



## Phytosociological parameters of hills around pune city, pune

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### Abstract

Phyto-sociological and floristic studies are widely recognised as being important in acquiring base-line data for the planning and management of any area. The most significant step in vegetation studies is to collect reliable and quantitative field data. This was done in the field by adopting the sampling technique as suggested by Braun-Blanquet (1932). The phyto-sociological surveys for suburban vegetation were undertaken on the hills (total 10) surrounding Pune city

During present investigations, a qualitative and detailed quantitative data on the ecological relationships of 90 woody species was acquired. Out of total species the native species represents 68 % and exotics 22%. These species were distributed on the hills. Though, the native species were more in number than exotics, however, few exotic species were most abundantly found and planted. Altogether 2316 numbers of individual were reported from the sampling plots. Phyto-sociological studies were carried out on the 10 hills namely ARAI, Baner, Bhopdev ghat, Chaturshringi, Fergusson College, Kothrud, Parvati, Sutarwadi, University and Vetal. Overall, 124 quadrates of size 15 m X 15 m were plotted. Each and every tree in the quadrate is sampled along with GPS and studied for various Phytosociological parameters.

Overall, the hills have represented fairly heterogeneous vegetation throughout the study area. In general, the plant community structure was *Gliricidia sepium* (IVI 1262.04) --- *Dalbergia melanoxylon* (141.32) -- *Acacia catechu* (133) -- *Azadirachta indica* (114.8) -- *Leucaena leucocephala* (91.69) -- *Acacia leucophloea* (87.17)....

Hence, to understand the status of vegetation on hills the field work was carried out. The phyto-sociological methods have been employed and the essential phyto-sociological parameters were analysed.

**Keywords:** phytosociology, GPS, heterogenous, importance value index (IVI), community

### Introduction

Pune is situated in close proximity (50kms) on the biodiversity of Sahyadri Hills also known as the Western Ghats. The importance of the Hills surrounded can be summarised as Rich biodiversity with local species, play important role in moderating the temperature by acting as heat sinks, in recharging the river as well as groundwater, as coolants, in Carbon Sequestration, Carbon Sinks, Aesthetic Value, provides Ecological services, provide suitable habitat for endemic species, Watershed Value, A cord with Western ghats and Corridor, Role in Weather pattern and Natural Heritage. The Hills which are the lungs of Pune are now under threat: Due to excessive concretisation and unscientific plantation drives, lot of construction activity like tiled pathways, gazebo's, statues etc. under the guise of beautification, the construction of roads, access to vehicles, a lot of food stalls, no understanding / awareness about the hills and their natural pristine condition, the unscientific plantation drive people plant exotic trees instead of native one, increasing concretisation on the hills, over urbanization, Industrialization, construction of highways and various roads, illegal hill cutting, diverting waste and drains, cutting and demolishing the hills to create a plain land for housing project constructions, Gardens, parks and urban forests are rapidly disappearing in the concrete jungle, the rise in the number of private ownership of vehicles, cab numbers, auto and private vehicles, two wheelers, new bikes, haphazard urban growth and environmental pollution, increase in carbon emissions, attempted forest station on such a habitats, no attention is being paid to the human imprint on wild animals and birds, habitat destruction,

fragmentation, habitat degradation, new industrial estates, construction of a new ring road, a by-pass and an express highway, leveling and filling up of rainwater pools, road networks passing through the sacred groves, and no botheration from anyone as if there is no need of good quality environment to live in. Plants naturally occur together in repetitive groups of associated plants and most frequent and abundant plants describe them well (Mueller-Dombois, 1974). Similarly, the size, form, structure and physiognomy of the species play an important role in making the composition of plant community. The quantitative study of the structure of vegetation has been called 'Phyto-sociology' (Odum, 1971). Each species is distributed in its own way, according to its physical environment and interactions with other species; hence no two species are similar in distribution. Braun-Blanquet (1932, 1965), regarded the plant community as the basic unit of vegetation classification. Plant community is a geographic phenomenon with spatial variation in which one or few species are predominant. Vegetation is an assemblage of plants growing together in a particular location and may be characterized either by its species composition or by the combination of structural and functional characters that describe the appearance or physiognomy of vegetation (Goldsmith et.al, 1992). Detailed vegetation studies usually require an assessment of the species composition of an area. It is generally accompanied by information about the abundance of each species present at the area under study. The disturbance in the natural community by man can be recognized by change in species composition, structure and physiognomy of the

vegetation. Hill ecosystems are at higher risk due to adverse abiotic and biotic factors (Bawa and Dayanandan, 1998). Degradation of forestland is the major negative impact of urbanization. In urban areas the natural vegetation is distributed on the hills. These hills play crucial role in regulation of environmental conditions and helps in balancing the urban ecosystem. The vegetation of hill habitats has long been recognized as considerably rich in biodiversity. This study is going to focus on study of qualitative and Quantitative phytosociological data and the parameters related there with. Altogether 2316 numbers of individual were reported from the sampling plots. Phytosociological studies were carried out on the 10 hills namely ARAI, Baner, Bhopdev ghat, Chaturshringi, Fergusson College, Kothrud, Parvati, Sutarwadi, University and Vetal. Overall, 124 quadrates of size 15 m X 15 m were plotted. Each and every tree in the quadrate is sampled along with GPS and studied for various Phytosociological parameters. The vegetation on these studied hills inculcates a sense of environmental responsibility, awareness among the common masses and helps to know various socio-economic and ecological benefits to population. And also, how these hills support and protect the biodiversity and overall balance of nature.

## Materials and Methods

### Study area

The work was carried out on 10 hills (Figure-1). All the trees in the selected quadrates were sampled with respect to their position by using GPS instrument, Tree height and GBH as per standard protocol and analysed. A total of 124

Quadrates of size 15 m x15 m were laid down and the total area sampled was 0.0279 sq. km out of 60.45 sq km.

### Materials Used

Measuring tape, worksheet, Measuring scale and GPS instrument.

### Sampling Design

The methods suggested in the book 'Ecology, Environment and Resource Conservation' by J.S. Singh, S.P. Singh, S.R. Gupta (first edition,2008), Anamaya Publishers, New Delhi were used for methods of Sampling Vegetation and Data Analysis. As the study area was studied by quadrate method, so, each and every tree was sampled for various parameters. The GPS instrument was used for measuring latitude and longitude of each and every tree. Data recording formats as per Rabindranath and Ostwald (2008) [14] have been used for trees and shrub species. The various phytosociological parameters such as % frequency, Frequency class, Relative Frequency, Density, Abundance, Relative Density, Relative Dominance and IVI were estimated based on data taken in sample area. All the parameters were calculated as per the standard protocol/ formulas. Each and every plant species and individuals above 15 cm GBH were sampled. All tree positions were recorded using a GPS. Each plant was measured for its GBH (cm) and height (m). The homo/heterogeneity of the studied vegetation is found out by the formula  $E + D / B + C$ , if its greater than 1, then the vegetation is homogenous and if its less than 1, then its heterogenous vegetation.

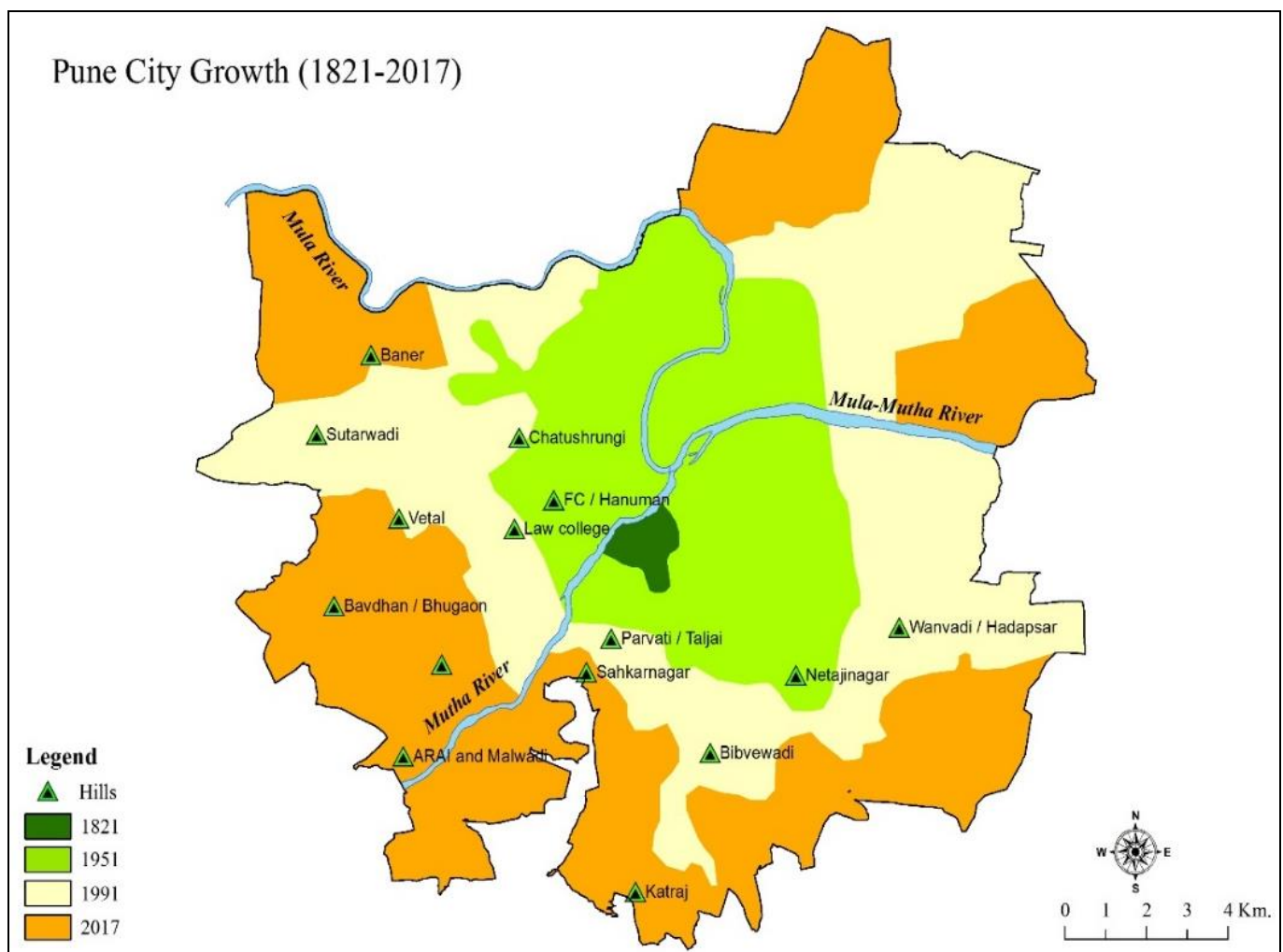


Fig 1: Pune map showing location of hills

**Table 1:** Phytosociological parameters of Native species in sampled area of studies hills

Botanical Name	Total no. of	%	Freq.	Rel.			Relative	Relative	IVI
	individuals	Freq.	Class	Freq.	Abundance	Density	Density	Dominance	
Dalbergia melanoxylon	266	157.71	E	29.94	24.54	11.11	48.16	63.21	141.32
Acacia catechu	97	267.97	E	57.50	22.82	9.98	61.90	13.59	133.00
Azadirachta indica	91	317.19	E	72.09	18.81	7.06	41.53	1.18	114.8
Acacia leucophloea	39	363.39	E	58.17	10.72	4.13	26.75	2.26	87.17
Bamboo spp.	130	5.88	A	1.00	130	7.65	28.57	35.74	65.31
Lannea coromandelica	50	192.41	E	38.73	12.23	3.34	19.48	0.19	58.40
Morinda pubescens	60	160.88	E	36.38	15.83	3.72	21.36	0.13	57.87
Boswellia serrata	34	106.66	E	22.05	15.08	3.76	23.07	7.78	52.90
Dalbergia lanceolaria	41	77.77	D	16.35	18.07	3.3	20.47	1.186	38.01
Dalbergia sisso	18	72.22	D	19.34	8.00	1.72	12.64	0.16	32.13
Diospyros melanoxylon	19	48.33	C	11.47	15.00	2.52	17.99	1.79	31.25
Acacia chundra	22	73.88	D	15.74	10.00	1.66	11.42	0.20	27.37
Pongamia pinnata	33	60.98	C	15.02	11.00	2.18	10.86	0.20	26.08
Anogeissus latifolia	22	75.88	D	13.59	9.00	2.04	11.50	0.19	25.29
Grewia asiatica	7	68.89	D	15.69	6.00	1.02	7.37	0.03	23.09
Ziziphus mauritiana	5	60	C	12.66	2.50	0.8	5.4245	0.1406	18.22
Flacourtia indica	8	43.33	C	10.30	6.00	1.03	7.18	0.25	17.73
Santalum album	28	43.66	C	9.66	17.33	1.48	8.05	0.0037	17.71
Bauhinia variegata	27	41.43	C	9.42	10.50	1.16	7.27	0.0317	16.72
Rhus mysorensis	3	50	C	11.59	2.00	0.50	3.37	0.0657	15.02
Bauhinia recemosa	11	43.88	C	10.42	6.50	0.67	4.24	0.0037	14.65
Albizia lebeck	8	37.22	B	9.25	3.25	0.39	2.37	0.0008	11.62
Bombax ceiba	5	44.31	C	9.17	3.00	0.44	2.45	0.0009	11.62
Holoptelea integrifolia	12	35.88	B	8.31	7.50	0.58	2.82	0.0019	11.14
Aegle marmelos	5	16.67	A	4.35	5.00	0.83	6.41	0.0936	10.85
Dolichandrone falcata	6	42.22	C	7.67	3.50	0.52	3.03	0.0033	10.70
Flacourtia montana	6	40	B	7.27	1.50	0.60	3.08	0.0093	10.36
Capparis grandis	7	43.99	C	7.92	4.00	0.46	2.21	0.0053	10.13
Tamarindus indica	10	32.2	B	6.88	4.33	0.57	2.44	0.0042	9.32
Terminalia tomentosa	6	32.22	B	5.82	2.67	0.52	3.26	0.007	9.09
Ficus benghalensis	6	28.43	B	6.76	3.00	0.40	2.13	0.021	8.91
Tectona grandis	9	30.33	B	5.51	5.00	0.55	3.19	0.005	8.70
Acacia ferugiana	19	24.77	B	5.36	7.00	0.61	3.21	0.009	8.59
Albizia amara	7	30.32	B	5.57	4.50	0.46	2.21	0.024	7.80
Phyllanthus emblica	4	23.33	B	5.19	4.00	0.26	1.53	2.75	6.73
Cochlospermum religiosum	5	24.44	B	4.57	3.50	0.34	1.77	0.0032	6.34
Gmelina arborea	13	15	A	3.78	5.00	0.35	1.99	0.01	5.77
Syzygium cumini	3	20.10	A	4.38	2.00	0.20	1.06	4.01	5.45
Butea monosperma	9	16.99	A	3.34	3.40	0.27	1.24	0.0004	4.57
Acacia nelotica	11	12.54	A	2.40	4.33	0.28	1.36	0.0024	3.76
Ehretia aspera	4	13.98	A	2.47	2.50	0.20	0.77	4.24	3.24
Cassia fistula	4	12.22	A	2.25	4.00	0.17	0.97	2.55	3.22
Madhuca langifoila	3	12.22	A	2.25	3.00	0.14	0.86	0.00023	3.11
Dalbergia latifolia	1	10	A	2.5	1.00	0.10	0.59	0.00012	3.09
Bauhinia perpuria	1	8.33	A	2.38	1.00	0.08	0.63	0.00018	3.01
Semecarpus anacardium	1	8.33	A	2.38	1.00	0.08	0.63	0.00013	3.01
Bridelia retusa	2	12.22	A	2.253	2.00	0.12	0.74	0.00035	3.00
Putranjiva roxburghii	2	11.76	A	2.00	1.00	0.12	0.44	0.000032	2.44
Hardwickia binata	1	10	A	1.79	1.00	0.10	0.63	0.00029	2.41
Erythrina suberosa	1	10	A	1.79	1.00	0.10	0.63	0.00025	2.41
Caryota urens	2	5.88	A	1.00	2.00	0.12	0.44	0.00023	1.44
Phoenix sylvestis	2	5.88	A	1.00	2.00	0.12	0.44	0.00012	1.44
Prosopis juliflora	2	5.88	A	1.00	2.00	0.12	0.44	0.000016	1.44
Sterculia foetida	1	5.88	A	1.00	1.00	0.06	0.22	0.00032	1.22
Ficus benamina	1	5.88	A	1.00	1.00	0.06	0.22	0.00027	1.22
Erythrina variegata	1	5.88	A	1.00	1.00	0.06	0.22	0.000076	1.22
Podocarpus nerifolius	1	5.88	A	1.00	1.00	0.06	0.22	0.000015	1.22
Polyalthia longifolia	1	5.88	A	1.00	1.00	0.06	0.22	0.000012	1.22
Cascabella thevetia	1	5.88	A	1.00	1.00	0.06	0.22	0.0000068	1.22
Ixora brachiata	1	5.88	A	1.00	1.00	0.06	0.22	0.0000039	1.22
Mangifera indica	1	5.88	A	1.00	1.00	0.06	0.22	0.0000016	1.22
Eleodendron glaucum	2	2.22	A	0.47	2.00	0.04	0.23	0.0000068	0.69
Buchanania lazan	1	2.22	A	0.47	1.00	0.02	0.11	0.0000088	0.58
Cleistanthus collinus	1	2.22	A	0.47	1.00	0.02	0.11	0.0000080	0.58

Vitex negundo	1	2.22	A	0.47	1.00	0.02	0.11	0.0000030	0.58
Heterophragma quadriloculare	1	2.22	A	0.47	1.00	0.02	0.11	0.0000013	0.58
Carissa congesta	1	2.22	A	0.47	1.00	0.02	0.11	0.0000004	0.58
Gymnosporia montana	1	2.22	A	0.47	1.00	0.02	0.11	0.0000001	0.58

**Table 2:** Phytosociological parameters of Exotic species in sampled area of studies hills

Botanical Name	Total no.of individuals	% Freq.	Freq. Class	Rel. Freq.	Abundance	Density	Rel. Density	Relative Dominance	IVI
<i>Gliricidia sepium</i>	866	582.61	E	131.75	97.05	60.39	363.39	766.91	1262.04
<i>Leucaena leucocephala</i>	139	217.32	E	52.67	20.92	6.48	35.88	3.13	91.69
<i>Cassia / Senna siamea</i>	33	88.10	E	23.25	18.5	3.19	21.74	1.34	46.33
<i>Albizia /Samania saman</i>	9	45.98	C	9.93	4.33	0.70	3.55	0.048	13.52
<i>Acacia auriculiformis</i>	5	35	B	9.23	5.0	0.55	3.67	0.005	12.91
<i>Tecoma stans</i>	10	45.75	C	9.47	4.0	0.68	3.20	0.00048	12.66
<i>Eucalyptus globulus</i>	10	34.54	B	7.10	7.5	0.63	3.91	0.0065	11.02
<i>Cissus woodroii</i>	1	20	A	4.55	1.0	0.20	1.39	0.0009	5.94
<i>Delonix regia</i>	11	14.77	A	2.87	5.0	0.35	1.57	0.0036	4.44
<i>Peltophorum pterocarpum</i>	8	14.77	A	2.87	2.75	0.21	1.02	0.0031	3.89
<i>Phyllanthus acidus</i>	1	10	A	1.79	1	0.1	0.63	0.00002	2.41
<i>Araucaria bidwillii</i>	2	5.88	A	1.0	2.0	0.12	0.44	0.00102	1.44
<i>Cryptomeria japonica</i>	2	5.88	A	1.0	2.0	0.12	0.44	0.00036	1.44
<i>Agathis robusta</i>	2	5.88	A	1.0	2.0	0.12	0.44	0.000031	1.44
<i>Taxodium distichum</i>	1	5.88	A	1.0	1.0	0.06	0.22	0.000079	1.22
<i>Afrocarpus gracillior</i>	1	5.88	A	1.0	1.0	0.06	0.22	0.000020	1.22
<i>Psidium guajava</i>	1	5.88	A	1.0	1.0	0.06	0.22	0.0000055	1.22
<i>Guazuma ulmifolia</i>	1	5.88	A	1.0	1.0	0.06	0.22	0.0000025	1.22
<i>Tabebuia aregentiana</i>	4	2.22	A	0.47	4.0	0.09	0.45	0.000050	0.92
<i>Khaya selegensis</i>	3	2.22	A	0.47	3.0	0.07	0.34	0.000012	0.81
<i>Bamboo</i>	2	2.22	A	0.47	2.0	0.04	0.23	0.0000032	0.69
<i>Samanea saman</i>	1	2.22	A	0.47	1.0	0.02	0.11	0.0000033	0.58
<i>Limonia acidissima</i>	1	2.22	A	0.47	1.0	0.02	0.11	0.0000015	0.58

**Table 3:** Total number of native plant species distribution as per Raunkiers classes

Total number of plant species- NATIVE	Raunkiers Frequency Classes
7	E
5	D
11	C
11	B
34	A
68	

**Table 4:** Total number of exotic plant species distribution as per Raunkiers classes

Total number of plant species-Exotic	Raunkiers Frequency Classes
3	E
0	D
2	C
2	B
15	A
22	

**Table 5:** Summary of individuals of native plant species

Sr. No.	Plant Species-Native	Total number of individuals
1	<i>Acacia catechu</i>	97
2	<i>Acacia chundra</i>	22
3	<i>Acacia ferugiana</i>	19
4	<i>Acacia leucophloea</i>	39
5	<i>Acacia nelotica</i>	11
6	<i>Aegle marmelos</i>	5
7	<i>Albizia amara</i>	7
8	<i>Albizia lebbeck</i>	8
9	<i>Anogeissus latifolia</i>	22
10	<i>Azadirachta indica</i>	91
11	<i>Bamboo spp.</i>	130
12	<i>Bauhinia perpuria</i>	1

13	<i>Bauhinia recemosa</i>	11
14	<i>Bauhinia variegata</i>	27
15	<i>Bombax ceiba</i>	5
16	<i>Boswellia serrata</i>	34
17	<i>Bridelia retusa</i>	2
18	<i>Buchanania lazan</i>	1
19	<i>Butea monosperma</i>	9
20	<i>Capparis grandis</i>	7
21	<i>Carissa congesta</i>	1
22	<i>Caryota urens</i>	2
23	<i>Cascabella thevetia</i>	1
24	<i>Cassia fistula</i>	4
25	<i>Cleistanthus collinus</i>	1
26	<i>Cochlospermum religiosum</i>	5
27	<i>Dalbergia lanceolaria</i>	41
28	<i>Dalbergia latifolia</i>	1
29	<i>Dalbergia melanoxylon</i>	265
30	<i>Dalbergia sisso</i>	18
31	<i>Diospyros melanoxylon</i>	20
32	<i>Dolichandrone falcata</i>	6
33	<i>Ehretia aspera</i>	4
34	<i>Eleodendron glaucum</i>	2
35	<i>Erythrina suberosa</i>	1
36	<i>Erythrina variegata</i>	1
37	<i>Ficus benghalensis</i>	6
38	<i>Ficus benjamina</i>	1
39	<i>Flacourtia indica</i>	8
40	<i>Flacourtia montana</i>	6
41	<i>Gmelina arborea</i>	13
42	<i>Grewia asiatica</i>	7
43	<i>Gymnosporia montana</i>	1
44	<i>Hardwickia binata</i>	1
45	<i>Heterophragma quadriloculare</i>	1
46	<i>Holoptelea integrifolia</i>	12
47	<i>Ixora brachiata</i>	1
48	<i>Lanea coromandelica</i>	50
49	<i>Madhuca langifoila</i>	3
50	<i>Mangifera indica</i>	1
51	<i>Morinda pubescens</i>	60
52	<i>Phoenix sylvestis</i>	2
53	<i>Phyllanthus emblica</i>	3
54	<i>Podocarpus neriifolius</i>	1
55	<i>Polyalthia longifolia</i>	1
56	<i>Pongamia pinnata</i>	33
57	<i>Prosopis juliflora</i>	2
58	<i>Putranjiva roxburghii</i>	2
59	<i>Rhus mysourensis</i>	3
60	<i>Santalum album</i>	28
61	<i>Semecarpus anacardium</i>	1
62	<i>Sterculia foetida</i>	1
63	<i>Syzygium cumini</i>	3
64	<i>Tamarindus indica</i>	10
65	<i>Tectona grandis</i>	9
66	<i>Terminalia tementosa</i>	6
67	<i>Vitex negundo</i>	1
68	<i>Ziziphus mauritiana</i>	5
	Total	1203

Table 6: Summary of individuals of exotic plant species

Sr. No.	Plant Species-Exotic	Total number of individuals
1	<i>Acacia auriculiformis</i>	5
2	<i>Afrocarpus gracilior</i>	1
3	<i>Agathis robusta</i>	2
4	<i>Albizia /Samania saman</i>	9
5	<i>Araucaria bidwillii</i>	2
6	Bamboo	2
7	<i>Cassia / Senna siamea</i>	33



## Results and Discussion

As per the present investigations, a qualitative and detailed quantitative data on the ecological relationships of 90 woody species was acquired. Out of total species the native species represents 68 % and exotics 22%. These species were distributed on the hills. Though, the native species were more in number than exotics, however, few exotic species were most abundantly found and planted. Altogether 2316 numbers of individual were reported from the sampling plots. Phyto-sociological studies were carried out on the 10 hills namely ARAI, Baner, Bhopdev ghat, Chaturshringi, Fergusson College, Kothrud, Parvati, Sutarwadi, University and Vetal. Overall, 124 quadrates of size 15 m X 15 m were plotted. Each and every tree in the quadrate is sampled along with GPS and studied for various Phytosociological parameters.

Overall, the hills have represented fairly heterogeneous vegetation throughout the study area. In general, the plant community structure was *Gliricidia sepium* (IVI 1262.04) -- *Dalbergia melanoxylon* (141.32) -- *Acacia catechu* (133) - *Azadirachta indica* (114.8) -- *Leucaena leucocephala* (91.69) -- *Acacia leucophloea*(87.17)...

The per cent frequency, relative frequency, abundance, density, relative density, relative dominance, and importance value index (Misra, 1968) of vegetation were determined. All the results of phyto-sociological investigations are presented in Table 1 and 2.

The most frequent species among native were *Dalbergia melanoxylon*, *Acacia catechu*, *Azadirachta indica*, *Acacia leucophloea*, *Bamboo spp.*, *Lannea coromandelica*, *Morinda pubescens*, *Boswellia serrata* and among exotic were *Gliricidia sepium*, *Leucaena leucocephala*, *Cassia / Senna siamea*.

*Gliricidia sepium* is having highest Importance Value Index (IVI 1262.04) followed by *Dalbergia melanoxylon* (141.32), *Acacia catechu* (133), *Azadirachta indica* (114.8), *Leucaena leucocephala* (91.69), *Acacia leucophloea* (87.17), *Bamboo species* (65.31), *Lannea coromandelica* (58.40), *Morinda pubescence* (57.87), *Boswellia serrata* (52.90), *Cassia / Senna siamea* (46.33).

In native species, *Dalbergia melanoxylon* showed highest Abundance (24.54) followed by *Acacia catechu* (22.82), *Azadirachta indica* (18.81), *Acacia leucophloea* (10.72) and in Exotic,

*Gliricidia sepium* (97.05), *Leucaena leucocephala* (20.92), *Cassia / Senna siamea* (18.5) showed the abundance.

The native species having less Abundance 1 were *Dalbergia latifolia*, *Bauhinia perpuria*, *Semecarpus anacardium*, *Putranjiva roxburghii*, *Hardwickia binate*, *Erythrina suberosa*, *Sterculia foetida*, *Ficus benjamina*, *Erythrina variegata*, *Podocarpus neriifolius*, *Polyalthia longifolia*, *Cascabella thevetia*, *Ixora brachiata*, *Mangifera indica*, *Buchanania lazan*, *Cleistanthus collinus*, *Vitex negundo*, *Heterophragma quadriloculare*, *Carissa congesta* and *Gymnosporia montana*.

The species that were sparsely distributed includes *Dalbergia latifolia*, *Bauhinia perpuria*, *Semecarpus anacardium*, *Bridelia retusa*, *Putranjiva roxburghii*, *Hardwickia binate*, *Erythrina suberosa*, *Caryota urens*, *Phoenix sylvestis*, *Prosopis juliflora*, *Sterculia foetida*, *Podocarpus neriifolius*, *Cascabella thevetia*, *Ixora brachiata*, *Eleodendron glaucum*, *Carissa congesta*, *Gymnosporia montana*., *Cissus woodroii*, *Phyllanthus*

*acidus*, *Taxodium distichum*, *Afrocarpus gracilior*, *Guazuma ulmifolia*, *Samanea saman* etc.

## Conclusion

As per the present investigations, a qualitative and detailed quantitative data on the ecological relationships of 90 woody species was acquired. Out of total species the native species represents 68 % and exotics 22%. These species were distributed on the hills. Though, the native species were more in number than exotics, however, few exotic species were most abundantly found and planted. Altogether 2316 numbers of individual were reported from the sampling plots. Phyto-sociological studies were carried out on the 10 hills namely ARAI, Baner, Bhopdev ghat, Chaturshringi, Fergusson College, Kothrud, Parvati, Sutarwadi, University and Vetal. Overall, 124 quadrates of size 15 m X 15 m were plotted. Each and every tree in the quadrate is sampled along with GPS and studied for various Phytosociological parameters.

Overall, the hills have represented fairly heterogeneous vegetation throughout the study area. In general, the plant community structure was *Gliricidia sepium* (IVI 1262.04) -- *Dalbergia melanoxylon* (141.32) -- *Acacia catechu* (133) - *Azadirachta indica* (114.8) -- *Leucaena leucocephala* (91.69) -- *Acacia leucophloea*(87.17)...

The hills conserve the biodiversity and hence balance of nature is maintained. It is therefore essential that not only the bio-diversity, but also the geo-climatic environment of these hilly habitats should be kept status-quo with no interference of any kind. Any alterations such as road and other constructions, quarrying, tunnelling, rope-ways, wind-mills or other similar interference should not be allowed to safeguard the life that exists in these hilly habitats, more so because these life forms do not have their say.

In contrast, several concerned citizens with the cooperation of the forest department have planted and nurtured trees here to create conducive habitats for the existing bio-diversity. Documentation of the existing base-line bio-diversity of this region will assist conservation prioritization, both for planners and protectors. So also, such data creates public awareness and sensitizes citizens, leading to the protection of the precious local bio-diversity. Identification of endemic and threatened species and recognition of immediate and possible future risks shall effectively protect this bio-diversity.

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