International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 27-04-2026, Accepted: 28-05-2026, Published: 12-06-2026
Volume 11, Issue 2, 2026, Page No. 397-407

Herbaceous vegetation dynamics in the proposed airport site of Purandar, Western India: A phytosociological approach

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DOI: https://doi.org/10.66856/ijbs.2026.11.2.11127

Abstract
In a phyto-sociological study, field sampling is the first step. Quadrats (1m x 1m size) for herbaceous vegetation were laid down in the proposed air port zone of Purandar tehsil. The airport for which the state Government of Maharashtra is acquiring the land of the villages include Aamble, Ambodi, Ekhatpur-Munjawadi, Khanwadi, Kumbharvalan, Pargaon-Memane, Rajewadi, Singapur, Sonori, Tekwadi, Udachiwadi, Vanpuri.
Among the documented overall 101 plant species, 19 species mentioned below, were located in both localities. (10 quadrats each in Air port zone and in the vicinity of village Kumbharvalan) *Acanthospermum hispidum, Alysicarpus rugosus, Argemone mexicana, Boerhavia diffusa, Cassia tora, Catharanthes pusilus, Celosia argentea, Cynotis cristata, Dactyloctenium agypticum, Euphorbia hirta, Evolvulus alsinoides, Glossocordia bosvallea, Indigofera cordifolia, Lavandula bipinnata, Leucas biflora, Pulicaria wighitiana, Spermacoce pusilla, Trichodesma amplexicaule,* and *Tridax procumbens.*
The above mentioned 19 plant species represent 13 families. (Asteraceae, Fabaceae, Papaveraceae, Nyctaginaceae, Caesalpinaceae, Apocynaceae, Amaranthaceae, Commelinaceae, Poaceae, Euphorbiaceae, Convolvulaceae, Lamiaceae, and Rubiaceae) The species sampled by quadrat method (1m x1m) by placing 10 quadrats each at both locations were equal in number i.e. 68. Based on the data recorded, qualitative and quantitative structures analyzed were Frequency, Abundance, Density, and IVI. The present Phyto-sociological work will help in providing materials for the academicians, researchers, to the flora of a state and the Country. It will be useful for conservation and long-term protection and management based on the research findings.

Keywords: Phyto-sociology, quadrat sampling, herbaceous vegetation, plant diversity, species composition, frequency, abundance

Introduction
Plants naturally occur together in repetitive groups of associated plants and most frequent and abundant plants describe them well (Mueller- Dombois, 1974). Vegetation form is a significant feature of the given area (Arey, 2010). Vegetation ecology is the study of both structure of vegetation and vegetation systematics. Vegetation ecology has a tradition of bridging a gap between the basic and applied approach to research.
Phytosociological and floristic studies are widely recognized in acquiring baseline data for the planning and management of any area (Mahajan, Shinde, 2021) [4]. Phytosociological studies are necessary for protecting the biodiversity and natural plant communities (Rao S.D., Murthy, et. al, 2015) [6]. Phytosociological studies are very essential components for understanding the changes accomplished in the past and future (Hamzaoglu, 2006) [3].

Materials and Methods
Biologists, Ecologists use different implements and skills to perform phyto-sociological studies. The different ranges of considerations are in use as they are investigated to understand the vegetation structure. To learn the multiplicity of plant communities in the Purandar tehsil, following techniques of sampling were followed.
Quadrat of 1x 1m. for herbaceous vegetation, Scale-tape, GPS Instrument (Geographical Position System), Camera, String, nails, Plastic rods (04), Rod locks, Notebook and Field guide book, Maps, Field diary, Pen etc. were used Fig. 1

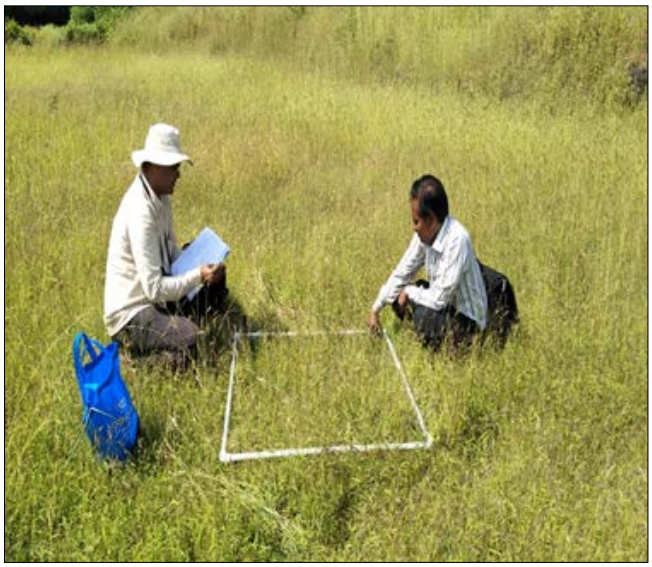

Fig 1: Sampling for Herbaceous vegetation

A community is characterized by detailing those species which most contribute to its characteristic structure and composition. The study of the structure and composition of each and every plant community is practically impossible. Therefore, rough estimate of species content of a locality has been done by observing the plant species at variety of places, in the habitat. The size of a quadrat varies with the type of vegetation studies. The methods used by Misra, (1968); Odum, (1971); Muller-Dombios (1974); Michael,

(1984); and Trivedi, Goel, *et.al*., (1988) were followed for the quantification of the data.

Field Sampling

A quadrat is a square sample plot or unit of applicable size for detailed analysis of vegetation. It is actually a sample plot method (Weaver, and Frederic, *et al.*, 1938) [11]. For the herbaceous vegetation communities, 1m x1m. Size quadrats were used. GPS were noted for each and every locality.

The Phyto-sociological investigation of the Proposed Airport region is represented in the Table 1 The quantitative analysis of the zone includes the quadrat study. The proposed air port zone is located at the east of the tehsil (Study area). The airport for which the state Government of Maharashtra is acquiring the land of the villages which include Aamble, Ambodi, Ekhatpur-Munjawadi, Khanwadi, Kumbharvalan, Pargaon-Memane, Rajewadi, Singapur, Sonori, Tekwadi, Udachiwadi, Vanpuri. The quadrats of 1 x 1m. Were laid down for herbaceous vegetation at Kumbharvalan and at proposed air port site.

10 Quadrats were laid down at each location. At the proposed air-port zone, herbaceous community principally represents grasses. The results indicate that *Cynotis cristata* shown highest percentage frequency (70%) followed by *Parthenium hysterophourus, Oldenlandia corymbosa, Tridax procumbens* (50% each) formed the dominant vegetation. These species were followed by *Oplismenus burmanii, Leucas biflora, Polygala persicariaefolia, Crotalaria filipes,* (40% each) *Justicia nagpurensis, Echinchloa colona, Leucas stelligera, Boerhavia diffusa, Urochoea ramosa, Alysicarpos glumaceus* (30 % each). The species with lowermost percentage frequency represented were *Argemone mexicana, Lantana camara* (saplings), *Brachiaria* sp., etc. But the percentage frequency does not determine the community alone Table 1.

Table 1: Phytosociological analysis of herbaceous vegetation: Proposed Air-port Zone/site

Botanical Name	% Freq	Freq. Class	Rel. Freq.	Abun.	Dens.	Rel. Density	IVI
Dactyloctenium agypticum	20	A	1.53	65.00	13.00	15.38	16.91
Oplismenus burmanni	40	B	3.05	23.75	9.50	11.24	14.30
Cynotis cristata	70	D	5.34	7.71	5.40	6.39	11.73
Lavandula bipinnata	50	C	3.82	8.20	4.10	4.85	8.67
Leucas biflora	40	B	3.05	10.75	4.30	5.09	8.14
Habenaria corniculata	20	A	1.53	22.50	4.50	5.33	6.85
Indigofera cordifolia	50	C	3.82	4.60	2.30	2.72	6.54
Argemone mexicana	10	A	0.76	45.00	4.50	5.33	6.09
Parthenium hysterophorus	50	C	3.82	3.60	1.80	2.13	5.95
Oldenlandia corymbosa	50	C	3.82	3.20	1.60	1.89	5.71
Justicia nagpurensis	30	B	2.29	9.33	2.80	3.31	5.60
Tridax procumbens	50	C	3.82	1.80	0.90	1.07	4.88
Polygala persicariaefolia	40	B	3.05	3.75	1.50	1.78	4.83
Crotalaria filipes	40	B	3.05	2.50	1.00	1.18	4.24
Zornia diphylla	10	A	0.76	29.00	2.90	3.43	4.20
Echinchloa colona	30	B	2.29	4.67	1.40	1.66	3.95
Curculigo orchioides	20	A	1.53	10.00	2.00	2.37	3.89
Acanthospermum hispidum	20	A	1.53	9.50	1.90	2.25	3.78
Leucas stelligera	30	B	2.29	4.00	1.20	1.42	3.71
Vigna radiata	20	A	1.53	8.50	1.70	2.01	3.54
Urochloea ramosa	30	B	2.29	2.33	0.70	0.83	3.12
Alysicarpus glumaceus	30	B	2.29	2.33	0.70	0.83	3.12
Bidens biternatea	10	A	0.76	19.00	1.90	2.25	3.01
Cosmos sulphureus	20	A	1.53	5.00	1.00	1.18	2.71
Lagasca mollis	10	A	0.76	16.00	1.60	1.89	2.66
Boerhavia diffusa	30	B	2.29	1.00	0.30	0.36	2.65
Kyllinga tenufolia	20	A	1.53	4.00	0.80	0.95	2.47
Cyperus triceps	10	A	0.76	10.00	1.00	1.18	1.95
Brachiaria sp.	10	A	0.76	10.00	1.00	1.18	1.95
Tribulus terestris	20	A	1.53	1.50	0.30	0.36	1.88
Alternanthera sessilis	20	A	1.53	1.50	0.30	0.36	1.88
Cassia tora	20	A	1.53	1.00	0.20	0.24	1.76
Glossocordia bosvallea	20	A	1.53	1.00	0.20	0.24	1.76
Euphorbia heterophylla	20	A	1.53	1.00	0.20	0.24	1.76
Scilla hyacinthina	20	A	1.53	1.00	0.20	0.24	1.76
Indigofera linifolia	10	A	0.76	6.00	0.60	0.71	1.47
Pulicaria wighitiana	10	A	0.76	4.00	0.40	0.47	1.24
Cleome villosus	10	A	0.76	3.00	0.30	0.36	1.12
Euphorbia hirta	10	A	0.76	3.00	0.30	0.36	1.12
Xanthium strumarium	10	A	0.76	3.00	0.30	0.36	1.12
Linum mysorensis	10	A	0.76	3.00	0.30	0.36	1.12
Spermacoce pusillus	10	A	0.76	3.00	0.30	0.36	1.12
Cocculus hirsutus	10	A	0.76	3.00	0.30	0.36	1.12
Trichodesma amplexicaule	10	A	0.76	2.00	0.20	0.24	1.00

Alysicarpus rugosus	10	A	0.76	2.00	0.20	0.24	1.00
Trichodesma amplexicaule	10	A	0.76	2.00	0.20	0.24	1.00
Phyllanthus amarua	10	A	0.76	2.00	0.20	0.24	1.00
Sonchus oleraceus	10	A	0.76	2.00	0.20	0.24	1.00
Euphorbia microphylla	10	A	0.76	1.00	0.10	0.12	0.88
Dactyloctenium agypticum	10	A	0.76	1.00	0.10	0.12	0.88
Celosia argentea	10	A	0.76	1.00	0.10	0.12	0.88
Digeria muricata	10	A	0.76	1.00	0.10	0.12	0.88
Cucumis callosus	10	A	0.76	1.00	0.10	0.12	0.88
Cleome simplicifolia	10	A	0.76	1.00	0.10	0.12	0.88
Crotalaria juncea	10	A	0.76	1.00	0.10	0.12	0.88
Evolvulus alsinoides	10	A	0.76	1.00	0.10	0.12	0.88
Kickxia romosissima	10	A	0.76	1.00	0.10	0.12	0.88
Vernonia cinerea	10	A	0.76	1.00	0.10	0.12	0.88
Lantana camara (Saplings)	10	A	0.76	1.00	0.10	0.12	0.88
Argyreia cuneata	10	A	0.76	1.00	0.10	0.12	0.88
Tagetus erecta	10	A	0.76	1.00	0.10	0.12	0.88
Crotalaria medicaginea	10	A	0.76	1.00	0.10	0.12	0.88
Sesamum indicum	10	A	0.76	1.00	0.10	0.12	0.88
Leea edgeworthii	10	A	0.76	1.00	0.10	0.12	0.88
Asparagus racemosus	10	A	0.76	1.00	0.10	0.12	0.88
Artemisia nilagirica	10	A	0.76	1.00	0.10	0.12	0.88
Securinega leucaepyrus	10	A	0.76	1.00	0.10	0.12	0.88
Pinda concanense	10	A	0.76	1.00	0.10	0.12	0.88
Proposed Airport Zone (2020) N 18^0 21. 930’ E0 74^0. 08 732'	Simpson Index = 0.9409 Shannon Index= 3.32779						

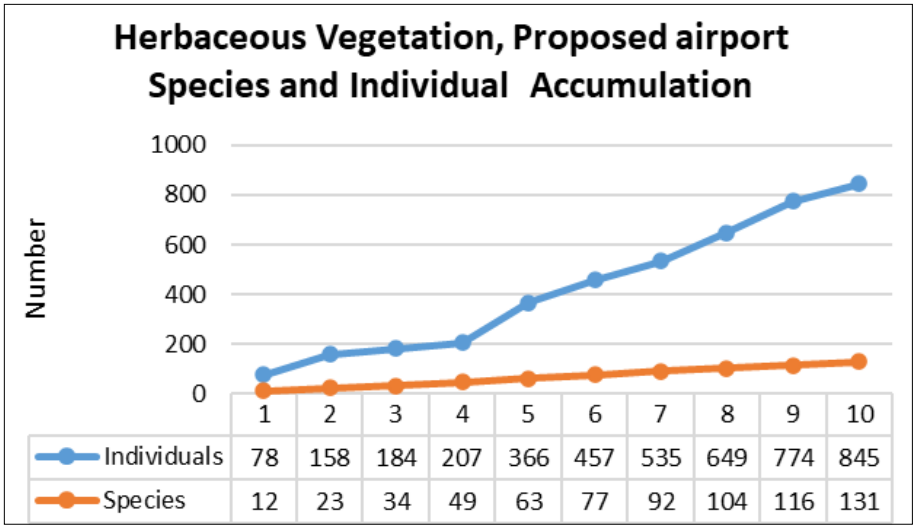

Fig 2: Species and Individuals Accumulation Curve, Proposed airport zone

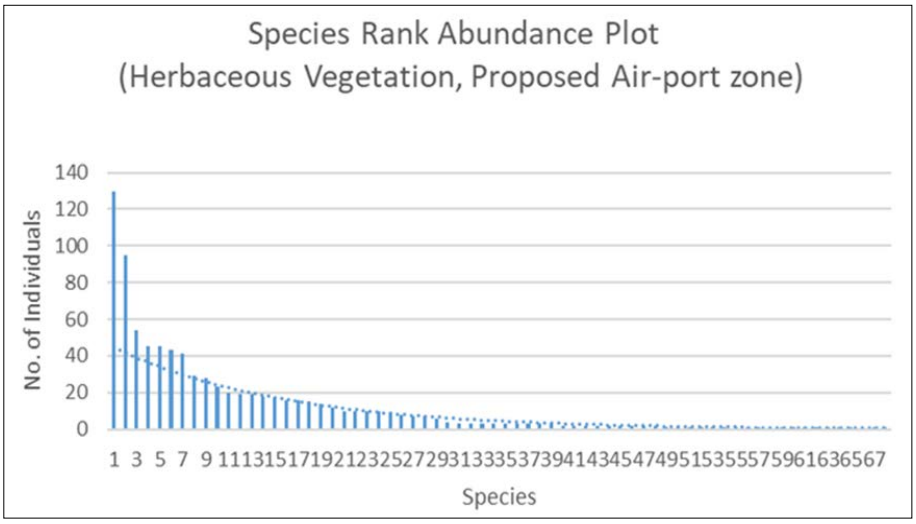

Fig 3: Species Rank Abundance Plot, Proposed Air-port Zone

Table 2: List of plant species for IVI

Sr.	Species	Sr	Species	Sr.	Species
1	*Dactyloctenium agypticum*	24	*Brachiaria sp*	47	*Phyllanthes amura*
2	*Oplismenus burmanni*	25	*Tridax procumbens*	48	*Sonchus oleraceus*
3	*Cynotis cristata*	26	*Kyllinga tenufolia*	49	*Euphorbia microphylla*
4	*Habenaria corniculata*	27	*Urochloea ramosa*	50	*Dactyloctenium agypticum*
5	*Argemone mexicana*	28	*Alysicarpus glumaceus*	51	*Celosia argentea*
6	*Leucas biflora*	29	*Indigofera linifolia*	52	*Digeria muricata*
7	*Lavandula bipinnata*	30	*Pulicaria wighitiana*	53	*Cucumis callosus*
8	*Zornia diphylla*	31	*Boerhavia diffusa*	54	*Cleome simplicifolia*
9	*Justicia nagpurensis*	32	*Tribulus terestris*	55	*Crotalaria juncea*
10	*Indigofera cordifolia*	33	*Alternanthera sessilis*	56	*Evolvulus alsinoides*
11	*Curculigo orchioides*	34	*Cleome villosus*	57	*Kickxia romosissima*
12	*Acanthospermum hispidum*	35	*Euphorbia hirta*	58	*Vernonia cinerea*
13	*Bidens biternata*	36	*Xanthium strumarium*	59	*Lantana sps.* (Saplings)
14	*Parthenium hysterophorus*	37	*Linum mysorensis*	60	*Argyreia cuneata*
15	*Vigna radiata*	38	*Spermacoce pusillus*	61	*Tagetus erecta*
16	*Oldenlandia corymbosa*	39	*Cocculus hirsutus*	62	*Crotalaria medicaginea*
17	*Lagasca mollis*	40	*Cassia tora*	63	*Sesamum indicum*
18	*Polygala persicariaefolia*	41	*Glossocordia bosvallea*	64	*Leea edgeworthii*
19	*Echinchloa colona*	42	*Euphorbia heterophylla*	65	*Asparagus racemosus*
20	*Leucas biflora*	43	*Scilla hyacinthina*	66	*Artemisia nilagirica*
21	*Crotalaria filipes*	44	*Trichodesma sps.*	67	*Securinega leucaepyrus*
22	*Cosmos sulphureus*	45	*Alysicarpus rugosus*	68	*Pinda concanense*
23	*Cyperus triceps*	46	*Trichodesma sps.*		

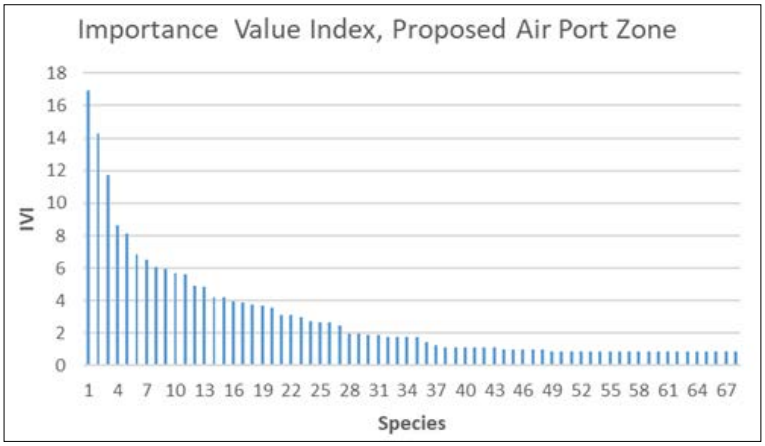

Fig. 4: Importance Value Index, Proposed airport zone

Table 3: List of Plant species

Sr.	Species	Sr	Species	Sr.	Species
1	Dactyloctenium sps.	24	*Cosmos sulphureus*	47	*Phyllanthus amarua*
2	*Oplismenus burmanni*	25	*Lagasca mollis*	48	*Sonchus oleraceus*
3	*Cynotis cristata*	26	*Boerhavia diffusa*	49	*Euphorbia microphylla*
4	*Lavandula bipinnata*	27	*Kyllinga tenufolia*	50	*Dactyloctenium sps.*
5	*Leucas biflora*	28	*Cyperus triceps*	51	*Celosia argentea*
6	*Habenaria corniculata*	29	*Brachiaria sp*	52	*Digeria muricata*
7	*Indigofera cordifolia*	30	*Tribulus terestris*	53	*Cucumis callosus*
8	*Argemone mexicana*	31	*Alternanthera sessilis*	54	*Cleome simplicifolia*
9	*Parthenium sps.*	32	*Cassia tora*	55	*Crotalaria juncea*
10	*Oldenlandia corymbosa*	33	*Glossocordia sps.*	56	*Evolvulus alsinoides*
11	*Justicia nagpurensis*	34	*Euphorbia sps.*	57	*Kickxia romosissima*
12	*Tridax procumbens*	35	*Scilla hyacinthina*	58	*Vernonia cinerea*
13	*Polygala persicariaefolia*	36	*Indigofera linifolia*	59	*Lantana camara*
14	*Crotalaria filipes*	37	*Pulicaria wighitiana*	60	*Argyreia cuneata*
15	*Zornia diphylla*	38	*Cleome villosus*	61	*Tagetus erecta*
16	*Echinchloa colona*	39	*Euphorbia hirta*	62	*Crotalaria medicaginea*
17	*Curculigo orchioides*	40	*Xanthium strumarium*	63	*Sesamum indicum*
18	*Acanthospermum sps.*	41	*Linum mysorensis*	64	Leea edgeworthii
19	*Leucas biflora*	42	*Spermacoce pusillus*	65	*Asparagus racemosus*
20	*Vigna radiata*	43	*Cocculus hirsutus*	66	*Artemisia nilagirica*
21	*Urochloea ramosa*	44	*Trichodesma sps.*	67	*Securinega leucaepyrus*
22	*Alysicarpus glumaceus*	45	*Alysicarpus rugosus*	68	*Pinda concanense*
23	*Bidens biternata*	46	*Trichodesma sps.*		

The proposed Air-port zone has shown diverse vegetation comprising 68 species and the number of individuals were 845 Fig. 3 though the proposed air-port zone was represented by 68 species, it consists few individuals. Abundance value of each species play a crucial role in community composition. The abundant species were *Dactyloctenium agypticum* (65.00), *Argemone Mexicana* (45.00), *Zornia diphylla* (29.00) *Oplismenus burmanii* (23.75) etc.

The occasional species were *Indigofera linifolia, Pulicaria wighiana, Cleome villosus, Euphorbia hirta, Xanthium strumarium, Linum mysorense, Spermacoce pusillus, Cocculus hirsutus etc. Euphorbia microphylla, Dactyloctenium agypticum, Celosia argentea, Digeria muricata, Cucumis callosus, Cleome simplicifolia, Crotalaria juncea, Evolvulus alsinoides, Kickxia romosissima, Vernonia cinerea, Lantana camara* (Saplings), *Argyreia cuneata, Tagetus erecta, Crotalaria medicaginea, Sesamum indicum, Leea edgeworthii, Asparagus racemosus, Artemisia nilagirica, Securinega leucaepyrus,* and *Pinda concanense* shown less IVI (0.88 each).

Based on the results the species were distributed into various frequency classes. Class A represented by 76.47%, class B 14.71%, class C 7.35%, class D has been represented by 1.47% of all species whereas class E (Frequency more than 80%) was absent. As class E was absent the vegetation can be interpreted as completely heterogenous. Homogeneity was highly suppressed because of human intervention in the natural ecosystem by means of domestic livestock and agriculture.

Table 4: Phyto-sociological analysis of herbaceous vegetation-Kumbharvalan

Botanical name	% Freq	Fre. Cl.	Rel. Freq.	Abun.	Dens.	Rel. Den.	IVI
Indigofera cordifolia	40	B	3.96	73.50	29.40	20.01	23.97
Alysicarpus rugosus	40	B	3.96	47.75	19.10	13.00	16.96
Lophopogon tridentatus	20	A	1.98	67.00	13.40	9.12	11.10
Parthenium hysterophorus	20	A	1.98	59.00	11.80	8.03	10.01
Heteropogon contortus	30	B	2.97	34.00	10.20	6.94	9.91
Glossocordia bosvallea	20	A	1.98	47.50	9.50	6.47	8.45
Dactyloctenium agypticum	40	B	3.96	10.00	4.00	2.72	6.68
Sehima nervosus	20	A	1.98	25.00	5.00	3.40	5.38
Buchnera hispida	10	A	0.99	49.00	4.90	3.34	4.33
Acanthospermum hispidum	30	B	2.97	6.33	1.90	1.29	4.26
Eragrostis bifaria	20	A	1.98	15.50	3.10	2.11	4.09
Cynodon dactylon	20	A	1.98	14.00	2.80	1.91	3.89
Boerhavia erecta	30	B	2.97	2.67	0.80	0.54	3.51
Launaea procumbens	30	B	2.97	1.33	0.40	0.27	3.24
Vigna indica	10	A	0.99	31.00	3.10	2.11	3.10
Cynotis cristata	20	A	1.98	7.50	1.50	1.02	3.00
Oplismenus burmanni	20	A	1.98	7.50	1.50	1.02	3.00
Melanocenchris sp	20	A	1.98	6.00	1.20	0.82	2.80
Iphigenia pallida	10	A	0.99	26.00	2.60	1.77	2.76
Tonningia axillaris	10	A	0.99	25.00	2.50	1.70	2.69
Euphorbia hirta	20	A	1.98	4.50	0.90	0.61	2.59
Commelina benghalensis	10	A	0.99	23.00	2.30	1.57	2.56
Lepidogathis cristata	20	A	1.98	3.50	0.70	0.48	2.46
Alternanthera triendra	20	A	1.98	3.00	0.60	0.41	2.39
Evolvulus alsinoides	20	A	1.98	2.00	0.40	0.27	2.25
Alternanthera cinera	20	A	1.98	2.00	0.40	0.27	2.25
Pentanema indicum	20	A	1.98	1.50	0.30	0.20	2.18
Rhinchosia minima	20	A	1.98	1.50	0.30	0.20	2.18
Acalypha indica	10	A	0.99	12.00	1.20	0.82	1.81
Curculigo orchioides	10	A	0.99	11.00	1.10	0.75	1.74
Amaranthes arvensis	10	A	0.99	9.00	0.90	0.61	1.60
Cyperus difformis	10	A	0.99	8.00	0.80	0.54	1.53
Tribulus terestris	10	A	0.99	7.00	0.70	0.48	1.47
Oldenlandia corymbosa	10	A	0.99	5.00	0.50	0.34	1.33
Vernonia cinerea	10	A	0.99	5.00	0.50	0.34	1.33
Ageratum conyzoides	10	A	0.99	4.00	0.40	0.27	1.26
Sporobolus diander	10	A	0.99	4.00	0.40	0.27	1.26
Aeschenomene aspera	10	A	0.99	4.00	0.40	0.27	1.26
Lagasca mollis	10	A	0.99	3.00	0.30	0.20	1.19
Scilla hyacinthina	10	A	0.99	3.00	0.30	0.20	1.19
Semecarpus anacardium	10	A	0.99	3.00	0.30	0.20	1.19
Heliotropium bacciferum	10	A	0.99	3.00	0.30	0.20	1.19
Mollugo nudicaulis	10	A	0.99	3.00	0.30	0.20	1.19
Tephrotia purpurea	10	A	0.99	3.00	0.30	0.20	1.19
Leucas biflora	10	A	0.99	2.00	0.20	0.14	1.13
Celosia argentea	10	A	0.99	2.00	0.20	0.14	1.13
Dactyloctenium agypticum	10	A	0.99	2.00	0.20	0.14	1.13
Justicia nagpurensis	10	A	0.99	2.00	0.20	0.14	1.13
Zornia diphylla	10	A	0.99	2.00	0.20	0.14	1.13

Sida rhombifolia	10	A	0.99	2.00	0.20	0.14	1.13
Clerodendrum multiflorum	10	A	0.99	2.00	0.20	0.14	1.13
Discorea pentaphylla	10	A	0.99	2.00	0.20	0.14	1.13
Achyranthes aspara	10	A	0.99	2.00	0.20	0.14	1.13
Andrographis paniculata	10	A	0.99	2.00	0.20	0.14	1.13
Asphodelous tenuifolius	10	A	0.99	2.00	0.20	0.14	1.13
Bideens pilosa	10	A	0.99	2.00	0.20	0.14	1.13
Tridax procumbens	10	A	0.99	1.00	0.10	0.07	1.06
Echinchloa colona	10	A	0.99	1.00	0.10	0.07	1.06
Cleome villosus	10	A	0.99	1.00	0.10	0.07	1.06
Spermacoce pusillus	10	A	0.99	1.00	0.10	0.07	1.06
Crotalaria medicaginea	10	A	0.99	1.00	0.10	0.07	1.06
Cocculus villosus	10	A	0.99	1.00	0.10	0.07	1.06
Tinospora cordifolia	10	A	0.99	1.00	0.10	0.07	1.06
Cyperus triceps	10	A	0.99	1.00	0.10	0.07	1.06
Azadirachta indica	10	A	0.99	1.00	0.10	0.07	1.06
Cucumis propheratum	10	A	0.99	1.00	0.10	0.07	1.06
Crotalaria hebecarpa	10	A	0.99	1.00	0.10	0.07	1.06
Apluda mutica	10	A	0.99	1.00	0.10	0.07	1.06
			100			100	200
Date: 01082017 Kumbharvalan					Simp. = 0.913258		
N 18^0 21 930' E0 74^0 08 732'					Shan. = 3.002671		

Heteropogon contortus, *Acanthospermum hispidum*, *Boerhavia erecta* and *Launea procumbens* showed (30.00 each) percent frequency. The moderately distributed species were *Lophopogon tridentatus*, *Parthenium hysterophorus*, *Glossocordia bosvallea*. *Sehima nervosus*, *Eragrostis bifaria*, *Cynodon dactylon*, *Cynotis cristata*, *Oplismenus burmanni*, *Melanocenchris jacquemontii*, *Euphorbia hirta*, *Lepidogathis cristata*, *Alternanthera triendra*, *Pentanema indicum* and *Rhinchosia minima* (20 each).

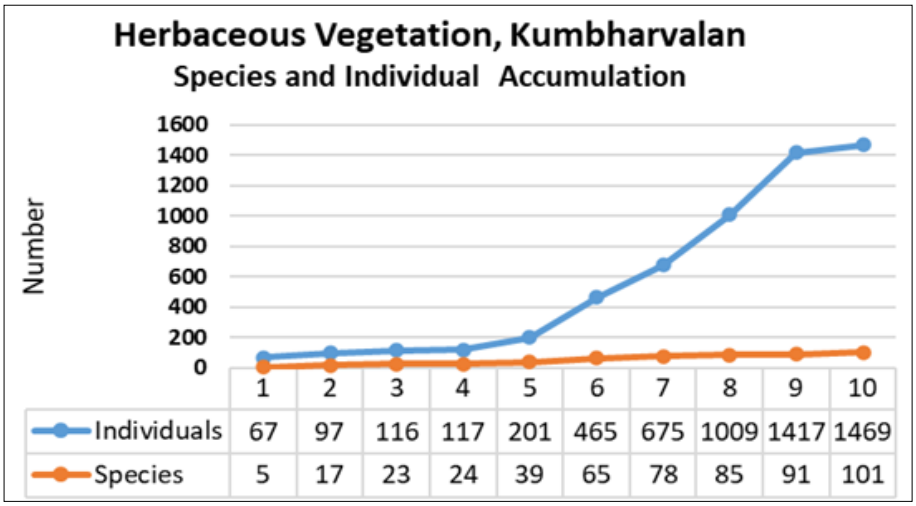

Fig 5: Species and Individuals Accumulation Curve, Kumbharvalan

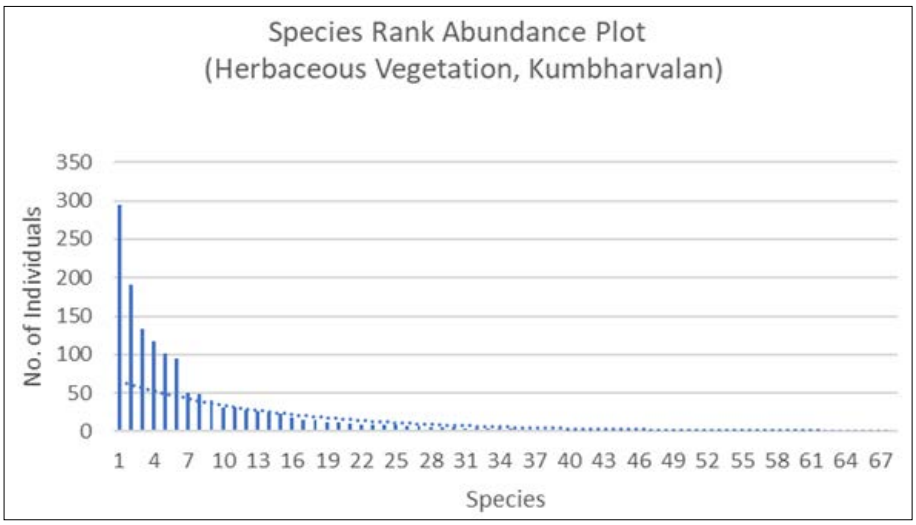

Fig 6: Species Rank Abundance Plot, Kumbharvalan.

Table 5: List of plant species to determine IVI

Sr.	Species	Sr	Species	Sr.	Species
1	*Indigofera cordifolia*	24	*Boerhavia erecta*	47	Dactyloctenium agypticum
2	*Alysicarpus rugosus*	25	*Cyperus difformis*	48	*Justicia nagpurensis*
3	*Lophopogon tridentatus*	26	*Lepidogathis cristata*	49	*Zornia diphylla*
4	*Parthenium hysterophorus*	27	*Tribulus terestris*	50	*Sida rhombifolia*
5	*Heteropogon contortus*	28	*Alternanthera triendra*	51	*Clerodendrum multiflorum*
6	*Glossocordia bosvallea*	29	*Oldenlandia corymbosa*	52	*Discorea pentaphylla*
7	*Sehima nervosus*	30	*Vernonia cinerea*	53	*Achyranthes aspara*
8	*Buchnera hispida*	31	*Launaea procumbens*	54	*Andrographis paniculata*
9	*Dactyloctenium agypticum*	32	*Evolvulus alsinoides*	55	*Asphodelous tenuifolius*
10	*Eragrostis bifaria*	33	*Alternanthera cinera*	56	*Bidedens pilosa*
11	*Vigna indica*	34	*Ageratum conyzoides*	57	*Tridax procumbens*
12	*Cynodon dactylon*	35	*Sporobolus diander*	58	*Echinchloa colona*
13	*Iphigenia pallida*	36	*Aeschenomene aspera*	59	*Cleome villosus*
14	*Tonningia axillaris*	37	*Pentanema indicum*	60	*Spermacoce pusillus*
15	*Commelina benghalensis*	38	*Rhinchosia minima*	61	*Crotalaria medicaginea*
16	*Acanthospermum hispidum*	39	*Lagasca mollis*	62	*Cocculus villosus*
17	*Cynotis cristata*	40	*Scilla hyacinthina*	63	*Tinospora cordifolia*
18	*Oplismenus burmanni*	41	*Semecarpus sps.*	64	*Cyperus triceps*
19	*Melanocenchris sps.*	42	*Heliotropium sps.*	65	*Azadirachta indica*
20	*Acalypha indica*	43	*Mollugo nudicaulis*	66	*Cucumis propheratum*
21	*Curculigo orchioides*	44	*Tephrotia purpurea*	67	*Crotalaria hebecarpa*
22	*Euphorbia hirta*	45	*Leucas biflora*	68	*Apluda mutica*
23	*Amaranthes arvensis*	46	*Celosia argentea*		

Kumbharvalan: Comprises *Indigofera cordifolia, Alysicarpus rugosus, Lophopogon tridentatus, Parthenium hysterophorus, Heteropogon contortus, Glossocordia bosvallea* and *Sehima nervosus* were the most abundant species. *Indigofera cordifolia, Alysicarpus rugosus, Lophopogon tridentatus, Parthenium hysterophorus, Heteropogon contortus, Glossocordia bosvallea, Dactyloctenium agypticum, Sehima nervosus, Buchnera hispida* Has high IVI, While least IVI was noted for *Tridax procumbens, Echinchloa colona, Cleome villosus, Spermacoce pusilla, Crotalaria medicaginea, Cocculus villosus, Tinospora cordifolia, Cyperus triceps, Azadirachta indica, Cucumis propheratum, Crotalaria hebecarpa, Apluda mutica* (1.06 each) Table 3. Village and adjoining area represented diverse vegetation comprising 68 species and the cumulative number of individuals were 1469 Table 6.

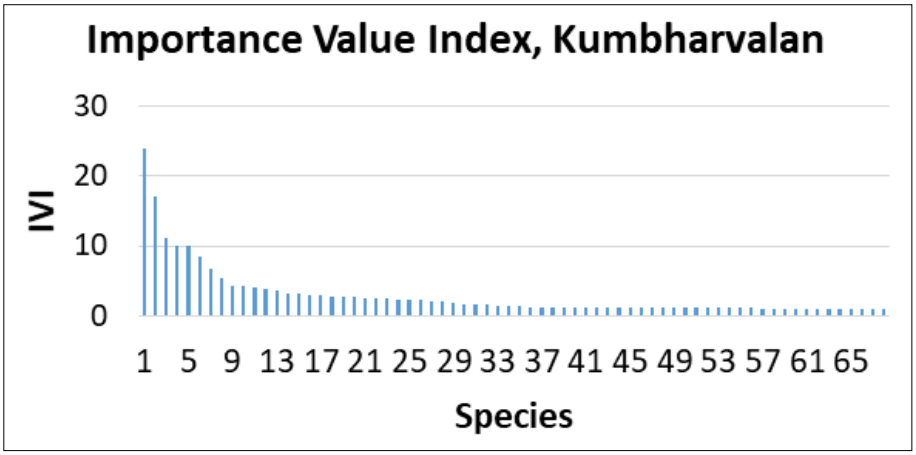

Fig 7: Importance Value Index, Kumbharvalan

Sr.	Species	Sr.	Species
1	*Indigofera cordifolia*	35	*Vernonia cinerea*
2	*Alysicarpus rugosus*	36	*Ageratum conyzoides*
3	*Lophopogon tridentatus*	37	*Sporobolus diander*
4	*Parthenium hysterophorus*	38	*Aeschenomene aspera*
5	*Heteropogon contortus*	39	*Lagasca mollis*
6	*Glossocordia bosvallea*	40	*Scilla hyacinthina*
7	*Dactyloctenium agypticum*	41	*Semecarpus anacardium*
8	*Sehima nervosus*	42	*Heliotropium bacciferum*
9	*Buchnera hispida*	43	*Mollugo nudicaulis*
10	*Acanthospermum hispidum*	44	*Tephrotia purpurea*
11	*Eragrostis bifaria*	45	*Leucas biflora*
12	*Cynodon dactylon*	46	*Celosia argentea*

13	*Boerhavia erecta*	47	*Dactyloctenium agypticum*
14	*Launaea procumbens*	48	*Justicia nagpurensis*
15	*Vigna indica*	49	*Zornia diphylla*
16	*Cynotis cristata*	50	*Sida rhombifolia*
17	*Oplismenus burmanni*	51	*Clerodendrum multiflorum*
18	*Melanocenchris sp.*	52	*Discorea pentaphylla*
19	*Iphigenia pallida*	53	*Achyranthes aspara*
20	*Tonningia axillaris*	54	*Andrographis paniculata*
21	*Euphorbia hirta*	55	*Asphodelous tenuifolius*
22	*Commelina benghalensis*	56	*Bidedens pilosa*
23	*Lepidogathis cristata*	57	*Tridax procumbens*
24	*Alternanthera triendra*	58	*Echinchloa colona*
25	*Evolvulus alsinoides*	59	*Cleome villosus*
26	*Alternanthera cinera*	60	*Spermacoce pusillus*
27	*Pentanema indicum*	61	*Crotalaria medicaginea*
28	*Rhinchosia minima*	62	*Cocculus villosus*
29	*Acalypha indica*	63	*Tinospora cordifolia*
30	*Curculigo orchioides*	64	*Cyperus triceps*
31	*Amaranthes arvensis*	65	*Azadirachta indica*
32	*Cyperus difformis*	66	*Cucumis propheratum*
33	*Tribulus terestris*	67	*Crotalaria hebecarpa*
34	*Oldenlandia corymbosa*	68	*Apluda mutica*

Analysis: Based on the results, the species were distributed into various frequency classes. Class A represented by 98.54%, class B 10.29%, class C (Frequency more than 40%) class D (Frequency more than 60%) and class E (Frequency more than 80%) were not represented. As class C, D, and E were not represented, the vegetation interpreted as considerably disturbed but heterogenous. Table 3 the biotic disturbance was severe due to the developmental activities as this location is very close (App. 5km) to Saswad town.

Table 6: Important Figures and Characters of the Herbaceous Vegetation

Place/ Village	No. of quadrats	No. of Sps.	No. of Individuals	Abundant species	Raunkiaer's Frequency equation
Proposed Air-port Zone (other than Kumbharvalan)	10	68	845	*Dactyloctenium agypticum, Oplismenus, burmanni, Cynotis cristata, Lavandula bipinnata, Leucas biflora, Habenaria corniculata*	A>B>C>D>E
Kumbhar-valan	10	68	1469	*Indigofera cordifolia, Alysicarpus rugosus, Lophopogon tridentatus, Parthenium hysterophorus, Heteropogon contortus, Glossocordia bosvallea*	A>B>C=D=E

Fig 8: Photoplates belongs to Air port site/zone, Purandar, Dist. Pune, M.S.
Table 7: List of plants noted in Air port Zone and K. Valan

Sr.	Plant Species	A P Zone	Kumbhar-valan
1	*Acalypha indica*	0	✓
2	*Acanthospermum hispidum*	✓	✓
3	*Achyranthes aspera var. porphyristachya*	0	✓
4	*Aerva lanata*	0	✓
5	*Alternanthera sessilis*	✓	0
6	*Alternanthera triendra*	0	✓
7	*Alysicarpus glumaceus*	✓	0
8	*Alysicarpus linifolia*	0	✓
9	*Alysicarpus pubescens*	0	✓
10	*Alysicarpus rugosus*	✓	✓
11	*Amaranthes viridis*	0	✓
12	*Apluda mutica*	0	✓
13	*Argemone mexicana*	✓	✓
14	*Argyreia cuneata*	✓	0
15	*Artemisia nilagirica*	✓	0
16	*Asparagus racemosus*	✓	0
17	*Bidens biternatea*	✓	0
18	*Boerhavia diffusa*	✓	✓
19	*Brachiaria sp*	✓	0
20	*Calotropis procera*	0	✓
21	*Cassia tora*	✓	✓
22	*Catharanthes pumilus*	0	✓
23	*Celosia argentea*	✓	✓
24	*Cleome simplicifolia*	✓	0
25	*Cleome villosus*	✓	0
26	*Cocculus hirsutus*	✓	0
27	*Corchrus trilocularis*	0	✓
28	*Cosmos sulphureus*	✓	0
29	*Crotalaria filipes*	✓	0
30	*Crotalaria juncea*	✓	0
31	*Crotalaria medicaginea*	✓	0
32	*Cucumis callosus*	✓	0
33	*Cucumis propheratum*	0	✓
34	*Curculigo orchioides*	✓	0
35	*Cynotis cristata*	✓	✓
36	*Cynotis tuberosa*	0	✓
37	*Cyperus triceps*	✓	0
38	*Dactyloctenium agypticum*	✓	✓
39	*Digeria muculata*	0	✓
40	*Digeria muricata*	✓	0
41	*Echinchloa colona*	✓	0
42	*Eichinops ehichinatus*	0	✓
43	*Eragrostis cilianensis*	0	✓
44	*Euphorbia heterophylla*	✓	0
45	*Euphorbia hirta*	✓	✓
46	*Euphorbia microphylla*	✓	0
47	*Evolvulus alsinoides*	✓	✓
48	*Glossocordia bosvallea*	✓	✓
49	*Habenaria corniculata*	✓	0
50	*Heteropogon contortotus*	0	✓
51	*Indigofera cordifolia*	✓	✓
52	*Indigofera linifolia*	✓	0
53	*Jatropa gossypifolia*	0	✓
54	*Justicia simplex*	0	✓
55	*Justicia nagpurensis*	✓	0
56	*Kickxia romosissima*	✓	0
57	*Kohautia aspera*	0	✓
58	*Kyllinga bulbosa*	0	✓
59	*Kyllinga tenufolia*	✓	0
60	*Lagasca mollis*	✓	0
61	*Lantana camara (Saplings)*	✓	0
62	*Lavandula bipinnata*	✓	✓
63	*Leea edgeworthii*	✓	0
64	*Leucas biflora*	✓	✓
65	*Leucas stelligera*	✓	0
66	*Linum mysorensis*	✓	0

67	*Melanocenchris jacquemontii*	0	✓
68	*Oldenlandia corymbosa*	✓	0
69	*Oplismenus burmanni*	✓	✓
70	*Parthenium hysterophorus*	✓	0
71	*Phyllanthus amarua*	✓	0
72	*Pinda concanense*	✓	0
73	*Polycarpa corymbosa*	0	✓
74	*Polygala glomerata*	0	✓
75	*Polygala persicariaefolia*	✓	0
76	*Portulaca oleracea*	0	✓
77	*Portulaca pusila*	0	✓
78	*Pulicaria wighitiana*	✓	✓
79	*Rhus mysorensis*	0	✓
80	*Scilla hyacinthina*	✓	0
81	*Securinega leucaepyrus*	✓	0
82	*Sehima nervosum*	0	✓
83	*Senna auriculata*	0	✓
84	*Sesamum indicum*	✓	0
85	*Sida rhombifolia*	0	✓
86	*Sonchus oleraceus*	✓	0
87	*Spermacoce pusilla*	✓	✓
88	*Striga densiflora*	0	✓
89	*Tagetus erecta*	✓	0
90	*Tephrotia purpurea*	0	✓
91	*Tribulus terestris*	✓	0
92	*Trichodesma amplexicaule*	✓	✓
93	*Tridax procumbens*	✓	✓
94	*Trigastrotheca pentaphylla*	0	✓
95	*Urochloea ramosa*	✓	0
96	*Vernonia cinerea*	✓	0
97	*Vigna indica*	0	✓
98	*Vigna radiata*	✓	0
99	*Xanthium strumarium*	✓	0
100	*Zizipus maurtiana*	0	✓
101	*Zornia diphylla*	✓	0

Results

Among the 101 plant species, 19 species mentioned below were located in both localities Table 7 *Acanthospermum hispidum, Alysicarpus rugosus, Argemone mexicana, Boerhavia diffusa, Cassia tora, Catharanthes pusilus, Celosia argentea, Cynotis cristata, Dactyloctenium agypticum, Euphorbia hirta, Evolvulus alsinoides, Glossocordia bosvallea, Indigofera cordifolia, Lavandula bipinnata, Leucas biflora, Pulicaria wighitiana, Spermacoce pusilla, Trichodesma amplexicaule*, and *Tridax procumbens.* The above mentioned 19 plant species represent 13 families. (Asteraceae, Fabaceae, Papaveraceae, Nyctaginaceae, Caesalpinaceae, Apocynaceae, Amaranthaceae, Commelinaceae, Poaceae, Euphorbiaceae, Convolvulaceae, Lamiaceae, and Rubiaceae) The species sampled by quadrat method (1m x1m) by placing 10 quadrats each at both locations were equal in number i.e. 68

The field surveys and samplings reveal that, the vegetation shows variations. Depending upon the climate, season, rainfall and soil type, luxuriant growth of grasses, climbers, shrubs, and trees found in different locations like various niches and microhabitats. Though the most of floristic composition is similar in the entire tehsil, the growth and vigor of plants was more in hilly regions of the tehsil, this could be due to soil and rainfall variations. (The proposed air port site is in a non hilly region).

Plant diversity studies will be useful for conservation and long-term protection and management based on the research findings. The present Phyto-sociological work will help in the preparation of the district flora in particular and for providing materials to the researchers and for flora of a state and the Country.

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