01	30.94
38.	*Zizyphus mauritiana* Lam.	2.86	0.10	0.02	0.00			2.98
	Group A total	300.24	70.98	19.37	5.86	2.66	2.04	401.13
	Group B total	42.87	5.24	1.54	0.49	0.23	0.19	50.57
	Division total	343.10	76.22	20.91	6.35	2.89	2.23	451.70

Percentage of stock of a species in a girth class to the total stock in that particular girth class is calculated for important species. The percentage of *Tectona grandis* (17.99%) was highest followed by *Lagerstroemia parviflora* (11.72%), *Butea monosperma* (10.76%) as compare to other species in the division. The stock of *Tectona grandis* was also highest in the girth class 0-30 cm i.e. 16.87% as compare to the stock of other tree species followed by *Butea monosperma* (11.42%), *Lagerstromia parviflora* (11.37%). In 31-60 cm girth class *Tectona grandis* (24.12%) was again highest followed by *Lagerstroemia parviflora* (14.19%), *Butea monosperma* (9.38%). In middle girth class (61-90 cm) again *Tectona grandis* (17.80%) was in number one position followed by *Lagerstroemia parviflora* (12.24%), *Butea monosperma* (8.00%). But in 91-120 cm girth class *Tectona grandis* (14.11%) was maximum followed by *Madhuca indica* (11.38%), *Lannea coromandelica* (11.15%) etc. In more higher girth *Madhuca indica* (55.16%) was maximum followed by *Tectona grandis* (5.29%), *Boswellia serrata* (3.88%) etc. (Table 9).

Table 9

Species wise percentage of stock in different girth classes to the total stock in that particular girth class

Sl. No.	Species	Species wise percentage of stock in different girth classes						Year 2005
		Girth classes (cm)						
	Group 'A'	0-30	31-60	61-90	91-120	121-150	151 and above	Total
1	*Acacia catechu* Wild.	2.16	1.38	0.65	0.39	0.32	0.45	1.91
2	*Acacia nilotica* (L.) Del.	1.03	0.21	0.18	0.25		0.15	0.83
3	*Adina cordifolia* (Roxb.) Bth. and Hk. f. ex Brand.	0.01	0.03	0.02	0.02	0.14	0.14	0.01
4	*Aegle marmelos* (L.) Corr.	0.38	0.72	0.81	0.41	0.21	0.62	0.46
5	*Albizia procera* (Roxb.) Bth.	0.18	0.19	0.28	0.27	0.34	0.24	0.19
6	*Annona squamosa* L.	2.63	0.09	0.01				2.01
7	*Anogeissus latifolia* (Roxb.) Wall. ex Bedd.	5.34	7.43	8.00	3.97	2.10	1.30	5.76
8	*Azadirachta indica* A. Juss.	1.70	0.60	0.42	0.45	0.66	0.52	1.42
9	*Bauhinia racemosa* Lam.	0.14	0.12	0.02	0.07	0.09		0.13
10	*Bombax ceiba* L.	0.12	0.22	0.50	0.42	0.57	0.73	0.17
11	*Borassus flabellifer* L.	0.02	0.02	0.05	0.50	0.93	1.18	0.04
12	*Boswellia serrata* Roxb.	0.48	2.03	6.13	10.06	6.40	3.88	1.20
13	*Buchanania lanzan* Spr.	0.44	0.86	1.00	1.14	0.53	0.43	0.55
14	*Butea monosperma* (Lam.) Taub.	11.42	9.38	8.00	8.26	2.78	1.28	10.76
15	*Cassia fistula* L.	0.16	0.38	0.49	0.23	0.13	0.13	0.21

contd...

Sl. No.	Species	Species wise percentage of stock in different girth classes						Year 2005
		Girth classes (cm)						
	Group 'A'	0-30	31-60	61-90	91-120	121-150	151 and above	Total
16	*Dalbergia sissoo* Roxb.	0.12	0.29	0.54	0.51	0.20	0.09	0.18
17	*Diospyrus melanoxylon* Roxb.	10.10	4.08	2.80	2.23	1.72	1.13	8.54
18	*Emblica officinalis* Gaertn.	0.32	0.04	0.03	0.01		0.04	0.25
19	*Gmelina arbo ea* L.	0.21	0.06	0.04	0.01			0.17
20	*Holoptelia integrefolia* (Roxb.) Planch.	1.06	1.29	1.28	1.06	0.55	0.66	1.10
21	*Lagerstroemia parviflora* Roxb.	11.37	14.19	12.24	6.79	2.41	2.40	11.72
22	*Lannea coromandelica* (Houtt.) Herrill	0.79	3.15	7.54	11.15	6.78	3.82	1.70
23	*Madhuca indica* J. F. Gmel.	0.13	0.29	1.80	11.38	42.71	55.16	0.94
24	*Miliusa tomentosa* (Roxb.) Sinclair	1.36	2.12	1.94	1.66	1.01	0.50	1.51
25	*Mitragyna parvifolia* (Roxb.) Korth.	0.26	0.62	1.30	2.21	1.71	2.37	0.42
26	*Morinda tomentosa* Heyne ex Roth	5.04	5.74	4.52	1.73	0.41	0.72	5.04
27	*Ougeinia oogeinensis* (Roxb.) Hochreut.	0.07	0.15	0.17	0.12		0.18	0.09
28	*Pongamia pinnata* (L.) Pierre	0.15	0.32	0.38	0.24	0.39	0.20	0.19
29	*Pterocarpus marsupium* Roxb.	0.04	0.11	0.13	0.15	0.28	0.22	0.06
30	*Schleichera oleosa* (Lour.) Oken.	0.59	1.86	3.26	3.87	3.43	1.72	1.00
31	*Sterculia urens* Roxb.	0.12	0.16	0.17	0.19	0.05		0.13
32	*Syzygium cumini* (L.) Skeels	0.09	0.12	0.35	0.60	0.91	1.20	0.12
33	*Tamarindus indica* L.	0.43	0.09	0.23	0.29	0.29	0.30	0.36
34	*Tectona grandis* L. f.	16.87	24.12	17.80	14.11	8.35	5.29	17.99
35	*Terminalia bellirica* (Gaertn.) Roxb	0.12	0.54	1.43	1.64	1.68	1.52	0.29
36	*Terminalia crenulata* Roth.	3.37	5.60	5.55	4.48	3.45	2.20	3.86
37	*Wrightia tinctoria* R. Br.	7.85	4.40	2.51	1.32	0.55	0.59	6.85
38	*Zizyphus mauritiana* Lam.	0.83	0.13	0.07	0.05			0.66
	Group A total	87.51	93.12	92.63	92.22	92.11	91.37	88.80
	Group B total	12.49	6.88	7.37	7.78	7.89	8.63	11.20
	Division total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Growing stock density and volume position in 2005

As per published yield Table for quality class IV in which the divisional stock falls, the normal stock density in case of Teak is 2500 trees per ha in 0-30 cm girth classes at the age of 4 years. When these trees reach to middle girth class i.e. 31-60 cm girth class in about 40 years, it goes down to 500 trees per ha. When the same stock reaches 61 cm and higher girth class i.e. mature girth class in about 80 years, only 280 trees remain in a ha. Taking these figures as normal stock density for all other species, percentage of present stock density to the normal stock density has been calculated for different ranges so as to know the per cent area occupied by different girth classes as given in Table 10.

The Table actually shows the per cent of total area per ha occupied by different girth classes of the stock. Ideally, the percentage of the total area occupied by all different girth classes of the stock should be 100% in a fully stocked area. Thus all the ranges except Vadodara are understocked. Boriyaad and Panvad are highly under stocked. But Vadodara was already reached 100 % of stock density i.e. towards full stocking.

Comparison of stock of year 2005 with that of year 1967

The data of 21 villages (Table 2) having similar area and boundaries in both years i.e. in 1967 and 2005 was taken up for comparison. The comparison was made to analyze the species, which disappeared during

Table 10

Range wise percentage of stock density to the normal stock density in different girth classes

Sl. No.	Range	Present density (2500)*	Percentage of present density/ normal density	Present density (500)*	Percentage of present density/ normal density	Present density (280)*	Percentage of present density/ normal density	Total % of present density/ normal density
1	Pavijetpur	429.21	17.17	91.76	18.35	26.70	9.54	45.06
2	Chhotaudepur	560.88	22.44	51.65	10.33	41.46	14.81	47.57
3	Vadodara	566.51	22.66	263.77	52.75	76.29	27.25	102.66
4	Kawant	321.42	12.86	40.57	8.11	6.05	2.16	23.13
5	Dolariya	234.31	9.37	99.33	19.87	88.37	31.56	60.80
6	Panvad	415.82	16.63	50.63	10.13	2.62	0.94	27.69
7	Naswadi	183.33	7.33	74.77	14.95	35.54	12.69	34.98
8	Rangpur	245.84	9.83	48.21	9.64	16.23	5.80	25.27
9	Boriyaad	109.21	4.37	28.44	5.69	15.95	5.70	15.75
	Total of Division	343.10	13.72	76.22	15.24	32.37	11.56	40.53

*Normal density of Trees.

this period, and the species appeared along with other parameters.

Loss of species diversity between 1967 and 2005 in villages of different ranges

The details are mentioned in Table 11.

The data shows that the loss of species varied from 0% to 58%. On an average 25% of species have been lost. The loss was more from the areas, which were open that is less dense.

Table 11

Disappearance of species diversity between 1967 and 2005

Sl. No.	Range	Village	Number of species			
			Present 1967	Common 2005	Absent 2005	Species disappeared/ Lost %
1	Pavijetpur	Bordha	36	15	21	58.33
2	Panvad	Kharamda	21	10	11	52.38
3	Kawant	Kakanpur	23	11	12	52.17
4	Pavijetpur	Kalarani	27	13	14	51.85
5	Rangpur	Bandla	24	12	20	50.00
6	Chhotaudepur	Luni	20	11	9	45.00
7	Chhotaudepur	Gabadiya	48	27	21	43.75
8	Pavijetpur	Karali	23	13	10	43.48
9	Chhotaudepur	Badvav	18	11	7	38.89
10	Pavijetpur	Mudhiyari	43	31	13	30.23
11	Dolariya	Mithibor	34	24	10	29.41
12	Panvad	Khasra	44	32	12	27.27
13	Vadodara	Zand	40	31	9	22.50
14	Vadodara	Dharola	9	7	2	22.22
15	Pavijetpur	Dhanpur	33	24	7	21.21
16	Dolariya	Dhadagam	53	42	11	20.75
17	Vadodara	Kothiya	26	21	5	19.23
18	Chhotaudepur	Runwad	34	28	6	17.65
19	Vadodara	Songir	19	16	3	15.79
20	Dolariya	Jamli	47	42	5	10.64
21	Dolariya	Gadola	8	8	0	0.00

Enrichment of species diversity between 1967 and 2005 in villages of different ranges.

The information is given as under in Table 12.

The data shows the percentage of species newly enriching the area varies from 25% to 98%. On an average it is 50%. Percentage of species enrichment in the area is more than the percentage of species loss. The enrichment is more in dense areas having young crop.

Girth wise number of trees of the species disappeared in 2005

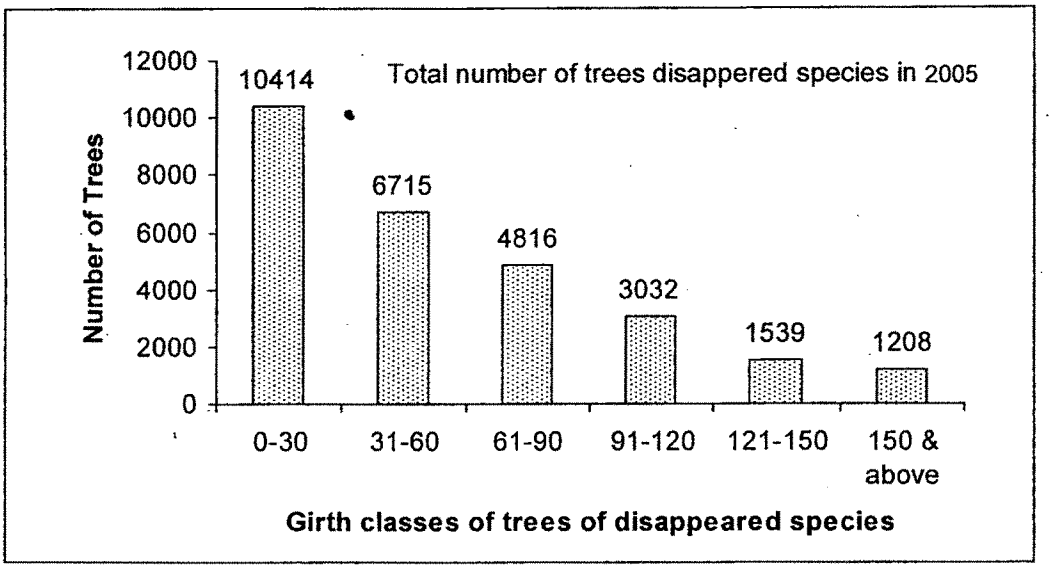
The information is shown in Fig. 1.

Table 12

Enrichment of species diversity between 1967 and 2005.

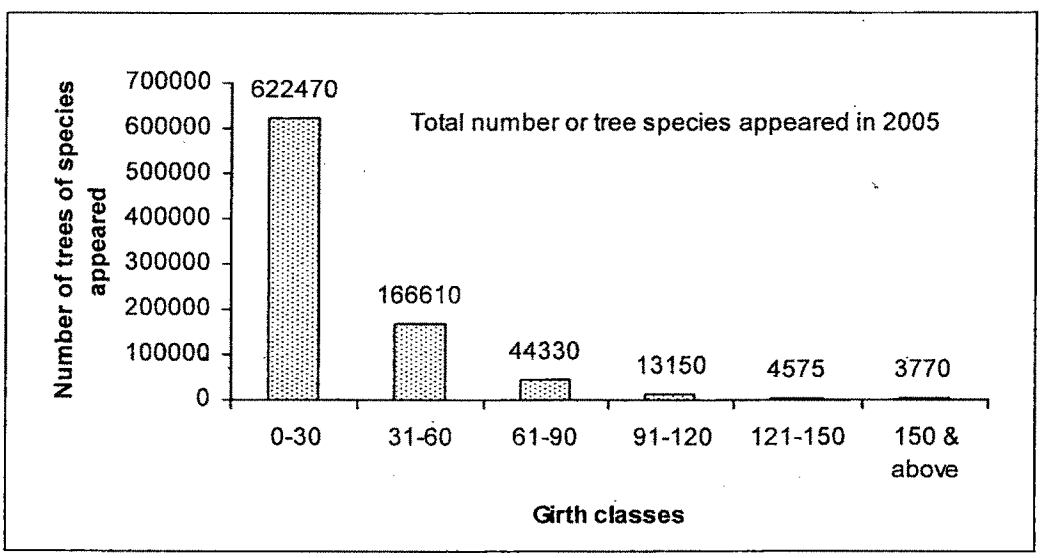
Sl. No.	Range	Village	Number of species				Species Enrichment %
			Present 1967	Present 2005	Common 2005	New 2005	
1	Dolariya	Gadola	8	88	8	80	92.05
2	Vadodara	Dharola	9	86	7	79	91.86
3	Vadodara	Kothiya	26	40	21	35	87.50
4	Dolariya	Dhadagam	53	61	42	50	81.97
5	Chhotaudepur	Badvav	18	48	11	37	77.08
6	Panvad	Kharamda	21	36	10	26	72.22
7	Kawant	Kakanpur	23	31	11	20	64.52
8	Dolariya	Mithibor	34	64	24	40	62.50
9	Chhotaudepur	Luni	20	28	11	17	60.71
10	Pavijetpur	Bordha	36	34	15	19	55.88
11	Pavijetpur	Kalarani	27	29	13	16	55.17
12	Pavijetpur	Karali	23	28	13	15	53.57
13	Panvad	Khasra	44	58	32	26	44.83
14	Chhotaudepur	Runwad	34	50	28	22	44.00
15	Vadodara	Zand	40	55	31	24	43.64
16	Pavijetpur	Dhanpur	33	28	24	12	42.86
17	Dolariya	Jamli	47	73	42	31	42.47
18	Vadodara	Songir	19	79	16	33	41.77
19	Pavijetpur	Mudhyari	43	47	31	16	34.04
20	Chhotaudepur	Gabadiya	48	40	27	13	32.50
21	Rangpur	Bandla	24	16	12	4	25.00

Fig. 1



The graph shows that the trees have been lost almost from all girth classes

Fig. 2



The graph shows that the newly appeared trees are maximum only in young girth class

- **Girth wise number of trees of the species newly appeared in 2005**

The information is shown in Fig. 1.

- **Species wise number of plants disappeared in 2005.**

The species wise trees disappeared shown in Table 13.

The data shows that *Mitragyna parvifolia* has been lost in high number from all the girth classes. Other species facing loss are *Lannea coromandalica, Boswellia serreta, Adina cordifolia, Buchanania lanzan, Pterocarpus marsupium, Dalbergia paniculata, Cochlospermum religiosum, Terminalia crenulata.*

- **Species wise number of trees newly appeared in 2005**

The species wise number of trees of newly appeared species is given in Table 14.

The species which have appeared in more number are *Morinda tomentosa, Hollarrhena antidysenterica, Anogeissus latifolia, Butea monosperma, Wrightia tinctoria, Diospyros melanoxylon, Zizyphus xylopyra, Holoptelia integrifolia, Aegle marmelos, Acacia catechu* (Table 14).

- **The species wise comparison of the total stock in 1967 and 2005**

The species wise total stock of both the years i.e. 1967 and 2005 is given in Tables 15-16 respectively.

The Table 15 shows that in 1967 the close associates of Teak in the decreasing order of their number were as follows : *Tectona grandis, Terminalia crenulata, Diospyros melanoxylon, Butea monosperma, Lagerstroemia parviflora, Anogeissus latifolia, Lannea coromandalica, Madhuca indica.*

The Table 16 shows that in 2005, the close associates of Teak in the decreasing order of their number were as follows : *Tectona grandis, Lagerstroemia parviflora, Diospyros melanoxylon, Anogeissus latifolia, Butea monosperma, Morinda tomentosa, Wrightia tinctoria, Terminalia crenulata.*

As far as the total stock position is concerned it has tremendously increased in all girth classes thereby showing overall improvement in the area. The total stock position during both the years is given in Table 17.

Discussion

3.40 crores trees exist in Chhotaudepur Division. They are belonging to 133 main species. On an average per ha number of trees in the division is 451.70, highest being 1190.37 trees per ha in Pavijetpur Range and lowest being 153.59 trees per ha in Boriyaad Range. About two-third of the total stock is distributed in 4 ranges, which are Pavijetpur, Chhotaudepur, Vadodara and Kawant. Most of the stock in the division is in young girth class of 0-30 cm. Only 1.13% of total stock of division is above 120 cm girth. Pavijetpur Range has highest total stock (70.22) lacs, whereas Boriyaad Range has lowest number of trees (10.31 lacs). Division has total of 61.22 lacs trees of Teak, which is 17.99% of the total stock of the division. Khakhar, Timru, Dudhkadi, Dhavdo, Aledi, Sadad, Kado, Sitafal and Khair show higher number.

Table 13

Species present in 1967 but disappeared in 2005 with girth class wise number of trees

Sl. No.	Species	Name of the tree	Year	Area ha.	Girth class (in cm)						Total
					0-30	31-60	61-90	91-120	121-150	<150	
1	*Mitragyna parvifolia*	Kalam	1967	10219.52	9672	5041	4138	2816	1424	1172	24263
2	*Lannea coromandalica*	Modad	1967	1654.74	108	222	126	58	23	13	550
3	*Boswellia serreta*	Guggal	1967	1056.23	116	101	58	26	9	0	312
4	*Albizia lebbeck*	Siris	1967	2911.6	11	128	40	34	52	11	276
5	*Adina cordiflolia*	Haldwan	1967	2125.15	77	50	17	8			152
6	*Buchanania lanzan*	Charoli	1967	908.19	4	67	53	14	4	2	144
7	*Anogeissus latifolia*	Dhavdo	1967	624.16		99	39	2			140
8	*Morinda tomentosa*	Aal	1967	95.02	Not applicable	125	14	1			140
9	*Pongamia pinnata*	Karanj	1967	1303.11	70	58	6	2		1	137
10	*Pterocarpus marsupium*	Biyo	1967	2345.5	43	58	19	8	1	1	130
11	*Dalbergia paniculata*	Patrad	1967	1401.26	14	28	40	16	6	2	106
12	*Cochlospermum religiosum*	Ganiario	1967	755.09		86	14	4			104
13	*Terminalia crenulata*	Sadad	1967	377.65		41	62				103

Table 14

Species not present in 1967 but appeared in 2005 with girth class wise number of trees.

Sl. No.	Species	Name of the trees	Year	Area ha.	Girth class (in cm)						Total
					0-30	31-60	61-90	91-120	121-150	<150	
1	*Morinda tomentosa*	Aledi	2005	6080.08	165930	45830	9930	1540	250	30	223510
2	*Hollarrhena antidysenterica*	Kado	2005	6923.65	126260	14970	1540				142770
3	*Anogeissus latifolia*	Dhavdo	2005	868	63510	21440	5130	720	40		90840
4	*Butea monosperma*	Khakhar	2005	868	26700	16130	5770	800	110	10	49520
5	*Wrightia tinctoria*	Dudh kadi	2005	1028.3	27890	4650	580	350	100		33570
6	*Diospyros melanoxylon*	Timru	2005	1267.87	26540	5350	1100	310	90	110	33500
7	*Zizyphus xylopyra*	Ghat bor	2005	3314.21	22690	3670	270	130	20	20	26800
8	*Holoptelia integrifolia*	Audo	2005	4679.8	11380	3260	1260	340	90	140	16470
9	*Aegle marmelos*	Bili	2005	1292.36	11880	3500	920	40	20		16360
10	*Acacia catechu*	Khair	2005	1645.36	11870	3240	190	100			15400
11	*Zizyphus mauritiana*	Bor	2005	5182.52	13470	510	150	60			14190
12	*Acacia leucophloea*	Aniyaar	2005	5999.34	9690	3700	220	30			13640
13	*Schleichera oleosa*	Kusum	2005	1256.78	5440	4270	2240	760	170	80	12960
14	*Milusa tomentosa*	Umbh	2005	1712.62	7140	3910	1260	180	40	20	12550
15	*Azadirchta indica*	Limdo	2005	3822.13	11870	540	40	30	10	10	12500

Table 15

Species wise total stock in 1967

Sl. No.	Species	Name of the trees	Total number of trees in different girth classes Year 1967					Total
			Girth class (in cm)					
			31-60	61-90	91-120	121-150	150 and above	
1	*Tectona grandis*	Saag	12535	3001	270	19	2	21120
2	*Terminalia crenulata*	Sadad	6239	1360	189	23	2	10201
3	*Diospyros melanoxylon*	Timru	3606	681	83	28		6815
4	*Butea monosperma*	Padash	2893	1252	363	210	138	6123
5	*Lagerestroemia parviflora*	Bondaro	3238	607	43	2	2	5842
6	*Anogeissus latifolia*	Dhavdo	2991	575	53	5	4	4804
7	*Lannea coromandalica*	Modad	2374	835	237	79	23	4717
8	*Madhuca indica*	Mahuda	830	902	692	647	364	3773
9	*Ailanthus excelsa*	Adu	1226	305	66	16		2574
10	*Buchanania lanzan*	Charoli	958	376	64	9	3	1986
11	*Lagerestroemia parviflora*	Kakad	855	365	83	22	18	1695
12	*Oroxylum indicum*	Tentu	845	493	110	19	15	1493
13	*Wrightia tinctoria*	Kudi	959	81				1474
14	*Morinda tomentosa*	Aal	1000	103	7	1		1283
15	*Schleichera oleosa*	Kosim	559	316	79	8	7	1148
16	*Mitragyna parvifolia*	Kalam	310	140	59	21	16	795
17	*Boswellia serrata*	Guggal	292	177	66	18	3	769
18	*Acacia catechu*	Khair	452	160	51	11	5	749
19	*Bombax ceiba*	Savar	383	179	39	10	2	705
20	*Milusa tomentosa*	Umbh	475	119	9	1		698
21	*Dalbergia latifolia*	Sisam	279	155	21	5	1	622

contd..

Sl. No.	Species	Name of the trees	Total number of trees in different girth classes Year 1967					Total
			Girth class (in cm)					
			31-60	61-90	91-120	121-150	150 and above	
22	?	Karvai	186	32	5	2		602
23	*Phyllanthus emblica*	Amla	344	195	35	6	5	599
24	*Adina cordiflolia*	Haldwan	294	139	58	7	11	593
25	*Dalbergia paniculata*	Patrad	278	127	63	20	7	577
26	*Pterocarpum marsupium*	Biyo	289	98	51	7	2	553
27	*Aegle marmelos*	Bili	217	71	6		1	510
28	*Bridelia retusa*	Asan	311	62	3		2	458
29	*Terminalia bellerica*	Baheda	245	75	15	5	7	415
30	*Albizia lebbeck*	Sirish	194	46	35	52	11	401
31	?	Karvel	125	93	32	12	1	292
32	*Schiebera swietenioides*	Mokho	135	60	9	1		279
33	*Oogenia oogenensis*	Tivas	170	71	4	5		275
34	*Sterculia urens*	Kadayo	94	85	16	12	2	229
35	*Tamarindus indica*	Amli	115	45	8	4		224
36	*Zizyphus xylopyra*	Ghat bor	75	21	4			207
37	*Pongamia pinnata*	Karanj	83	29	9	2	1	194
38	*Ficus benghalensis*	Vad	68	85	20	7	5	185
39	*Soymida febrifuja*	Royno	73	44	13	6	1	177
40	*Albizia procera*	Kilai	81	58	29	2		170
41	*Azadirachta indica*	Limdo	74	42	15	3		156
42	*Cordia gharaf*	Gundi	110	33	1	2		147
43	*Gmelina arborea*	Shivan	42	22	5	1		133
44	*Spondias pinnata*	Khatambo	44	11	2	1	1	130
45	*Grewia tillaefolia*	Dhaman	54	11	8			126

Table 16

Species wise total stock in 2005

Sl. No.	Species	Name of the trees	Total Number of Trees in different girth classes Year 2005						Total
			Girth class (in cm)						
			0-30	31-60	61-90	91-120	121-150	150 and above	
1	*Tectona grandis*	Saag	421060	169690	44540	12710	3430	1890	653320
2	*Lagerestroemia parviflora*	Kakad	419060	130820	37500	8030	1630	920	597960
3	*Diospyros melanoxylon*	Timru	345200	37720	10190	3930	1290	440	398770
4	*Anogeissus latifolia*	Dhavdo	270440	86850	25810	6050	1180	650	390980
5	*Butea monosperma*	Khakhar	280360	60060	18730	7390	1290	400	368230
6	*Morinda tomentosa*	Aledi	213740	69180	13650	1990	260	340	299160
7	*Wrightia tinctoria*	Dudhkadi	233340	35770	6380	930	380	320	253680
8	*Terminalia crenulata*	Sadad	141540	61180	22450	8460	3500	1140	238270
9	*Hollarrhena antidysenterica*	Kudo	126400	14970	1540				142910
10	*Lannea coromandalica*	Moyno	33240	30270	18730	9960	3200	1210	96610
11	*Milusa tomentosa*	Umbh	46660	16160	7190	2030	450	100	72590
12	*Schleichera oleosa*	Kusum	27570	19120	11160	6190	2480	580	67100
13	*Madhuca indica*	Mahuda	7130	4860	7800	11540	13080	18560	62970
14	*Buchanania lanzan*	Charoli	30160	11030	4350	900	200	30	46670
15	*Acacia catechu*	Khair	27460	7060	580	160	10	35270	
16	*Aegle marmelos*	Bili	21900	8880	3130	520	110	230	34770
17	*Azadirachta indica*	Limdo	26800	3050	700	290	250	120	31210
18	*Dendrocalmus strictus*	Vaans	29860	40	10		120	30030	
19	*Zizyphus xylopyra*	Guth	24650	3870	270	130	20	20	28960
20	*Mitragyna parvifolia*	Kalam	11250	6710	4980	3110	1430	1160	28640

contd. ...

Sl. No.	Species	Name of the trees	Total Number of Trees in different girth classes Year 2005						Total
			Girth class (in cm)						
			0-30	31-60	61-90	91-120	121-150	150 and above	
21	*Boswellia serreta*	Guggal	7540	7930	5370	2460	760	180	24240
22	*Acacia leucophloea*	Samdi	18470	3940	220	30			22660
23	*Casearia graveolens*	Muji	13560	5590	1660	360	70	140	21380
24	*Annona squamosa*	Sitaphal	20010	40					20050
25	*Holoptelia integrifolia*	Audo	13760	3270	1260	340	90	140	18860
26	*Dalbergia paniculata*	Patrado	7880	4450	3100	1670	670	330	18100
27	*Terminalia bellirica*	Baheda	4060	5840	4580	1690	760	430	17360
28	*Alangium salvifolium*	Ankal	12490	2770	940	120	30	130	16480
29	*Nyctanthus arbor-tristis*	Parijatak	14940	40					14980
30	*Zizyphus mauritiana*	Bor	13590	510	150	60			14310
31	*Acacia nilotica*	D Bawal	12440	630	310	170		50	13600
32	*Soymida febrifuja*	Royono	5440	3130	1680	1260	550	360	12420
33	*Dalbergia latifolia*	Sissam	5930	3670	1790	630	130	30	12180
34	*Albizia lebeck*	Siris	9210	1920	570	110	10	20	11840
35	*Eucalyptus globulus*	Nilgiri	7410	1520	1010	780	570	70	11360
36	*Syzygium cumini*	Jambu	3700	2750	2470	750	580	250	10500
37	*Lantana camara*	Lentana	9830	50					9880
38	*Schiebera swietenioides*	Mukho	4040	2660	1430	340	245	140	8850
39	*Bombax ceiba*	Simlo	4080	2350	1270	560	210	90	8550
40	*Pongamia pinnata*	Karanj	4880	2400	720	430	410	170	8370
41	*Tamarindus indica*	Khatiamli	7020	550	570	140	30	30	8340
42	*Balanites aegyptiaca*	Ingorio	7220	1080					8300
43	*Casearia* sp.	Bhutadi	4480	2010	1110	450	50	120	8220
44	*Bridelia retusa*	Dantiyo	4300	1670	710	270	90	20	7060
45	*Grewia tiliaefolia*	Dhaman	5810	600	100				6510

Table 17

Total stock in 1967 and 2005.

Year	Total No. of species	Total number of species and the number of plants in different girth classes in 1967 and 2005					
		Girth class (in cm)					
		31-60	61-90	91-120	121-150	150 and above	Total
1967	94	47719	13968	3080	1319	677	88181
2005	173	861190	281130	102630	42715	33360	4332290

Pavijetpur have got highest area compared to all the ranges but density is little above the average. Most of stock is also in young girth classes in the ranges. Chhotaudepur Range is better than Pavijetpur except 31-60 cm girth class in density.

In Dolariya Range area is little below the average of division and density is also average of the division. But Percentage of stock in high girth class i.e. 61 cm and above is much more compared to any other range. In higher girth class i.e. 61 cm and above, total stock is more in Dolariya Range compared to Pavijetpur or Chhotaudepur Range even when the area in this range is less than Pavijetpur or Chhotaudepur Range.

In Rangpur Range area is quite high, less than Chhotaudepur but in density it is just half of Chhotaudepur. 92%-94% stock in both the ranges is in 0-60 cm girth class. In 121 cm and above girth class Rangpur Range is better compared to Chhotaudepur. In Rangpur range area is more than that of Boriyaad. At the same time total stock and density is also better compared to Boriyaad. About 85% stocks are also in 0-60 girth class. Regarding density in higher girth classes i.e. 121 cm and above, the range is comparable to Chhotaudepur.

Boriyaad Range shows very poor performance among all the ranges. Area is least even then the density is the least compared to any other range. The stock percentage in each girth is also the least. About 90% stock lies only in 0-60 cm girth class.

In Naswadi Range, number of trees are less than Dolariya and density is also less than Dolariya Range. 87% of stock in Naswadi is also in 0-60 cm girth class while it is 78% in Dolariya.

In Panvad Range, area is quite less than Kawant Range, the density is more. About 97-98% in stock in both the range is in 0-60 girth class. In high girth classes almost similar performance is there in both the ranges.

In Vadodara Range, area is less than that of Dolariya Range. Even then, the number of trees is more than that of Dolariya. Density is also more. Total stock as well as density in 0-60 cm girth class is also more in Vadodara Range compared to that of Dolariya. Density is more even in 60-90 cm girth. It is only in more than 90 cm girth class that Dolariya takes over Vadodara in density.

If we look at the species wise information in division, *Tectona grandis* has maximum

number of trees followed by *Lagerstroemia parviflora, Butea monosperma, Diospyros melanoxylon*, *Wrightia tinctoria*, and *Anogeissus latifolia* etc. *Tectona grandis* has remarkably performed well in all the girth classes. All these species are very hardy, less browsable and so complete with all other species. Regeneration of *Madhuca indica* is poor as its fruit itself is used as a source of oil for the people in the area. So very less seed of the species is available for natural as well as artificial regeneration. No new regeneration of the species is thus coming up. There are more trees seen in higher girth classes of *Madhuca indica*. It is performing well in higher girth classes. It is protected well by the tribals. The tribal greatly depend on the forest trees for meeting their timber, firewood, forage, and other non-wood domestic and agricultural needs. The trees act as an attractive income source of Non-Wood Forest Products (NWFPs), to supplement their other incomes. Important NWFP yielding trees in the area are *Butea monosperma*, *Diospyros melanoxylon*, *Wrightia tinctoria*, *Anogeissus latifolia*, etc. As *Madhuca indica* is an important NWFP tree and the dependency of tribals is very high on this species, plantation of *Madhuca indica* tree becomes very important. The other trees of NWFPs should be planted more as the tribals are dependent on these trees.

Most of the area in the division is understocked. In terms of volume it is quite less than the normal in 31-60 cm girth class. It is also quite less in 61 cm and above girth class also.

The data of comparison of stock of 2005 with that of 1967 show that per cent of species loss from the villages varies from 0% to 58%. On an average it is 25%. It is more where forest is open i.e. less dense. New species enrichment in the villages varies from 25% to 90%. On an average it is 40%. It is more where forest crop is dense and is of young age. Species which have disappeared in most of the villages included *Mitragyna parvifolia, Adina cordifolia, Dalbergia latifolia, Terminalia bellirica* etc. Number of trees lost is high in all the girth classes while number of trees of newly appeared species is high only in young girth class of 0-30 cm. Among the species lost in highest number is *Mitragyna parviflora*. It has been lost from all girth class in large number. Among newly appeared species, maximum number is of *Morinda tomentosa* followed by *Hollarrhena antidysenterica*, *Anogeissus latifolia, Butea monosperma, Wrightia tinctoria*, *Diospyros melanoxylon*.

The species comparison of total stock of 1967 and 2005 shows that *Terminalia crenulata* is shifted to 8th rank in 2005. The close associated *Tectona grandis* is now *Lagerstroemia parviflora*. The total stock of trees in 2005 shows tremendous increase over the stock present in 1967.

Thus, there is much variation in performance of different ranges of the same division. There is a change in species composition from 1967 to 2005. The variation can be attributed to several factors. But, it is mainly due to soil factor e.g. soil fertility, soil moisture which varies more than any other factor in the area. The terrain in the area is moderately hilly. Unauthorized cultivation has promoted illicit cutting of trees resulting into heavy soil erosion, loss of soil fertility and soil moisture in the area. The tribals posses land but no means to irrigate and fertilize the soil, resulting into a poor output and far below optimum utilization of land resource. This invites greed to own more fresh fertile lands.

Thus, basic resource i.e. land is lost to encroachments benefiting neither. There are various other reasons also for encroachments which all results into loss of precious land and its quality. Heavy grazing has added much more to the problem. The forests are well stocked in Vadodara. It is due to very less instances of grazing and unauthorized cultivation in the range. The stock in Dolariya Range has remained protected even in high girth classes. It speaks of good protection of stock by the staff as well as by people in the area.

Poor performing ranges require introduction of wide spread soil moisture conservation works on large scale so as to improve soil moisture and check soil erosion thereby reducing the degree of further deterioration of soil fertility. Protection measure so as to stop ill effect of grazing also need to be strengthened. Large blank areas deficient of young, immature and mature growing stock causes concern and calls for urgent remedial action. Protection against encroachments, illicit cultivation, illicit cutting, and artificial regeneration of fast growing species, together with necessary steps to obtain a well balance growing stock for a healthy normal forest of desired composition of species in the shortest possible time span is need of time.

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SUMMARY

In Chhotaudepur forest division having an area of 75,353 ha, density in general is poor. It is poor in terms of volume also. Most of the area is under stocked. Major stock lies is only in 0-30 cm girth class stock higher girth classes is missing everywhere except in Dolariya Range having 9.85 % of total area. Heavy grazing pressure and unauthorized cultivation is prevalent in most of the ranges which shows poor performance. It has resulted in drastic changes in soil quality in degradation of soil cover, it quality and depth in reduction of moisture retention capacity of the soil. These reasons seem to be the major reasons of variation of stock, its density and percentage in the area. Many tree species e.g. *Mitragyna parvifolia, Adina cordiflolia, Bridelia retusa, Dalbergia latifolia* which used to be present in most of the villages during 1967, have disappeared from the area in 2005. Percentage of disappearance is more from area having less density. These species have appeared in other areas having good density. Where crop is young and dense such an appearance is in higher percentage. In most of the places, the species like *Acacia nilotica, Acacia leucophloea,* and *Zizyphus mauritiana* have appeared.

There is an urgent need to protect the soil in general, with more emphasis on areas which have become less dense and open. Small structures spread covering more area for effective moisture conservation over vast area is the need of hour. Heavy grazing and unauthorized cultivation needs to be checked so as to help natural reproduction to come up and establish the open areas. It may be supplemented with heavy artificial regeneration efforts.

Simultaneously, the strategies should be developed for scientific management of area which is becoming dense and accumulating an excess stock and volume compared to normal.

वन प्रबन्धाधियोजनाओं में सुदूर संवेदन और भौगोलिक सूचना प्रणालियां उपयोग में लाना

एम०के० राव, ए०ओ० वर्घिस व वाई०वी०एन० कृष्णामूर्ति

सारांश

75,349 हेक्टे० क्षेत्रफल वाले छोटा उदयपुर वनमण्डल का घनत्व सामान्यतः घटिया है। आयतन की दृष्टि से भी यह कमजोर है। इसका अधिकांश क्षेत्र अल्पभरित है। इसकी प्रधान वृक्ष संनिधि केवल 0–30 सेमी परिधि वर्ग में आती है इससे ऊपर वाली परिधि श्रेणियां सर्वत्र लुप्त है सिवाए डोलरिया वन परिक्षेत्र के जिसमें वह संपूर्ण क्षेत्र की 9.85% है। चराई का भारी दबाव और अनधिकृत खेती का अधिकांश वन परिक्षेत्रों में प्रचलना है जिससे वृक्षों की घटिया क्रियाशीलता दिखाई देती है। इसका परिणाम मृदा गुणवत्ता में अत्यधिक परिवर्तन, मृदा आवरण में व्याह्रास मृदा की नमी बनाए रखने की गुणवत्ता और गहराई में कमी आना हुआ है। बहुत सी वृक्ष जातियां उदा० *मित्रागायना पार्विलोरा, एडिना कौर्डिफोलिया, ब्रिडेलिया रेटसा, डलबर्गिया लैटिफोलिया,* जो 1967 में अधिकांश गांवो में मिल जाया करती थी, इस क्षेत्र से 2005 में लोप हुई मिलती हैं। इन जातियों का लोप का प्रतिशत उन क्षेत्रों में अधिक है जहां वृक्ष घनत्व कम है। अन्य क्षेत्रों में जहां वृक्ष घनत्व अच्छा है ये जातियां पुनः उभर आई है। जहां सस्य नौ उम्र का और सघन है वहां यह उभार अधिक प्रतिशत में हुआ है। अधिकांश जगहों में *अकेसिया निलोटिका, अकेसिया ल्यूकोलिआ* और *जिजीफस मोरिटियाना* जैसी जातियां प्रकट हुई है। विलोप सभी परिधि श्रेणियों में अधिक है। *मित्रागायना पार्विलोरा* का विलोप सर्वाधिक संख्या में हुआ है। यह अपनी उच्चतर परिधि श्रेणियों से भी विलुप्त हुआ है। अधिकांश नव प्रकटीकरण केवल 0–30 सेमी वाली नौउम्र परिधि श्रेणी में ही ज्यादा है। *मोरिण्डा टोमेनटोसा, होलारेहना एण्टिडायसेंट्रिका, एनोगायसस लैटिफोलिया, ब्यूटिआ मोनोस्पर्मा, राइटिया टिंक्टोरिया, डायोसपायरस मेलानोक्सीलन* आदि अधिक संख्याओं में इस क्षेत्र में 0–30 सेमी वाली नौउम्र परिधि श्रेणी में नए सिरे से प्रकट हुए हैं। केवल चार जातियां अर्थात् *टेक्टोना ग्रांडिस, लैगरस्ट्रोमिया पार्विलोरा, ब्यूटिआ मोनोस्पर्मा* और *मधुका इण्डिका* ही अपने–अपने क्षेत्रों से विलुप्त नहीं हुए हैं। *टेक्टोना ग्रांडिस* संपूर्ण संनिधि और घनत्व की दृष्टि से अपना संनिधि स्थान 1967 से पहले की तरह संभाले हुए है परन्तु इसकी निकट सहचारी जाति अब पूर्णतया बदल चुकी है। *टर्मिनेलिया क्रेनुलाटा* जो संपूर्ण संनिधि और घनत्व की दृष्टि से 1967 में *टेक्टोना ग्रांडिस* के बाद दूसरे अनुक्रम पर हुआ करती थी, अब 2005 में आठवें अनुक्रम पर आ गई है। सामान्यतः मृदा की सुरक्षा करने की, उन क्षेत्रों पर अधिक जोर देते हुए जो कम संघन और खुले हो गए हैं, बहुत शीघ्र आवश्यकता है। विस्तृत क्षेत्र पर प्रभावकारी नमी संरक्षण करते ज्यादा क्षेत्र आवृत करने वाले छोटी संरचनाएं फैलाना समय की आवश्यकता है। भारी चराई और अनधिकृत खेती रोकना आवश्यक है ताकि प्राकृतिक पुनरुत्पादन को उभरने में सहायता मिले और खुले स्थानी में वृक्ष स्थापित हो सकें। इसे भारी कृत्रिम पुनर्जनन प्रयत्नों द्वारा संपूरित भी किया जाना चाहिए। इसके साथ–साथ, इस क्षेत्र का वैज्ञानिक प्रबन्ध करने की समरनीतियां भी विकासित की जानी चाहिए क्योंकि यह सामान्य की तुलना में ज्यादा घना और अधिक संनिधि और आयतन संचित करने वाला क्षेत्र बनता जा रहा है।

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COUNTING OF GREEN HEADS OF VADODARA CITY

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ABSTRACT

Vegetation play an effective role in the urban environment by supporting many fundamental sub-systems like hydrological cycle, nutrient cycle, atmospheric gas balance, climate in the surrounding and others. However increasing population and the expanding cities leading to rapid urbanization is converting more and more greener spaces into impermeable hard concrete sky-scrapers. Our activities both in-house and out-door causes several problems. Hence the urban areas experience water scarcity, air pollution, heat islands effect; traffic jams etc apart from many routine problems. For our convenience and needs the biota and soil components have been replaced by industrialization and urbanization. During last few decades because of this tremendous urbanization and industrialization the whole environment of Vadodara have changed. With all their beauty, city trees are also not spared. It is sometimes surprising how they can survive the artificial and adverse conditions under which they grow. Number of such studies under taken in this direction suggests that, the development of green areas help improve the urban environmental conditions. The present study includes tree census with their scientific identification and counting (of each tree species). In the present study 179 tree species were reported belonging to 56 plant families. The major families are Ceasalpiniaceae, Mimosaceae, Bignoniaceae, Moraceae, Arecaceae. The study has also identified VITrees (Very Important Trees) which need special care for their sustenance.

Key words: number of trees, VITs, rare trees

INTRODUCTION

For better managing the ecosystem, for the years, people have worked on bird census and animal census. And according to results of such census survey, the rare and endangered species are listed out and the missions get started for their conservation. As far as plants are concerned people do take care of those species which are exotic, having good ornamental or medicinal values or with good market value. No attention is paid to the plants of city area especially tree species which are maintaining themselves in the worst atmosphere of concrete jungle.

Vadodara is one of the major cities of Gujarat state. It is beautiful and well planned city and the main seat of learning and culture in the state of Mahatma Gandhiji. The general topography is plain. The weather in general remains dry and sunny except during monsoon. The city is situated on the southern bank of the river Vishwamitri, the total city area is 108.22 sq. kms. The population is estimated to be approximately 1,50,000.

Vadodara is also one of the major industrial cities in Gujarat. The industrial area covers an area of 35 sq. kms. and lies on North-West direction of the city. Due to anthropogenic activities gases like O_3, NO_x, CO_2, NH_3, and SO_2 are released in excess into the atmosphere. These pollutants are known to have effects on human health, animals, plants, natural and managed ecosystems. The impacts of pollutants on vegetation are much apparent due to their stationary nature. Trees, because of their perennial nature, are exposed to the pollutant most of the times and get damaged. Some of the common visible symptoms are chlorosis, necrosis, burnt tip of branches defoliation etc (Saha, 1998)

The present study includes tree census with scientific identification and counting of each tree species. The survey has been carried out in every street and road for the tree count of Vadodara city limits.

METHODOLOGY

The quality of vegetation in any ecosystem is one of the best indicators of the environmental conditions there. Plants being the primary producers are one of the important factors that determine the nature of all other life forms in the area. The survey included visits to each street and roads to collect data on number of trees of each species and subsequent analysis of information gathered. All the species were classified according to Bentham and Hooker's system of classification using reference flora (Cooke, 1958; Shah, 1978; Santapau, 1962; Bole and Pathak, 1988; Rao, 2001). For documentation, photographs were also taken for plant specimens. The photography was accomplished with the help of photographic camera (Canon, AE-1)

RESULTS AND DISCUSSION

There are many reasons for undertaking this tree census. This helps to determine the importance of a site, the population size of a species, the habitat requirements of a species, habitat management and also understand the population dynamics. All these help in better management of the city. Earlier, in an adjoining area Sayajibaug (well known as Kamatibaug), spread in an area of 113 acres, on river Vishvamitri, total 98 tree species were listed under the project-Tree Diversity of Sayaji Park, Vadodara. (Thaker et al. 1999). Similarly, Prof. Subnis (1967) has also reported 147 tree species from Baroda and its environs. In the present study, however 179 tree species were recorded belonging to 56 families (Table-1). The major families are Ceasalpiniaceae, Mimosaceae, Bignoniaceae, Moraceae, Arecaceae.

Table – 1 : Total Tree species recorded in Vadodara city limits

	FAMILY	GENERA	SPECIES
Dicotyledons	48	117	159
Polypetalae	30	68	94
Gamopetalae	11	37	46
Monochlamydae	07	12	19
Monocotyledons	03	12	12
Gymnospermae	05	06	08
Total	56	135	179

Total 96,475 numbers of tres were noted from Angiosperms and 1865 from Gymnosperm group. The lesser number of trees were found in the city areas like Raopura, Mangal Bazar, Panigate where both human population and vehicular traffic is the most. Some of the major tree species are *Azadirachta indica* A.Juss, *Mangifera indica* L., *Polyalthia longifolia* Benth. & HK.f., *Peltophorum pterocarpum* (Dc.), *Pongamia pinnata* L., *Mimusops elengi* L., etc. Ornamental flowering trees are *Bauhinia purpurea* Lamk., *Bombax ceiba* L., *Butea monosperma* (Lamk), *Cassia javanica* L., *Cassia fistula* L., *Cassia renigera*, *Delonix regia*(Boj.), *Erythrina variegata* L., *Jacandra mimosifolia* D. Don., *Nyctanthes arbor-tristis* L. *Saraca asoca* (Roxb.), etc. Ornamental foliage and shade trees are *Ailanthus excelsa*(Roxb.), *Alstonia scholaris* (L.), *Azadirachta indica* A. Juss, *Casuarina equisetifolia* J. R. & G. Forst., *Ciba pentendra* (L.), *Kigelia pinnata* (Jacq.), *Melia Azedarach* L., *Polyanthus longifolia* Benth., *Roystonea regia* (H. B. & K.). some medicinal tree species are *Acacia catechu* (L. f.), *Aegle marmalose* (L.), *Ailanthus excelsa* Roxb., *Azadirachta indica* A. Juss., *Saraca asoca* (Roxb.), *Strychnos nux-vomica*, *Tamarindus indica*, *Terminalia bellerica*(Gaertn.), *Terminalia chebula* Retz. etc.

Table – 2 : Major tree species with their numbers in Vadodara city limits.

Botanical name	No. of trees	% of total trees number
Polyalthia longifolia Benth. & HK.f.	2893	3
Azadirachta indica A.Juss	2710	3
Peltophorum pterocarpum (Dc.) Backeref.K.Heyne.	2271	2
Punica granatum L.	2040	2
Manilkara zapota (L.) Van.	1790	2
Thevetia peruviana (Pers.) Merrill.	1755	2
Holoptelia integrifolia (Roxb.) Planch.	1731	2
Plumeria rubra Linn.	1717	2
Pongamia pinnata L.	1686	2
Tecoma stans (L.) H.B. K.	1519	2
Vitex negundo L.	1484	2
Roystonea regia (H.B. & K.) O.F.Cook.	1437	1
Mangifera indica L.	1426	1
Mimusops elengi L.	1351	1
Kigelia pinnata (Jacq.) DC.	1236	1
Ficus benghalensis L.	668	0.5

Table – 3 : Tree species tolerant to air pollution

Resistant	Moderate	Sensitive
Anogessus latifolia (Roxb.) Wall.	Cordia dichotoma Forst. f.	Acacia nilotica (L.) Willd. Ex Delle,
Azadirachta indica A. Juss.	Holopptelia integrifolia (Roxb.)	Mangifera indica L.
Bauhinia recemosa Lamk.	Pithecellobium dulce (Roxb.) Benth.	Mimusops hexandra (Roxb.) Dub.
Strablus asper Lour.	Tamarindus indica L.	Moringa oleifera Lam.

(Saha, 1998)

The least number of trees were found for (Fig.-1) *Adansonia digitata* L., *Choclospermum religiosum* (L.) Alst. Handb., *Diospyros embryopteris* Pers., *Sterculia urens* Roxb., *Strychnos nux-vomica* , *Xerompis uglinosa* (Retz.) Maheshwari etc.

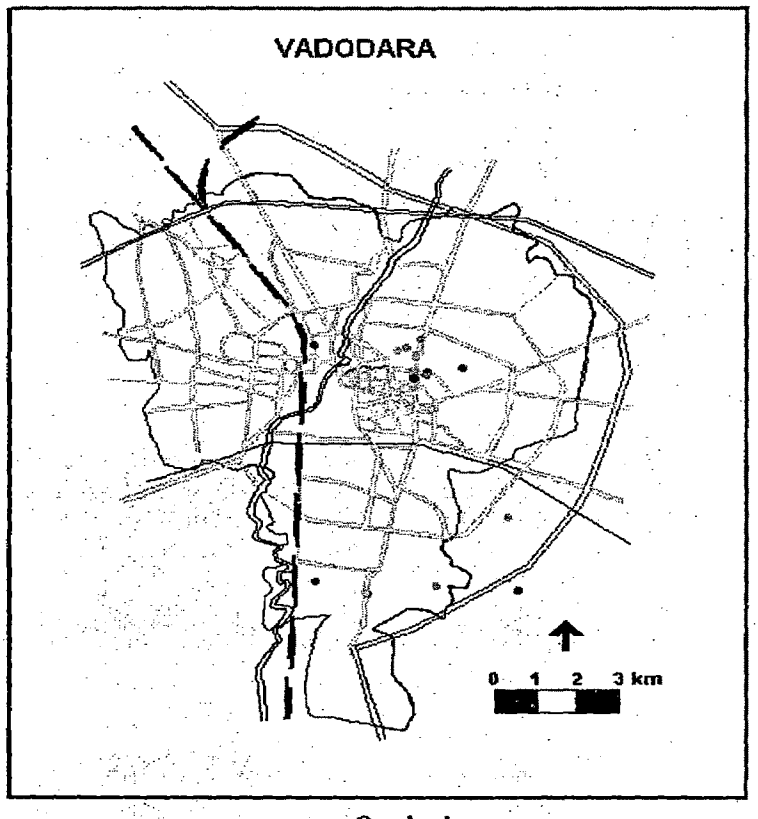


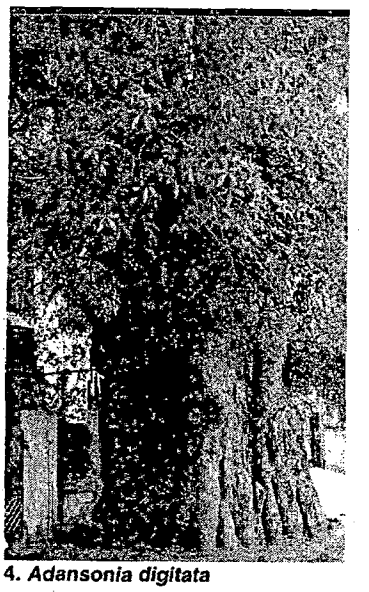
Fig. 1: The map showing the location of some of the rare and VITrees in Vadodara city limits.

Plate I

1. *Ficus benghalensis* L.

2. *Hyphaene dichotoma*

3. *Polyalthia longifolia*



4. *Adansonia digitata*

Fig. 2: Some of the rare and VITrees in Vadodara city limits.

Some trees on private / public land locations seem to date back to several decades and in part define the long term association with the society. These trees have significant specification due to their characteristics/size/age etc. Such trees can be defined as VITs (Very Important Trees) as they have special / exceptional value to the community due to their enormous size / special characteristics or long term association of the species. The city must retain VITs (except when removal is mandatory for public health / safety or welfare) as they are the assets of our city. VITs with their enormous size in Vadodara has been identified as *Ficus benghalensis*, *Azadirachta indica* at D.N. Hall ground (M.S.U. Baroda), *Tamarindus indica* and *Mimusops elengi* in Faculty of Arts with the maximum girth among all tree species. Such huge canopy of trees speaks about the royal era of the University in the mid 20th century. Trees like *Adansonia digitata* at Ellora park; *Cassia fistula, Manilkara hexandra* and *Kigelia pinnata* at Kareli baug; have been marked as VITs.

Earlier, Sabnis (1967) has also reported 898 plant species from Baroda and its environs with 147 tree species. This clearly indicates that number of tree species has increased but numbers of trees have distinctly decreased. As per the latest survey (2001) the population of Vadodara is 15,000,00 approximately and the number of trees is 98,340 only. In fact, to maintain ecological balance fifteen trees are required for every person.

According to the survey by Gujarat State Forest Department, the number of trees of Vadodara District is 2,33,211. The survey showed the population of *Acacia nilotica* Del. being 14 %, *Azadirachta indica* is 13%, *Eucalyptus globulus* is 11 % and *Bombax ceiba* is 9 %. In the districts the number of trees per head is only 2 which are lesser than the average. 53 % of these trees are of 10 - 45 cm GBH with the age of 3 to 15 years and 31 % of trees are of 46 - 90 cm GBH with the age of 16 to 30 years. Among 20 main tree species, *Azadirachta indica* is found to be the most abundant and distributed all over the Gujarat state. Result also demonstrates that there are 12 trees per hectare in Vadodara District which is much less than the average. (Anonymous, 2000).

Benefits of city trees:

The city tree with the characteristic shape of its canopy, its habit of growing tall and slender or small and spreading, its spring bloom or fall color, the shape and size of its leaves, and its evergreen or deciduous nature. No single item distinguishes a city more than its green areas, and probably our first reaction to a society is to its abundance or lack of trees. The shade they give from the scorching sun makes the summer heat more tolerable, and natural filters for grateful eyes the dazzling reflection from masonry and concrete.

For all their beauty, city trees are no weaklings. It is sometimes surprising how they can survive the artificial and adverse conditions under which they grow. Smoke and gases, physical injuries, the disrupted water table, hard packed soil, lack of humus renewal and mulch, inadequate root space, reflected heat from pavements and buildings, and glacial blasts of air through the wind tunnel formed by street and buildings, all make their survival a lot hard.

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Trees act as catalyst in nature's antipollution squad. Tree alleviate dust, cleanse the air and absorbs moisture and as they play the role of cooling agents and as a buffer against noise. Besides all these biological activities trees aid to the beauty in the city's concrete infrastructure. Above all trees are beautiful to look at and to have them around.

Step forward to make our city beautiful :

Even if a single tree falls or is felled the community loses a worth more than Rs. 32 lakhs. Therefore every citizen should actively participate in the efforts being made by the government and voluntary agencies to protect existing trees and to plant more trees. The first task is of education and awareness about biodiversity and its important role in our lives. Nature clubs and residents' association need to encourage short trips to urban gardens of biodiversity to inculcate love and respect for the same. Citizens can put pressure on the city administration agencies to plant appropriate trees species or to ensure that biodiversity conservation is an important consideration in an urban development Plans. More parks and gardens should be planned with diverse but appropriate variety as per the need. Sometimes many exotics are introduced to arouse people's interests in trees. Citizens can do a lot towards the protection of their immediate environment. As a part of these exercises we have recently conducted a training programme for school children on Plants: Importance, Diversity and Conservation during 1-2 February 2005 with the successful training to students and teachers. (Anonymous, 2005)

In short, it is our duty to protect some of the surviving 'lungs' of the city before they catch the greedy eyes of the so call'developers' of the once beautiful urban green centre which combined all the good features of the city and a village.

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Tree diversity in Vadodara city

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Abstract

The Vadodara city is situated on the southern bank of the river Vishwamitri. The total city area is 108.22 sq. km. it is one of the major industrial cities in Gujarat state. The industrial area covers an area of 35 sq. kms. and lies on north-west direction of the city. During last few decades because of tremendous urbanization and industrialization the whole environment of Vadodara have changed. The prerequisites for any biodiversity study of an area include detailed inventory of the available plant forms and their associations, as a parts of these, studies were under taken to generate an inventory of tree species. In the present study 179 tree species a reported form 56 families. The dominant families are Caesalpiniaceae, Mimosaceae, Bignoniaceae, Moraceae, Arecaceae.

Key words : Tree diversity, Vadodara, Urbanization, Tree species

Introduction

Biodiversity studies are gaining immense significance and are the hot topic today. Biodiversity conservation is not only for ecological and environmental rejuvenation, but also for sustainable economic development. In recent years, biodiversity – its conservation and sustainable utilization has become the most important component for the survival of human being on this earth. The biological diversity was at its extreme and natural resources were abundant and freely available to man for his survival and development at the time he entered the industrial age (Das, 2002).

For our convenience and needs the biota and soil have been stripped away and replaced by industrialization and urbanization. Vadodara is an example of such synthetic ecosystem where tremendous urbanization and industrialization during last dew decades have changed the whole landscape. Vadodara is one of the major industrial cities in Gujarat. The industrial area covers an area of 35 sq. km. And lies on the North - West direction of the city. In fact industrial units are located all around the city.

The prerequisites for any biodiversity/vegetation/green cover plans, it is essential to generate a detailed inventory of the available plant forms and their associations. Therefore, studies were undertaken to generate an inventory of tree forms growing in the Vadodara city.

Geology and Geography

The Vadodara city is situated on the banks of Vishwamitri river and between the fertile lands of rivers Narmada-Mahi. Vadodara is situated in the western parts of Gujarat between 22°17'59" latitude and 73°15'18" East longitudes and 35.5 Mts. Altitudes above mean sea level. The total area of the city is 108.22 sq. kms. The general topography is plain. The general soil types are black soil and red loam and the area is very fertile for agricultural use, soil characters are almost same at all localities.

Climate

In general the weather remains dry and sunny except during monsoon, the wind flow has a definite pattern with higher speeds during pre-monsoon. The wind remains calm during October. The average winter temperature is 31°C maximum and 11°C minimum. During summer

temperature rises up to 45°C maximum 24°C minimum. The duration of rainfall is mid June to mid September with an average rainfall of 931.9 mm.

Tree enumeration of the Vadodara city

Biodiversity means the variability among living organisms from all sources. It refers to the ecosystem complexes in which they occur. Biological resources contribute much to the social and economical development of the nation. Once they are lost, they can be replaced at any cost. An immediate action is required at the national and international levels for developing a global systems of protected areas, so that the biological diversity continues to remain available for their benefit and welfare of all human beings for all times to came Restoration of the habitats and the rehabilitation of the endemics and threatened species have to identified and located and to be untaken to promote biological diversity. (Dadhich and Sharma, 2002).

Therefore, studies were undertaken to generate an inventory of tree forms growing in the Vadodara city. The trees were identified with the help of general floras and text books (Batter; 1997, Cooks, 1906, Menon, 2000; Patil 1980; Randhawa, 1983; Sabnis, 1967; Shah 1978; Swaninathan, 2003, Verma et al, 1993; Vwarman, 1999).

Table - 1 : Tree species identified in the Vadodara city

Angiosperms

Sr. No.	Botanical Name	Sr. No.	Botanical Name
	Annonaceae		**Averrhoaceae**
1	*Annona reticulata* L.	1	*Averrhoa carambola* L.
2	*Annona squamosa* L.		
3	*Polyalthia cerasoides* (Roxb.)HK.f.&Bth		**Rutaceae**
4	*Polyalthia longifolia* (Sonn.) Thw.	1	Aegle marmelos (L.) Corr.
		2	*Citrus limon* (L.) Burm.f.
	Capparaceae	3	*Limonia acidissima* (L.) Linn.
1	*Crateva nurvala* Duch.-Hum.Var.*nurvala*	4	*Murraya koenigii* (L.) Spr.
		5	*Murraya paniculata* (L.) Jack.
	Bixaceae		
1	*Bixa orellana* L.		**Simarubaceae**
2	*Hydnocarpus* wightiana Bluma	1	*Ailanthus excelsa* Roxb.
		2	*Quassia amara* L.
	Cochlospermaceae		
1	*Cochlispermum religiosum* (L.) Alston		**Balanitaceae**
		1	*Balanites aegyptiaca* (L.) Delile.
	Tamaricaceae		
1	*Tamarix dioica* Roxb.Ex.Roth		**Burseraceae**
		1	*Boswellia serrata* Roxb.
	Clusiaceae		
1	*Garcinia mangostana* L.		**Ochnaceae**
2	*Garcinia xanthochymus* Hook.f.	1	*Ochna squarrosa* L.
	Malvaceae		**Maliaceae**
1	*Thespesia populnea* (L). Soland.ex.Corr.	1	*Azadirachta indica* A.Juss
		2	*Melia azedarach* L.
	Bombacaceae	3	*Melia composita* Willd.
1	*Adansonia digitata* L.	4	*Swietenia mahogany* (L.) Jacq.
2	*Bombax ceiba* L.		

3 *Ceiba pentandra (L.) Gaerth.*

Sterculiaceae

1 *Guazuma ulmifolia* Lam.
2 *Helicteres isora* L.
3 *Kleinhovia hospita* L.
4 *Pterospermum acerifolium* (L.)Willd.
5 *Pterospermum suberifolium* Lam.
6 *Sterculia alata* Roxb.
7 *Sterculia foetida* L.
8 *Sterculia urens* Roxb.

Zygolhyllaceae

1 *Guaiacum officinale* L.

Papilionaceae

1 *Butea monosperma* (Lamk.) Taubert.
2 *Dalbergia latifolia* Roxb.
3 *Dalbergia sissoo* Roxb.
4 *Erythrina indica* Lamk.
5 *Gliricidia sepium* (Jacq.) Walp.
6 *Pongamia pinnata* L.
7 *Pterocarpus marsupium* Roxb.

Caesalpiniaceae

1 *Bauhinia purpurea* L.
2 *Bauhinia racemosa* Lamk.
3 *Bauhinia variegata* L.
4 *Cassia fistula* L.
5 *Cassia javanica* L.
6 *Cassia renigera* Wall ex Bebth.
7 *Cassia roxburghii* DC.
8 *Cassia siamea* Lamk.
9 *Delonix regia* (Boj.) Ref
10 *Parkinsonia aculeate* L.
11 *Peltophorum prerocarpum* (DC.) Backeref K. Heyne.

12 *Saraca asoca* (Robx.) de. Willde.
13 *Tamarindus indica* L.

Mimosaceae

1 *Acacia auriculiformis* A.Cumm. ex. Benth.
2 *Acacia catechu* (L.f.) Willd.
3 *Acacia leucophloea* (Robx.) Willd.
4 *Acacia nilotica* (L.) Willd. Ex. Delile.
5 *Acacia Senegal* (L.) Willd.
6 *Adenanthera pavonina* L.
7 *Albizzia amara* (Robx.) Boiv.
8 *Alizzia lebbeck* (L.) Benth.

Mimosaceae

1 *Parkia biolandulosa* Wigth & Arn.
2 *Pithwcellobium dulce* (Robx.) Benth.

Rhamnaceae

1 *Zizyphus mauritiana* Lamk.
2 *Zizyphus nummularia* (Burm.f.) W.& A.

Sapindaceae

1 *Sapindus emarginatus* Vahl.

Anacardiaceae

1 *Anacardium occidentale* L.
2 *Lannea coromandelica* (Houtt.) Merrill.
3 *Mangifero indica* L.

Moringaceae

1 *Moringa concanensis* Nimmo.
2 *Moringa oleifera* Lam.

Myrtaceae

1 *Callistemon lanceolatus* D.C.
2 *Eucalyptus globules* Labill.
3 *Psidium guajava* L.
4 *Syzygium cumini* (L.) Skeels.

Lecythidaceae

1 *Cogerstroemia guianensis* Aubl.

Lythraceae

1 *Lagerstroemia speciosa* (L.) Pers.

Punicaceae

1 *Punica granatum* L.

Caricaceae

1 *Carica papaya* L.

Alangiaceae

1 *Alangium salvifolium* (L.f.) Wang.

Rubiaceae

1 *Adina cordifolia* (Robx.) Ridsd.
2 *Anthocephalus indicus* A. Rich.
3 *Gardenia jasminoides* Ellis
4 *Hymenodictyon excelsum* (Roxb.) Wall.
5 *Ixoro arborea* Roxb. Ex. Smith
6 *Ixoro coccinea* L.
7 *Mitragyna Parvifolia* (Roxb.) Korth.
8 *Morinda tinctoria* Roxb.
9 *Xeromphis spinosa* (Thunb.) Keay.
10 *Xeromphis ulignosa* (Retz.) Maheswari

Sapotaceae

1 *Madhuca indica* J.F. Gmel.
2 *Manilkara hexamdra* (Roxb.) Dub.

3 *Prosopis cineraria* (L.) Druce.
4 *Prosopis juliflora* (Sw.) DC.
5 *Samanea saman* (Jacq.) Merr.

Combretaceae
1 *Anogeissus sericea* Brandia.
2 *Terminalia arjuna* (Robx.) W.&A.
3 *Terminalia bellirica* (Gaertn.) Robx.
4 *Terminalia catappa* L.
5 *Terminalia chebula* Retz.
6 *Terminalia crenulata* Roth.

Oleaceae
1 *Nyctanthes arbor-tristis* L.
2 *Schredera swietenioses* Roxb.

Salvadoraceae
1 *Savadora persica* L.

Apocynaceae
1 *Alstonia scholaris* (L.) R.Br.
2 *Holarrhena anatidysenterica* (L.) Wall ex Dl.
3 *Plumeria rubra* Linn.
4 *Thevetia peruviana* (Pers.) Merrill.
5 *Wrightia arborea* (Dennst.) Mabberly
6 *Wrightia tinctoria* R.Br.

Loganiaceae
1 *Strychnos nux-vomica* L.

Ehretiaceae
1 *Cordia dichotoma* Forst f.
2 *Cordia gharaf* (Forsk.) Ehrenb. & Asch.
3 *Cordia sebestena* Linn.
4 *Ehretia laevis* Roxb.

Bignoniaceae
1 *Crescentia cujete* L.
2 *Haplophragma adenophyllum*(Wall.) P.Dop.
3 *Heterophragma quadriloculare* (Roxb.) K. Schum.
4 *Jacaranda mimosifolia* D.Don.
5 *Kigelia pinnata* (Jacq.) DC.
6 *Millingtonia hortensis* L.
7 *Oroxylum indicum* (L.) Vent.
8 *Radermachera xylocarpa* K.Schum.
9 *Spathodea campanulata* Beauv.
10 *Tabebuia argentea* (Bur. & Schum.) Britt.
11 *Tabebuia rosea* D.C.
12 *Tecoma stans* (L.) H.B.K.
13 *Tecomella undulata* (Sm.) Seem.

3 *Manilkara zapota* (L.) Van.
4 *Minusops elengi* L.

Ebenaceae
1 *Diospyros embryopteris* Pers.
2 *Diospyros melanoxylon* Roxb.
3 *Diospyros Montana* Robx.

Lauaceae
1 *Cinnamomum camphora* (L.) T. Nees & Eberm.

Proteaceae
1 *Grevillea robusta* A. Cunn. Ex. R. Br.

Santalaceae
1 *Santalum album* L.

Euphorbiaceae
1 *Emblica officinalis* Gaerth.
2 *Putranjiva roxburghii* Wall.
3 *Sapium insigne* Bth.

Ulmaceae
1 *Holoptelea integrifolia* (Roxb.) Planch.

Moraceae
1 *Artocarpus heterophyllus* Lam.
2 *Ficus amplissima* Sm.
3 *Ficus benghalensis* L.
4 *Ficus benjamina* L.
5 *Ficus elastica* Roxb.
6 *Ficus hispida* L.f.
7 *Ficus krishnae* C. DC.
8 *Ficus racemosa* L.
9 *Ficus religiosa* L.
10 *Morus alba* L.
11 *Streblus asper* Lour

Casuarinaceae
1 *Casuarina equisetifolia* L.

Sterlitziaceae
1 *Ravenala Madagascarensis* J.F.Gmel.

Arecaceae
1 *Borassus flabellifer* L.
2 *Calamus rotang* L.
3 *Caryota urens* L.
4 *Cocos nucifera* L.
5 *Elaeis guinensis* Jacq.

	Verbenaceae	6	*Hyphaene dichotoma* (White) Furtads.
1	*Gmelina arborea* Roxb.	7	*Livistonis chinesis* R.Br.
2	*Tectona grandis* L.f.	8	*Phoenix sylvestris* (L.) Roxb.
3	*Vitex negundo* L.	9	*Roystonea regia* (H.B.&K.) O.F.Cook.
		10	*Sabal palmetto* (Watter) Lodd. Ex R. & S.
	Pandanceae		
1	*Pandanus odoratissimus* L.f.		**Poaceae**
		1	*Bambusa orundinacea* Willd.

Gymnosperms

Sr. No.	Botanical Name	Sr. No.	Botanical Name
	Cycadaceae		**Podocarpaceae**
1	*Cycas revolute* Thumb.	1	*Podocarpus gracilior*
2	*Cycas rumphii* Miq.		
3	*Cycas circinalis* L.		**Auaucariaceae**
		1	*Auaucaria auriculiformis*
	Cupressaceae		
1	*Biota orientalis* (L.) Endl.		**Pinaceae**
2	*Juniperus chinensis* L.	1	*Pinus longifolia Roxb.*
	Zamiaceae		
1	*Zamia furfuracea*		

Result and discussion

The trees are judged by the shape of its canopy, its habit of growing tall and slender or small and spreading, its bloom or fall color, the shape and size of its leaves, and its evergreen or deciduous nature. Besides its biological activities, trees aid to the beauty in the city's infrastructure and are beautiful to look at and to have around.

The present study enumerated 183 trees species belonging to 138 genera and 59 families (Table - 2).

Table – 2 : Number and Percentage of families, genera and species of each class

Class	Family		Genera		Species	
	No.	%	No.	%	No.	%
Dicotyledons	**49**	**83.03**	**118**	**85.5**	**161**	**87.8**
Polypetalae	32	65.3	68	57.62	95	59
Gamopetalae	10	20.4	38	32.2	47	29.2
Monochlamydae	7	14.3	12	10.18	19	11.8
Monocotyledons	4	6.78	13	9.42	13	7.1
Gymnospermae	6	10.17	7	5.08	9	4.92
Total	59	100	138	100	183	100

Among the Angiosperms, dicotyledons contributed 161 trees species belonging to 118 genera and 49 families which is 83.05% of the total. The monocotyledons are comparatively lesser in number having 13 species belonging to 13 genera and 4 families which is 6.78% of total. Gymnosperms were also found in some areas of city including the gardens of the Maharaja Sayajirao University of Baroda. The gymnosperms contributed 9 plant species belonging to 7 genera and 6 families which is 10.17% of total. Among the dicotyledons, the

polypetatae group was higher than that of others which is 65.30% of the total polypetalae group. The proportion of the monocotyledons to dicotyledons was also recorded (Table - 3).

Table – 3 : Comparison of Monocotyledons – Dicotyledons ratio of various levels in Vadodara city.

Comparison	Monocotyledons – Dicotyledons ratio
Family	01:12.3
Genera	01:09.1
Species	01:12.4
Genera to	01:01.3

These ratio are higher in comparison to a correspondence ratio (1:2.2) for the Vadodara city (Sabnic, 1967). The dominant families recorded were *Caesalpiniaceae, Mimosaceae, Rubiaceae, Sterculiaceae, Papilionaceae, Biononiaceae, Moraceae and Arecaceae*. Dominant tree species are *Azadirachta indica* A. Juss. *Mangifera indica* L., *Polylthia longifolia* Benth & H.K.f., *Peltophorum pteocarpum* (DC.) Backerf K. Heyne, *Pongamia pinnata* L., *Mimusops elengi* L. etc. Some medicinally important tree species noted were *Aegle marmelod* (L.) Corr., *Azadiracha indica* A. Juss., *Acacia catechu* (Lf) Willde, *Saraca asoca* (Roxb.) de Willde, *Ailanthus excelsa* Roxb., *Terminalia bellerica* (Gaertn) Roxb., *Tamarindus indica* L. etc. Some economically important trees were *Butea monopserma* (Lamk) *Taubert, Delonix reiga* (Boj) Ref., *Cassia fistula* L, *Bombox ceiba* L, *Alstonia scholaris* (L.)R.Br.

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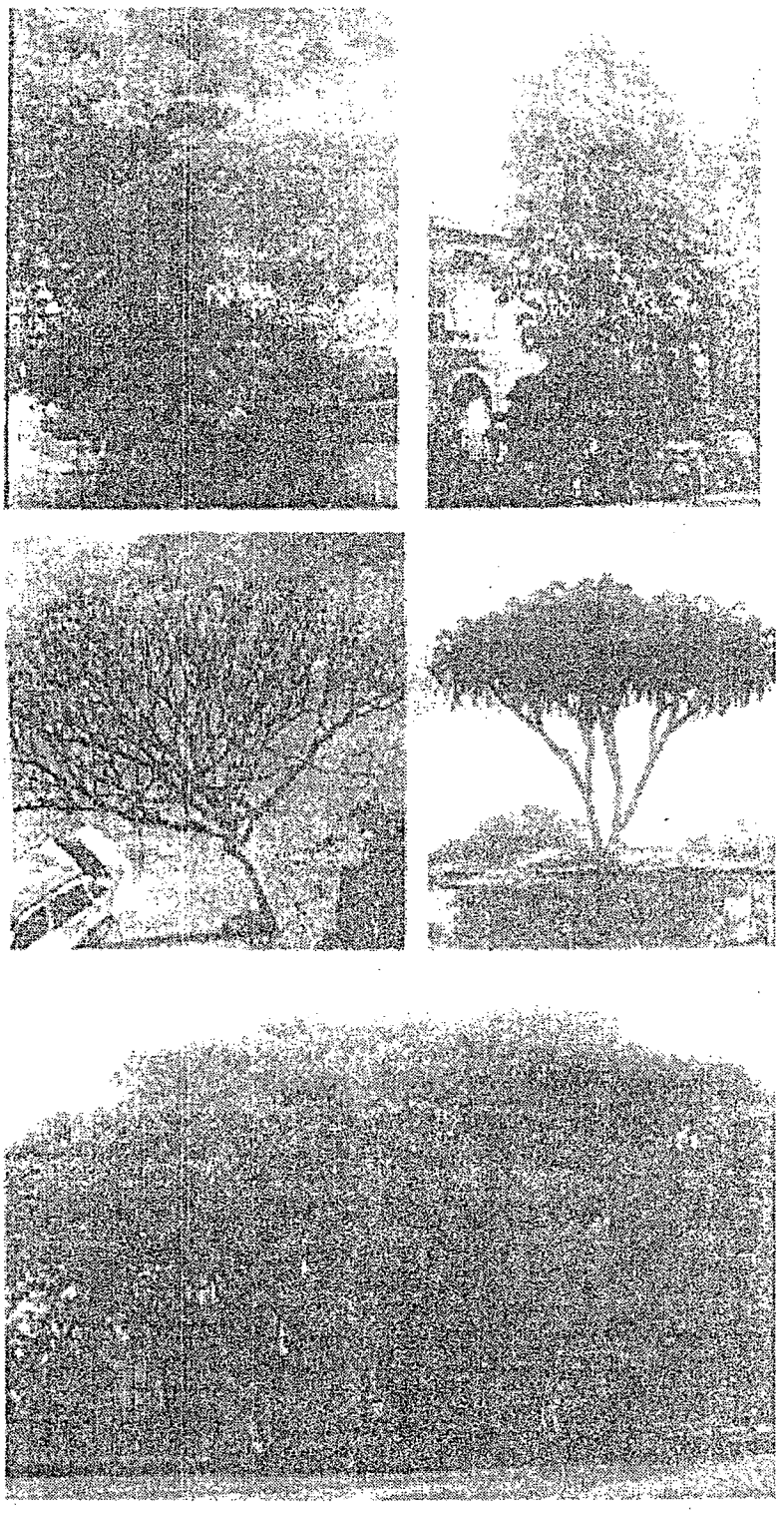

Plate - : Some of the trees in Vadodara city limits

(1) Adansonia digitate L. (2) Polyalthia longifolia (Sonn.) Thw. (3) Plumeria reubra Linn. (4) Hyphaene dichotoma (White) Furtads. (5) Ficus benghalensis L.

THE TIMES OF INDIA

SATURDAY

FEBRUARY 9, 2002

Banyan city asks for more than banyans

Manju Ramanan
Times News Network

The Ficus Benghalensis or the banyan tree that has been long associated with Vadodara city is slowly losing ground. The tree the city is named after is surely lesser in number than it used to be. The reason: its incessant cutting to widen city roads and a gross indifference towards its disappearance. But not all seems to be lost. NGOs in the city are busy reviving the tradition of the tree-with-roots which the city is named after. And other trees as well.

Says Gunvant Oza of the International Society of Naturalists (INSCNA), "By planting more banyans we shall retrieve the city's lost identity. Their numbers have declined in the past few years due to rapid industrialisation and expansion of the city beyond its limits. So it is time we plant many of them so that the city retains its originality."

The disappearance of the banyan according to Oza is also due to the non-participation of the common man in conserving bio-diversity. "People mow down trees as there is no law against the cutting of trees in Gujarat. While it might take less than an hour to bulldoze a big tree and less than 15 minutes to raze to the ground a smaller one, keeping trees green and healthy is the biggest challenge for naturalists," he says.

Tree Time

Nature lovers are in abeyance too and their concern is not restricted to just the banyan tree. "Vadodara has a lot of industries resulting in pollution. Hence we do need a large number of trees throughout the city. The older city has buildings cramped near each other with no space for tree plantations while in the newer part largely people are indifferent," says a tree lover Harsha Patel.

So, Insona has adopted two roads for tree planting. Old Padra road by now has 100 sanctuaries (as banyan trees are called) while planting has also been carried out at the road from Atladra to Gujarat Electricity Board as well as the area from Lalbag to the Vishwamitri overbridge. The other place is the belt near the Vikram Sarabhai marg to the Shastri bridge near Vadivadi. "In all, 125 banyans have been planted," says Oza.

Mukund Parikh of the Tree Lover's cooperative society adds, "The deserts of Kutch and Rajasthan are slowly invading the rest of Gujarat and we need more trees to stop this erosion. Places like Devgadh Baria, Suwas and even places like Pavagadh have less forests now which is an alarming sign. We must encourage more trees."

There are also plans to introduce indigenous trees in the city. "Apart from banana, the city need trees like tamarind, neem, peepul etc and not trees like gulmohur or eucalyptus which have a life as short as 14 years. The former live for generations and their produce can also be put to use," says Oza.

Parikh adds, "Neem can be called the kamdhenu of Gujarat. In an experiment we conducted a few years ago, the extract of neem fruit, when added with fertiliser proved to be beneficial to the paddy crop cultivated in South Gujarat, Surat, Valsad, Dangs, Kheda, Ahmedabad and Panchmahals."

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TOI 23/4/03

TO SPEND A COOL EVENING

Times News Network

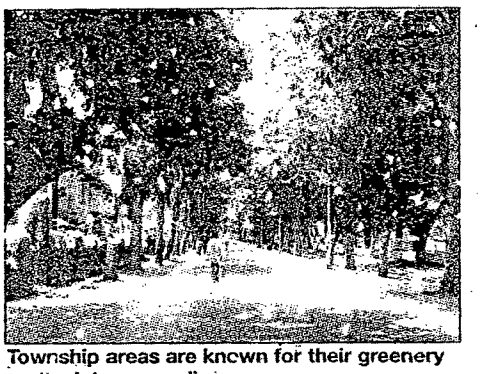
MORNINGS are hot. Afternoons are hotter. By evening, you are too tired to move out. Besides, the big question is: Where do you go? Parks are overcrowded. As are fast-food corners and other hangout joints. Little wonder that Barodians wanting to chill out are looking for unusual alternatives to spend an evening. "A green patch within the city" is all that one yearns for, given the dry zones that Vadodara abounds in. With not many cool locations to boast of inside or for that matter even outside it, denizens are making the most of the few green areas.

GREEN PATCHES

Sindhrot is popular as before, but most people now prefer the drive than just spending time at the bridge. The narrow roads, with trees dotting it on either side are great for long walks or even a drive. Fortunately, this area is still not 'developed' as a result of which you find a lot of trees, and they provide a cool repose too. "We prefer taking long walks along the woods there," says Jyuthika Pandey, a home-science student who loves sprinting off to the Mahi banks with her friends.

And how can you forget the Nature Park en route to Sindhrot? Apart from a sight for sore eyes, the trees and birds here help you rediscover the environment. It is an ideal for a small trek or a biking expedition. "Every weekend we go on our bikes to the park and spend the evening there," says Anuj Pancholi. "It's a good, quiet place to hang out within the city limits and provides respite from the heat," he adds.

Surprising though it may sound, Refinery and other township areas are almost becoming a hot-spot. Neat roads, lots of greenery and fresh air — what more do you need to spend a cool evening? So Ashim Sharma, a government employee takes his family for a drive to the township simply because 'you can breathe some unpolluted air'. "The crowds at Kamatibaug becomes intolerable in the evenings and one can't think of shopping," says Sharma. "So that leaves us with little choice."



Township areas are known for their greenery and quiet surroundings

Closer within the city is the EME campus, though of course off limits for civilians but the road to the temple is perhaps one of the greenest areas in Vadodara. Even the Motibaug palace ground is a delight for evening walkers. Still lush and unaffected by the pollution and traffic outside, this place is ideal for a quiet getaway.

So the choice is yours, make the most of what the city offers.

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Is G'nagar world's greenest capital?

ToI 2/4/03

By Presley Thomas
TIMES NEWS NETWORK

Gandhinagar: Some years ago when a world-wide survey adjudged Islamabad as the greenest national capital in the world, the authorities in Gandhinagar started counting the number of trees in Gujarat's capital city.

Islamabad's record 325 trees per hectare was a tall order to emulate. But when the count ended in Gandhinagar, officials were surprised to find that there were 425 trees per hectare in the state capital. Today, if you try telling people that Gandhinagar is the greenest capital in the world, you will probably get a snigger from them. This is because people have an impression that Gujarat is a semi-arid region with a perennial problem of drought.

But Gandhinagar has a statistics which would, perhaps, turn other cities green with envy. With 32 lakh trees for a 1.5 lakh population, Gujarat's capital has an enviable 22 trees per person. That's saying a lot, considering that the nearest city, Ahmedabad, does not even average one tree per person. There are, of course, no surveys for Ahmedabad which can help draw a comparison.

But as you drive from Ahmedabad towards Gandhinagar, the scenery starts to change. A cramped dusty landscape is slowly replaced by wide open spaces and a blur of green from the canopy of lakns of trees that envelope Gandhinagar. Your lungs, which choke in Ahmedabad, can tell the difference.

According to the forest department, Gandhinagar has 32 lakh trees made of 35 different species, including neem, gulmohar, banyan, pipal, mahua and rhine, in its 56 square kilometres. "We have 425 trees per square hectare. The only capital city that comes close to Gandhinagar is Islamabad with about 325 trees per square hectare," says assistant conservator of forests (Gandhinagar) R M Desai.

Gandhinagar-based Dr Darshin Pandya, an expert in pulmonary diseases, says, "The pollution level in the state capital is much less compared to other cities. The number of asthma cases or lung ailments, specifically due to vehicular pollution, is much less in Gandhinagar." No wonder, if doctors are suggesting patients to shift to Gandhinagar to be free from pollution.

However, director of the state meteorological centre R K Kankane says the trees bring down temperature by only one or two degrees. But residents say comfort levels in Gandhinagar are much greater. As Hitesh Patel of Sector 16 puts it, "There are times in summer when you can't go out for a stroll even at 6 pm in Ahmedabad. But it is not so the case in Gandhinagar. One can have a cool walk in the state capital by that time, and this is just because of trees."

Praveen Vaghela of Sector 12 adds. "The afternoons may be hot, but the city cools down substantially by evening. Anyone can easily make out the difference. The trees keep the atmosphere cool here."

Despite the cool atmosphere and the pleasant evenings, officials are still a worried lot. With no healthy monsoon for the last three years, groundwater here has already gone below 800 feet, leaving the trees high and dry. "The only solution is implementing water harvesting and conservation programmes," Desai says.

However, deputy conservator of forests J V Pandav is not worried about it. "To get the greenest city status in the world, we had planted a lot of short duration trees with a maximum lifespan of 15 to 20 years. These trees have now dried up. Many even had to be cut for projects like the Infocity. At present, we have marked about 10,000 dried trees for cutting. However, to compensate, we will plant 15,000 more trees having long lifespan. In fact, we have already started the process to make it a reality."

Arun Buch of the Gandhinagar Shaher Vasahat Mandal, a local NGO, says the city needs more trees with long life. "What is the point in planting short duration trees? We have represented before the forest department to plant more neem, jamun and gulmohar trees."

5/5/2003 Monday.

સંદેશ

વૃક્ષોની ગણતરીના કેટલાક રસપ્રદ તારણો

એકલા કમાટીબાગમાં વૃક્ષોની ૮૯ જેટલી પ્રજાતિઓ છે

(પ્રતિનિધિ દ્વારા) વડોદરા, રવિવાર

વડોદરામાં કદાચ પહેલી વખત હાથ ધરાયેલી વૃક્ષોની ગણતરીના કેટલાક રસપ્રદ મુદ્દાઓ અત્રે પ્રસ્તુત છે.

- શહેરમાં વૃક્ષોની સંખ્યા ૯૧૦૦૦ જેટલી થવા જાય છે. જેમાં ૧૩૦૦૦ જેટલા વૃક્ષો ૨ થી લઈને પાંચ ફુટના ઘેરાવા છે અને આટલા જ વૃક્ષો વિશાળ કદના પણ છે.

- શહેરમાં ૧૯૩૯માં પ્રસિદ્ધ થયેલા રીપોર્ટ મુજબ વૃક્ષની ૧૨૩ જેટલી પ્રજાતિઓ અસ્તિત્વમાં હતી જ્યારે આજે વિવિધ પ્રકારના ૧૮૦ વૃક્ષો જોવા મળે છે.

- વૃક્ષોનું સૌથી વધુ વૈવિધ્ય કમાટીબાગમાં જોવા મળ્યું છે. એકલા કમાટીબાગમાં જ ૮૯ પ્રકારના વૃક્ષો છે.

- સૌથી વધારે વૃક્ષો આસોપાલવના છે જ્યારે રેલ્વે સ્ટાફ કોલેજના ત્રણ મહોગનીના વૃક્ષોના સંખ્યાની દ્રષ્ટિએ સૌથી છેલ્લો ક્રમ આવે છે.

- વડોદરાની સૌથી મોટું વૃક્ષ યુનિ. કેમ્પસમાં આવેલું છે. વડના આ વૃક્ષના થડનું કદ ૨૬ ફુટ જેટલું થવા જાય છે.

- શહેરના દરેક વિસ્તારમાં ચોકકસ પ્રકારના વૃક્ષોની સંખ્યા વધારે જોવા મળે છે.

- શહેરના યુનિ. કેમ્પસ, રાજમહેલ અને કમાટીબાગ તથા ઈ.એમ.ઈ. આસપાસના વિસ્તારમાં વૃક્ષોની સંખ્યા સૌથી વધારે છે.

લીમડાના ૮૫૧, કરંજના ૯૫૯ અને રાવણતાડના ૪૨ વૃક્ષો

વડના ૪૯૧ પૈકીના ૩૫ વૃક્ષોના થડનું કદ ૧૨ ફુટ કરતા પણ વધારે છે

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Vadodara may have derived its name from the banyan tree but the low number of these trees has botanists worried and residents unhappy. *Newsline photo by Chandan Giri*

The canopies gone, banyans in the city are now outnumbered by asopalav and neem trees: MSU survey

bers the other varieties. There are 1,148 asopalavs, the sprawling shady peltoforum make an head-count of 997, while the pongamias, locally known as *Karanj* which grow in the valley region of Vishwamitri, are 959 in numbers. Neem trees also outnumber the Banyan, with their total of 851.

It is just not Banyan trees which stand at a miserly 491. The pipal, regarded religiously, totals to around 156. Compared to a 1968 survey report carried by the Botany Department, the number of varieties definitely seems to have increased from the then 123 to the present 140.

"While we have no concrete data about the number of trees in earlier days, what is alarming is the diminishing number of banyan trees," says Prof Jasrai.

Old-timers in the city still talk about the thick canopy of banyan trees on Rajmahal Road, where just a few trees can be seen these days. "The trees have become the biggest casualty of development in the city, we're to yet realise the gravity," says Prof Jasrai.

Size does matter

The largest trees in the city

Banyan: In D N Hall Grounds at MSU, 27-feet girth.

Peltoforum: In TB Hospital grounds, 12-feet girth.

Neem: Opposite MSU office, 17-feet girth

The survey statistics could definitely add to the worries of any tree lover. "For a population of around 15 lakhs spread over 10,800 hectares, there are around 91,000 trees," reveals the professor.

Compared with State capital Gandhinagar, which boasts of around 23 lakh trees, with an average of 491 trees per hectare, the Vadodara count is dismal.

"Look at the increasing temperature, nobody could have thought that Vadodara could be the hottest in the state. The diminishing number of trees has added to the problem," he warns.

Yet another alarming fact is the number of *gando bawal* trees, a variety which is known for its rapid growth while not allowing others to grow.

"The present count is 349 trees and are found near Golden Chowkdi, banks of river Vishwamitri and some parts of Waghodia," Premindra says. Prof Jasrai adds that the variety is a potential threat to the bio-diverse tree wealth of the city, and that uprooting and burning them "is the only way to deal with the problem."

Gujarat Samachar

14-5-03

શહેરમાં કુલ ૯૧ હજાર વૃક્ષો ઘેઘુર વડલાની સંખ્યામાં ઘટાડો

વડોદરા, મંગળવાર

વડોદરામાં વૃક્ષોની વૈવિધ્ય વધ્યું છે પણ જેના પરથી આ શહેરનું નામ પડયું છે તેવા વડલાની સંખ્યા ઘટતી જાય છે. તાજેતરમાં એમ.એસ.યુનિવર્સિટીના બોટની વિભાગ દ્વારા હાથ ધરાયેલા એક અભ્યાસમાં આ વિગતો બહાર આવી છે.

ગાંડા બાવળની વધતિ વસતિ ચિંતાજનક

આ અગાઉ ૧૯૬૮માં શહેરના વૃક્ષોનું સર્વેક્ષણ થયું હતું. એ પછીના વર્ષોના ચોક્કસ આંકડા ઉપલબ્ધ નથી. તાજેતરમાં યુનિવર્સિટીના બોટની વિભાગના સર્વેક્ષણમાં ઉપલબ્ધ થયેલી વિગતો અનુસાર શહેરના કુલ ૧૦,૮૦૦ હેક્ટર વિસ્તારમાં ૧૫ લાખ નગરજનોની વસતિ છે પણ તેના પ્રમાણમાં વૃક્ષોની વસતિ કેવળ ૯૧ હજાર છે. શહેરમાં એક હેક્ટરદીઠ વૃક્ષનું પ્રમાણ માત્ર ૪.૮નું જ છે. આ પ્રમાણ બહુ હરખાવા જેવું નથી.

વૃક્ષનું સૌંદર્ય તેના થડના ઘેરાવા પરથી અંકાય છે. જેટલું થડ દળદાર તેટલું વૃક્ષ રુઆબદાર. શહેરના આવા ત્રણ મહારૂઆબદાર વૃક્ષોમાં દાદાભાઇ નવરોજી હોલ મેદાન સામેનો વડલો (૨૭ફીટનો ઘેરાવો), ટીબી હોસ્પિટલ મેદાન પરનો ગુલમહોર (થડનો ઘેરાવો ૧૨ ફીટ) તથા યુનિવર્સિટી કાર્યાલય સામેના ભારેખમ લીમડાનો (થડનો ઘેરવો ૧૭ફીટ) સમાવેશ થાય છે.

માણસની ભાષામાં શહેરના વૃક્ષોનું માતૃત્વ પ્રમાણે વર્ગીકરણ કરીએ તો શુભપ્રસંગોએ તોરણ લટકાવવા લોકો ડાળીઓની કરપીણ હત્યા કરે છે તેવા અશોકવૃક્ષ-આસોપાલવની ૧૧૪૮ જેટલી છે. હરિયાળા ગુલમહોરની સંખ્યા ૯૯૭ જેટલી છે. વિશ્વામિત્રીના કોતર પ્રદેશમાં ઉગેલા કરંજના ઝાડવાઓની સંખ્યા ૯૫૯ છે. લીમડાં ૮૫૧ જેટલા છે, જ્યારે વડોદરાની ઓળખ જેવા વડલાની સંખ્યા ૪૯૧ જેટલી થઇ છે એટલે તેમને લઘુમતીમાં મૂકવા પડે તો નવાઇ પામવા જેવું નથી. પવિત્ર પીપળાની વૃક્ષ સંખ્યા ૧૫૬ જેટલી છે.

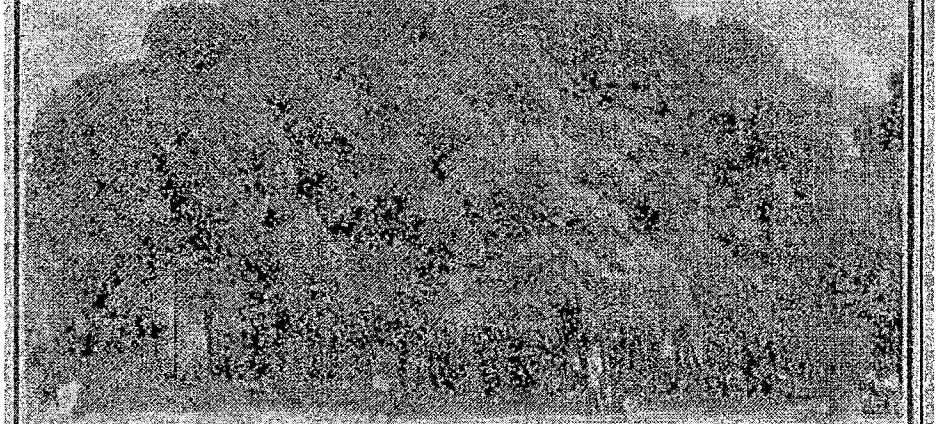
વડલા જેવા વડીલો આજે પણ સૂરજનું કિરણ ટપટીને ધરતી સુધી ન પહોંચે તેવી ઘેઘૂર વડરાજીથી છવાયેલા રાજમહેલ રોડ જેલ રોડની વાતો કરે છે. જ્યાં હવે વડલાની સંખ્યા ગણતા આંગળાના વેઢા પણ વધી પડે તેટલી જ રહી છે. સંતોષની વાત એટલી જ કે ૧૯૬૮ના સર્વેક્ષણમાં લગભગ ૧૨૩ જાતના વૃક્ષો-વનસ્પતિનું અસ્તિત્વ શહેરમાં નોંધાયું હતું. તેની સામે વૃક્ષ જાતિની વિવિધતા વધીને ૧૪૦ જેટલી થઇ છે. જોકે, ભૂતકાળની વૃક્ષવસતિ અંગે વિશ્વસનીય આંકડા કે માહિતી ખાસ ઉપલબ્ધ નથી.

બીજી એક ચિંતાની બાબત જાતે જ ઉગતાં અને વિસ્તરતા પણ બીજાનો વિકાસ અટકાવતાં ગાંડા બાવળની વધતી જતી સંખ્યા છે. તેમની સંખ્યા હાલમાં ૩૪૯ જેટલી છે જે ગોલ્ડન ચોકડી, વિશ્વામિત્રી નદીના કાંઠે અને વાઘોડીયા રોડ તરફ જોવા મળે છે. આ વૃક્ષ જાતિ વૃક્ષ સમૃદ્ધિના જૈવિક વૈવિધ્ય માટે ખતરનાક છે એમ આ સર્વેક્ષણ હાથ ધરનારા બોટની વિભાગના પ્રો. વાય.ટી.જસરાય જણાવ્યું હતું. મેઘીન્દ્ર સીસોદીયા તથા બિંદિયા ઓઝાએ આ સર્વેક્ષણ માટે કામ કર્યું હતું.

સંદેશ Date : 5-5-2003- MONDAY - VADODARA Sandesh

સ્વકર્મણા તમભ્યર્ચ્ય સિદ્ધિં વિન્દતિ માનવઃ

વડોદરા • અમદાવાદ • સુરત • રાજકોટ • ભાવનગરથી એક સાથે પ્રગટ થતું દૈનિક



બોટની ડીપાર્ટમેન્ટની ટીમે સંશોધનના ભાગરૂપે કરેલી વૃક્ષ ગણતરી અનુસાર યુનિ.ના ડી.એન. હોલ ગાર્ડન પાસેનું આ વટવૃક્ષ શહેરનું મોટામાં મોટું વૃક્ષ છે. વડના આ ઝાડની વડવાઈઓ એટલી હદે ફુલીફાલી છે કે તેણે તેના મૂળ થડને ઢાંકી દીધું છે. આ વૃક્ષના થડનું કદ જ ૨૬ ફુટ જેટલું થવા જાય છે.

વટવૃક્ષ અને વડોદરાનું અવનવું:

શહેરનું સૌથી મોટામાં મોટા વટવૃક્ષનું થડ ૨૬ ફૂટનું છે!?!

(પ્રતિનિધિ દ્વારા) વડોદરા, રવિવાર

સરકારી કવાયતના ભાગરૂપે શહેરની વસ્તી ગણતરી તો સમયાંતરે થતી જ આવી છે, પણ શહેરમાં વૃક્ષોની સંખ્યા કેટલી હશે તેની કોઈ ગણતરી થઈ છે ખરી?

- જેના પરથી વડોદરા નામ પડ્યું છે તેવા વડના શહેરમાં ૪૯૧ જેટલા વૃક્ષો છે

અત્યારસુધી આ પ્રશ્નનો જવાબ મળે તેમ ન હતો પણ શહેરના ઈતિહાસમાં સર્વપ્રથમ વખત યુનિ.ના બોટની ડીપાર્ટમેન્ટે વૃક્ષોની ગણતરી કરવાનું ભગીરથ કાર્ય બે વર્ષની મહેનત પછી પાર પાડ્યું છે. જે અનુસાર વડોદરા શહેરમાં વૃક્ષોની સંખ્યા લગભગ ૯૧૦૦૦ જેટલી થવા જાય છે. ગુજરાતના સાંસ્કૃતિક

અનુ. પાન ૨ પર

કુલ વૃક્ષોની કેટલી સંખ્યા: રસપ્રદ આંકડાકીય માહિતી

(પ્રતિનિધિ દ્વારા) વડોદરા, રવિવાર

વૃક્ષોની ગણતરીના ભાગરૂપે વડોદરામાં કેટલા પ્રકારના વૃક્ષોની સંખ્યા કેટલી છે અને તેઓ કયા વિસ્તારમાં જોવા મળે છે તેની પણ તમામ પ્રકારની રેકોર્ડ તૈયાર કરવામાં આવ્યા છે. આ ઝાડની કેટલીક આંકડાકીય માહિતી નીચે મુજબ છે.

વૃક્ષ	સંખ્યા	વિસ્તાર
પીપળા	૧૫૦	શહેરના અલગ-અલગ વિસ્તારમાં
આંબા	૩૨૫	ત્રિશ્વામિત્રી રેલ્વે સ્ટેશનની આસપાસ પ્રમાણમાં
૬૨૭	૯૫૮	ત્રિશ્વામિત્રીથી આગળ રેલ્વે લાઈનની આસપાસના પટ્ટા પર

અનુ. પાન ૨ પર

- શહેરમાં યુનિ.ના બોટની ડીપાર્ટમેન્ટે વૃક્ષોની ગણતરીનું ભગીરથ અભિયાન પાર પાડ્યું

અનુસંધાન

છેલ્લા પાનનું ચાલુ

શહેરનું સૌથી મોટામાં

પાટનગર ગણાતા વડોદરાની પંદર લાખની વસતીની સરખામણીએ લગભગ ૯૧,૦૦૦ જેટલા વૃક્ષોની ગણતરી કેટલી મહેનત માંગી લે તેવી હશે તે તો સમજી શકાય એવી વાત છે. પણ આ કામ માત્ર બે વિદ્યાર્થીઓએ ડીપાર્ટમેન્ટના પ્રાધ્યાપકની મદદથી પાર પાડયું છે.

વૃક્ષોની વસતી ગણતરી એક સંશોધનના ભાગરૂપે કરાઇ છે અને આના તારણો પર એક નજર નાંખવામાં આવે તો વડોદરાના વૃક્ષોમાં સૌથી વધારે વૃક્ષો આસોપાલવના છે જેની સંખ્યા લગભગ ૧૧૪૮ જેટલી થવા જાય છે જ્યારે સૌથી ઓછી સંખ્યા ઇમારતી લાકડા માટે પ્રખ્યાત મહોગનીની વૃક્ષની છે. શહેરમાં આવા માત્ર ત્રણ ઝાડ અત્યારે હયાત છે.

વડોદરા નામ જેના પરથી પડયું છે તેવા વડના વૃક્ષોની બાબતમાં વડોદરા ''ભાંગ્યુ ભાંગ્યુ તો ય ભરૂચ....!'' જેવી પરિસ્થિતિમાં છે. આ ગણતરી મુજબ શહેરમાં આજે પણ ૪૯૧ જેટલા વડના વૃક્ષ હયાત છે. જેમાંના ૩૫ વૃક્ષના થડનો ઘેરાવો તો ૧૨ ફુટ કરતા પણ વધારે છે.

વૃક્ષોની ગણતરીના ભાગરૂપે શહેરના સૌથી વિરાટકાય વૃક્ષને પણ ગોધી કાઢવામાં આવ્યું છે. જે અનુસાર યુનિ. કેમ્પસના ડી.એન. હોલ ગ્રાઉન્ડ પાસે સંસ્કૃત મહાવિદ્યાલયનું વડનું ઝાડ આ બહુમાન ખાટી ગયું છે. આ વટવૃક્ષના થડનો ઘેરાવો જ લગભગ ૨૬ ફુટ જેટલો છે. આ વૃક્ષની વડવાઇઓની વચ્ચે આટલું મોટુ થડ ઘેરાઇ ગયું છે. બીજા શબ્દોમાં કહીએ તો આ થડને

બોટની ડીપાર્ટમેન્ટના પ્રાધ્યાપક વાય.ડી. જસરાયના માર્ગદર્શન હેઠળ ડીપાર્ટમેન્ટના પી.એચ.ડી. વિદ્યાર્થી પ્રેમેન્દ્રસિંહ સીસોદીયા અને બી.ટી.યા ઓઝાએ જ્યારે બે વર્ષ અગાઉ ગણતરી શરૂ કરી ત્યારે તેમને પણ ખ્યાલ ન હતો કે આ ગણતરીના પરિણામ આટલી હદે રસપ્રદ આવશે.

પ્રા. જસરાય કહે છે કે, આ ગણતરીમાં અમે લગભગ શહેરના તમામ વિસ્તારો અને વૃક્ષોને આવરી લીધા છે. પણ મહત્વની વાત એ જોવા મળી છે કે વૃક્ષોની સંખ્યા ભલે પહેલાના વર્ષોની સરખામણીમાં ઘટી હોય પણ વૃક્ષોની પ્રજાતિઓમાં વધારો થયો છે. ભૂતકાળમાં શહેરમાં થયેલા એક સર્વે અનુસાર ૧૨ ઉપ્રકારની વૃક્ષોની પ્રજાતિઓ હતી જે આજે વધીને ૧૪૦ થઇ છે.

પ્રા. જસરાયના અનુસાર આ ગણતરી કરવા માટે અમે વૃક્ષોને અલગ- અલગ છ કેટેગરીમાં વહેંચી નાંખ્યા હતા. જેમાં ૨૫૦ સેન્ટીમીટરથી વધારે થડનું કદ ધરાવતા વૃક્ષોને અમે 'વી.આઇ.પી.' કેટેગરીમાં મુકયા છે. સામાન્ય માણસ વર્ષોથી જેને જાણે છે તેવા આસોપાલવ, લીમડા, આંબા, પીપળા, કરંજ, આમલી, વડ, ગરમાવો, ગુલમહોર જેવા વૃક્ષો આજે પણ વડોદરામાં સારી એવી સંખ્યામાં જોવા મળે છે.

પ્રા. જસરાય કહે છે કે, શહેરની આસપાસની ફેકટરીઓ આટલી હદે પ્રદુષણ ઓકે છે આમ છતાં આ શહેર જીવવા લાયક બની રહ્યું હોય તો તેનું કારણ આ વૃક્ષો છે. ખાસ કરીને શહેરના રાજમહેલ, કમાટીબાગ અને યુનિ. કેમ્પસની આસપાસનો વિસ્તાર આજે પણ હરીયાળો રહ્યો છે અને આ વિસ્તારો વડોદરાના ફેફસા તરીકે કામ કરી રહ્યા છે.

વૃક્ષોની ગણતરી માટેનું અભિયાન હાથ ધરનાર પી.એચ.ડી.ના વિદ્યાર્થી પ્રેમલ સીસોદીયા કહે છે કે વૃક્ષોની સંખ્યા પણ ઉપરોકત વિસ્તારમાં વધારે છે એટલું જ નહી શહેરના અલગ- અલગ વિસ્તારમાં ચોકકસ પ્રકારના વૃક્ષ વધારે જોવા મળે છે. જેમ કે રાયણ ઝાડના વૃક્ષો કમાટીબાગ અને નરહરી હોસ્પિટલની પાછળના ભાગમાં સૌથી વધારે જોવા મળ્યા છે તે રીતે ગરમાળાના વૃક્ષ મોટાભાગે યુનિ. કેમ્પસમાં જ અસ્તિત્વ ધરાવે છે. આવું જ વડ, કરંજ, ગુલમહોર અને આમલીના વૃક્ષો માટે પણ કહી શકાય.

પ્રેમલસિંહ કહે છે કે વડોદરાનું નામ ભલે વડ પરથી પડયું હોય પણ હાલમાં તો લીમડા અને કરંજની સંખ્યા વડને આંબી ગઇ છે. જે અનુસાર શહેરમાં ૯૫૯ જેટલા કરંજના અને ૮૫૧ જેટલા લીમડાના વૃક્ષો છે. આમ છતાં સર્વાધીક લોકપ્રિય અને લગભગ તમામ વિસ્તારમાં જોવા મળે તેવું વૃક્ષ આસોપાલવ જ રહ્યું છે. શહેરમાં લગભગ ૧૧૪૮ જેટલા આસોપાલવના વૃક્ષો છે.

પ્રા. જસરાય કહે છે કે, આસોપાલવના પાન શુભપ્રસંગે તોરણ બનાવવા માટે પણ વપરાતા હોવાથી લોકો આસોપાલવને કાપવાનું પસંદ કરતા નથી. આપણા પૂર્વજોએ વૃક્ષોની પૂજા કરવાની પ્રથા ચાલુ કરી હતી તેની પાછળનું એક કારણ આ પણ હતું.

તેમનું કહેવું છે કે વડોદરામાં પણ રાજમહેલ કમ્પાઉન્ડ, કમાટીબાગ, ઇ.એમ.ઇ. જેવા વિસ્તારો પહેલેથી સુરક્ષીત રહ્યા હોવાને કારણે અહીંયા વૃક્ષો સારી એવી સંખ્યામાં છે.

જો કે બે વર્ષના આ પ્રોજેકટમાં તેમને મુશ્કેલીઓ પણ ઘણી નડી હતી. પ્રેમલસિંહ કહે છે ખાસ તો કેટલીક જગ્યાએ વૃક્ષોની ગણતરી માટે પરવાનગી મેળવવામાં અમારે લમણાઝીંક કરવી પડી હતી. આમ છતાં આખરે અમે આ પ્રોજેકટ સફળતાપૂર્વક પાર પાડયો એ જ ઘણું છે.

પ્રો. જસરાયના કહેવા મુજબ વડોદરામાં કદાચ સર્વ પ્રથમ વખત આ પ્રકારની પદ્ધતીસરની વૃક્ષોની ગણતરી હાથ ધરવામાં આવી છે. યુનિ ને એક બે મહિનામાં વિધિવત રીતે આ અહેવાલ સુપ્રત કરાયા બાદ તેમણે વડોદરાવાસીઓ માટે આ અંગેનું પુસ્તક બહાર પાડવાની પણ યોજના ઘડી છે.

કયા વૃક્ષોની કેટલી સંખ્યા:

વડ	૪૯૧	ઇ.એમ.ઇ. કેમ્પસથી લઇ રાજમહેલ રોડ, લાલબાગ રોડ, માંજલપુર, મકરપુરા વિસ્તાર
લીમડો	૮૫૧	ઇ.એમ.ઇ. એરફોર્સ સ્ટેશનની આસપાસ અને છાણી વિસ્તાર
ગરમાવો	૪૧૯	મોટાભાગે યુનિ. કેમ્પસમાં
ગુલમહોર	૨૭૨	સભા અને છાણી વિસ્તારમાં મોટા પ્રમાણમાં છે
આમલી	૨૫૬	ગોરવા વિસ્તાર
ગોરાસામલી	૩૭૩	વિશ્વામિત્રી રેલ્વે સ્ટેશનની આસપાસ
કંજો	૨૭૨	શહેરના અલગ- અલગ વિસ્તારમાં
રાયણતાડ	૪૨	નરહરી હોસ્પિટલની પાછળના ભાગમાં અને કમાટીબાગ
આસોપાલવ	૧૧૪૮	લગભગ દરેક સોસાયટી વિસ્તારમાં
મહોગની	૨ થી ૩	માત્ર રેલ્વે સ્ટાફ કોલેજના કમ્પાઉન્ડમાં જોવા મળ્યા છે

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Baroda Times

Tree wealth of MSU recorded

HIRAL DHOLAKIA
Times News Network

HAVE you ever seen a VIP tree? Walk through M S University's Sayajigunj campus and you won't miss the canopied Banyan tree, the giant Azadirachta indica commonly known as the Neem, the huge Tamarind tree, Arts faculty's massive Bakul tree. All of them are referred to as VIP trees by botanists because of their massive size.

In the first phase of a two year project undertaken by the M S University's department of Botany, a total of 129 species of trees, belonging to 48 families found in a part of the campus are being documented. The effort becomes important as the idea is to extend the project to cover the rest of the MSU campuses and trees within the city-limits.

The first phase of the project is covered in a dissertation titled 'Tree Diversity, Abundance and Biomass in MSU campus' by MSc student Bindya Oza under the guidance of Prof Yogesh T Jasrai. "In future this will enable us to bring out colourful brochures and CDs projecting the city's flora," says Jasrai. The entire project is funded by the University.

The study helps to know about the nature's gifts found in bounty within the campus. In fact one can even reach the desired tree at its exact location as they are marked with different codes on the University line map. The study area covers a part of the MSU campus comprising faculties of science, arts, commerce, law, education and psychology, home science, fine arts. Also the area surrounding C C Mehta auditorium, D N hall ground, and residential areas like Adhyapak Niwas, Ketkibaug, Gulabbaug, Chamelibaug, Dhanvantari, among others.

Interestingly, Asopalav, Garmalo, Neem and Bakul are the tree species that dominate the campus. The Faculty of Science including the Botanical garden has the maximum diversity with 131 tree species, most of them belonging to the 'free petal' group. Three different kinds of cycas were also noted in the gardens, which are now almost 80 to 90 years old.

GREEN BLESSINGS

The VIP Banyan tree near D N Hall

A special and rare palm, Hyphaene dichotoma (the only branched palm or *Ravan taad*), which is endemic to India was also recorded in the campus besides 30 to 40 year old varieties of palms like royal Palm, *shivajata* and oil palm.

Many medically important trees are also found like Asoka, *Saptaparni* and *Bel*. The campus has a variety of flowering plants like Parkia, *jamun* or roseapple, Bombax and Butea monosperma (*kesudo*). The data is compared with past records to know the variation in the vegetation around the campus. And results reveal that the number of species has only increased.

Jasrai is optimistic that the efforts will help in conservation and the second phase is expected to be completed by the end of next academic year.

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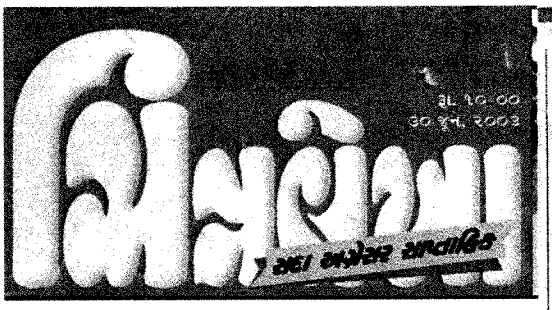
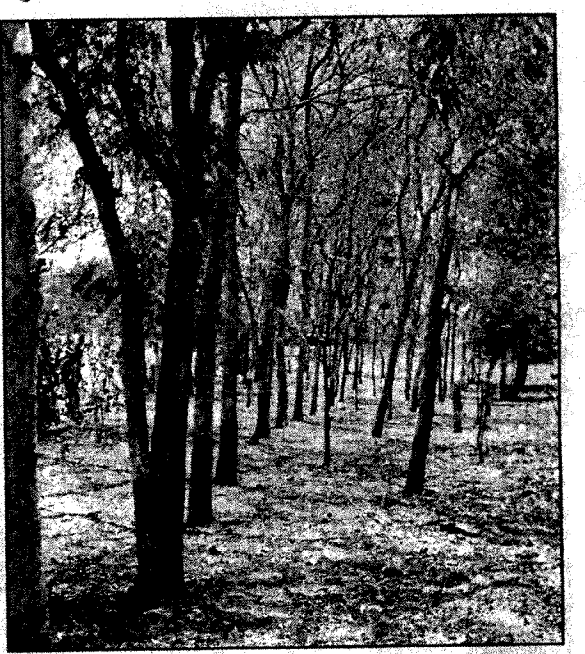


ક્યાં ગયાં એ વૃક્ષ?

ગરમીની સિઝનમાં વડોદરા ચમકી ગયેલું. વડોદરામાં ગરમીનો પારો ખૂબ ઊંચો ચડી ગયેલો. પર્યાવરણવાદીઓ વૃક્ષોની સંખ્યા વધારવાની હિમાયત કરે છે, પરંતુ તાજેતરમાં થયેલી વૃક્ષોની ગણતરીના આંકડા ચોંકાવી દે તેવા છે. વડોદરાની મહારાજા સયાજીરાવ યુનિવર્સિટીના બોટની વિભાગના બે વિદ્યાર્થીએ શહેરમાં વૃક્ષોની સંખ્યા વિશે સંશોધન કર્યું.

બિંદિયા ઓઝા અને પ્રેમિન્દ્ર સિસોદિયાએ પ્રોફેસર યોગેશ જસરાયના માર્ગદર્શન હેઠળ રિસર્ચ વર્ક હાથ ધર્યું. યોગેશ જસરાય કહે છે કે આ રિસર્ચ કરતાં અમને બે વર્ષનો સમય લાગ્યો. વડોદરા શહેરના ૧૦,૮૦૦ હેક્ટર વિસ્તારમાં માત્ર ૯૧ હજાર વૃક્ષ છે. વડલા પરથી જે ગામનું નામ વડોદરા પડ્યું છે તે વડલાની સંખ્યા ગણી ગણીને માંડ ૪૯૧ સુધી પહોંચી. ૯૯૭ ગુલમહોર, ૧૧૪૮ આસોપાલવ, કરંજ ૯૫૯, લીમડા ૮૫૧ અને પીપળાની સંખ્યા ૧૫૬ નોંધાઈ છે. જો કે આનંદની એક વાત એ છે કે અગાઉ થયેલાં સંશોધનોમાં ૧૨૦ અલગ અલગ જાતનાં વૃક્ષ જોવા મળેલાં. અમને ૧૪૦ જાતનાં વૃક્ષ જોવા મળ્યાં છે. અભ્યાસમાં અમુક રેર ગણાતાં વૃક્ષ પણ અભ્યાસ દરમિયાન અમારા ધ્યાનમાં આવ્યાં છે.



રાવણ તાડ, મહોગની જેવાં વૃક્ષ અમને નજરે પડ્યાં છે, જ્યારે અમુક વર્ષો પુરાણાં વૃક્ષ રેલવે સ્ટાફ ટ્રેનિંગ કૉલેજ, એમ.એસ. યુનિવર્સિટીના કેમ્પસમાં, કમાટી ગાર્ડનમાં અને રાજમહેલ વિસ્તારમાં સચવાયેલાં છે. વડોદરાના રસ્તા પહોળા કરવાની લાયમાં અને ઊંચાં ઊંચાં બિલ્ડિંગોએ વૃક્ષોથી સમૃદ્ધ વડોદરાને ઉજ્જડ જેવું કરી દીધું છે. બિંદિયા ઓઝાએ તો પોતાના ડિઝર્ટેશન માટે વડોદરાનાં વૃક્ષની ગણતરી કરી છે, પરંતુ એના અભ્યાસના આંકડા ચોંકાવનારા છે. યોગેશ જસરાય કહે છે: 'પંદર લાખની વસતિવાળા વડોદરા શહેરનો એક એક નાગરિક માત્ર એક વૃક્ષ વાવીને ઉછેરે તો પણ વડોદરા વધુ હરિયાળું બની જાય. લીમડો, આસોપાલવ, વડ, ગુલમહોર, પીપળા જેવાં વૃક્ષનું તો બે વર્ષ ધ્યાન રાખો અને બાદમાં કુદરતને હવાલે કરી દો તો પણ એ જીવી જાય.' ◆

મનીષ મહેતા *(અમદાવાદ)* ◆ **જ્યોતિ રાવલ** *(વડોદરા)*

TOI, July 1, 2003

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Cruising along the coast

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Who gave Harry his scar?

Page 2

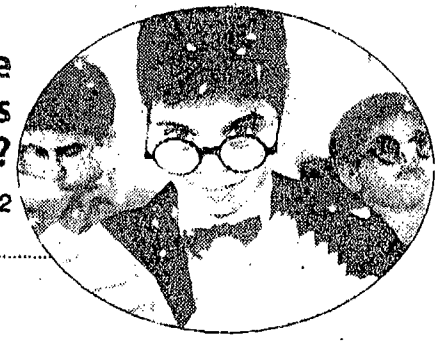


FIGURE IT OUT

1,148

The number of Asopalav trees found in Vadodara as per a recent study by the Department of Botany, MSU. The banyan count is a low 500 trees. Time to rechristen the city as Asodara?

Baroda Times

OF INDIA

Anybody for Asodara? TOI - July 2, 2003

Times News Network

VOX POP

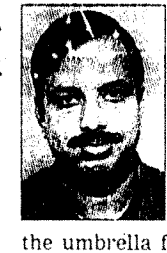
Is Vadodara the Banyan city? Not according to research by the department of Botany, M S University. There are about 1,150 *asopalav* trees in the city while the banyan tree (*vad*) after which Vadodara was named, is less than half the number — about 500. Which means we should think of rechristening the city 'Asodara' instead of Vadodara. Our suggestion met with a vehement No! Vadodara is not merely a Banyan City — it is a place that implied much more than mere tree counts, say our respondents.

BHUPEN VYAS
Colour therapist

A clear no. The city was and will be known as the Banyan City regardless of what research says. Banyans have great utility value while *Asopalavs* are decorative and do not provide shade. Also the Banyan holds the soil better and contributes more to ecology than the *Asopalav*. Look at the colossal beauty of the banyan. In Kolkata's botanical garden, the famous banyan tree has about 180 in-built branches. Kabeerwad, near Vadodara too has a small enclave of banyan trees. We need to preserve their beauty. If the *'vads'* are decreasing in number we are to blame for we have chopped them off indiscriminately. We are the culprits and why should a city's name change because of our follies?

PURVI MEHTA BHATT
Convenor, Science Ashram

No, let us not follow the trend of a Chennai, Mumbai or Kolkata. As it is we are confused between calling the city Baroda or Vadodara. Besides there is already a place called Asodara so we cannot be called by the same name. Regarding the rising number of *asopalav* trees and the dwindling number of banyan trees, we ourselves are responsible for it. We have created this imbalance, so we shouldn't now justify our mistake by changing the name of the city.



S K JHA
Secretary, Komal Nishad

The word 'banyan' or *vad* is a symbol rather than being the name of a tree. It stands for shelter (*aashray*) and true to its meaning, Vadodara has been the umbrella for a lot of cultures. Eminent personalities like Sri Aurobindo Ghosh, Ustad Faiyaaz khan, Maulabaksh, Sam Pitroda lived here and contributed their bit to society. The city's generous nature, like the banyan tree, is responsible for its cosmopolitan outlook as it accommodates a lot of diversity. Like its widespread roots, its citizens too have won accolades in various fields. Did you know that the first carbon-dioxide laser beam used extensively by industries was made by a Barodian C K N Patel?

GOPIKA JADHAV
Student

No the name shouldn't be changed at all. The dwindling head count of banyan trees take a back seat in comparison to the symbolic meanings the tree holds. To begin with, the roots of the banyan tree are widespread and go deep into the heart of the soil which could be interpreted as a sign of a rich cultural past and heritage. It could also mean that the city has a strong base — industrial and educational which in turn justifies its second name — *Sanskarnagri*. In contrast, the *asopalav* tree is of mere decorative value and cannot compare to the beauty and utility value of the banyan.

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