International Journal of Botany Studies
2ISSN: 2455-541X; Impact Factor: RJIF 5.12
Received: 17-03-2020; Accepted: 16-04-2020: Published: 25-04-2020
www.botanyjournals.com
Volume 5; Issue 2; 2020; Page No. 175-182

Floristic diversity and composition of Dharampur hills in western Ghat, Gujarat

Ayantika Das[1*], Dr. Jigna Desai[2]
[1] Research Scholar, Department of Biosciences, Veer Narmad South Gujarat University, Surat, Gujarat, India
[2] Associate Professor, Department of Biosciences, Veer Narmad South Gujarat University, Surat, Gujarat, India

Abstract
The present study primarily focused on the ecological status of Dharampur hill ranges. Data collection is done at an interval of fifteen days for the year 2017-2019 from fifty-six random sampling sites. The data was qualitatively analyzed by Jacquard's similarity cluster of study sites based on similarity in the floristic composition. For quantitative analysis, we have applied the Important Value Index. The study area has 226 species of flowering plants belonging to 173 genera and 66 families, dominated by weeds indicating disturbed habitat resulting from the loss of biodiversity of the original forest vegetation, due to anthropogenic interferences. Fabaceae was the dominant family in the study region followed by Poaceae, and Asteraceae which were mostly annual weeds that able to survive in diverse ecological conditions. Observations revealed that ecological status is threatened due to human interventions, but the ecological balance can be restored with the conservation effort. The floral diversity of these hills to be monitored regularly to facilitate conservation activities to improve the environment of the area.

Keywords: floral biodiversity, jaccardian similarity index, important value index, biological indicator species

1. Introduction
The beta diversity is generally influenced by several factors such as climatic, edaphic, topographical, anthropogenic activities, dispersal limit, genetic trait and species trait [11, 4, 6, 2, 3, 9]. Other factors affecting the plant species composition are frequent disturbance like trampling by cattle and humans badly effecting the slow-growing species, foraging by cattle affecting the herbaceous cover, timber harvest, and intentional introduction of non-native but economically important species. The most important factor that causes a drastic change in specie composition is an anthropogenic disturbance in the form of extinction due to competitive exclusion. Secondary forest develops as a result of anthropogenic activities, where there is no absolute dominant tree [16]. Naturally, vegetation remains clustered but the extent of clustering is also a measure of the stress level.

We are going to discuss the floral diversity of the mountainous region of Valsad district of south Gujarat, India. The northernmost tip of the Western Ghats lies in the east part of South Gujarat, including the districts of Dang and Valsad. Valsad district of south Gujarat has a rich flora as compared to the rest of Gujarat. The Western Ghats mountain range of India is 1600 km long running from south Gujarat to Kerala covering a wide range of latitude. The beta diversity of forests of Western Ghats is dependent upon several factors such as climatic gradient, topographic variation and species traits [5]. For sustainable management of the resources of the hilly tracks of Dharampur, we need to create a floristic database at the taluk level.

2. Material and Methods
2.1. Location Description
We have surveyed the area in the hilly ranges of Dharampur taluk in Valsad situated on 20.53^0 N latitude and 73.18^0 E longitude for every fifteen days throughout two years so that seasonal variation can be observed in this open forest hilly range. The average altitude of these ranges is 74 meters (242 feet). The ranges cover an area of 533.15km^{2}in the northern part of Western Ghats. These mountain ranges are faulted and eroded edge of the Deccan plateau. Basalt is the predominant rock found in these hills. Dharampur ranges have the highest rainfall in the state of Gujarat. Figure 1 shows the sampling sites of the Dharampur hills. The sampling sites – (1) Karanjveri, (2) Barumal, (3) Avdah, (4) Sindhumbar, (5) Luheri, (6) Tuterkhed, (7) Rajpuri, (8) Bildah, (9) Jamaliya, (10) Chonda, (11) Pipron, (12) Bhilpuri, (13) Bopi.

2.2. Sampling method
The area was divided into thirteen sampling sites. The number of random sampling spots for each site was five, making the total number of sixty-five random sampling spots. During fieldwork, small quadrants were laid for weed diversity and line transects were done for trees. Accordingly, a line transect of 30 m for the tree species was laid on all corners of a large plot. Small quadrants were laid on all four corners and the center of the plot was used for sampling shrub and herb. To collect information about shrub and herb in ground layer quadrates of 5 x 5 m and 1 x 1 m size were laid down respectively. Climbers attached to trees were also considered.

Observations were done regarding the habit, habitat, phenology, and circumference at breast height (CBH in case of trees). All scattered trees of more than fifteen centimeters were taken into consideration [12]. Vegetation was identified by Vegetation of Dangs district [7]; Flora of Gujarat state [13]; Floristic, phytosociology and ethnobotanical study of Umarpada forest in South Gujarat [15]; this also includes a sketch of the Flora of Gujarat [14]; and Flora of Saurashtra part I and II [1].

During the study special attention was paid on the presence or absence of ruderals, exotic and invasive species if any found. Plant collection was done according to the flowering season of the respective plants. Plants so collected were processed with mercury chloride and alcohol and herbarium were prepared of the same.

2.3. Statistics used

We used both qualitative and quantitative techniques to determine the beta diversity of the open forests of the Dharampur hills. We used the Jaccardian Index (JI) to estimate the homogeneity in the species composition between several plots and observed the temporal and spatial variation in vegetation. Jaccardian similarity index can be used to find the level of stress by finding out the level of homogeneity indicating the stressed condition. We also used quantitative techniques such as the Importance Value Index (IVI) used to determine the ecological status of vegetation. IVI is calculated by adding the relative frequency, relative density and relative dominance of trees of the area. For shrubs and herbs, we have used quantitative measures frequency, abundance and density and correlated these data with the environmental stress factors of the area. Density is used to monitor long time changes in vegetation under stress. Frequency is mostly used to compare plant communities at various sites and also to detect temporal changes in vegetation composition. In this way, the frequency can be used to assess vegetation trends. The abundance of plant species shows species distribution within the ecosystem.

Fig 1: The location of sampling sites – (1) Karanjveri, (2) Barumal, (3) Avdah, (4) Sindhumbar, (5) Luheri, (6) Tuterkhed, (7) Rajpuri, (8) Bildah, (9) Jamaliya, (10) Chonda, (11) Pipron, (12) Bhilpuri, (13) Bopi

3. Result and Discussion

We evaluated the vegetation composition of our study area along with the stress factors affecting it. Table 1 enlists the various anthropogenic stress factors observed during our field trips at various study sites. All the sites are stressed by irregular water availability and are subjected to the different levels of anthropogenic stress in the form of change of land use pattern. All these lead to habitat loss for the slow-growing, specialist plant species due to their need for very specific micro environmental habitat are getting replaced by invasive weedy species especially in areas where land use pattern is altered.

Table 1: Stress factors observed at various sites plants of Dharampur hills of Western Ghats

Stress	1	2	3	4	5	6	7	8	9	10	11	12	13
Deforestation for fuel and timber						√	√	√	√	√			√
Selective plantation		√	√	√	√						√	√	
Invasive plant	√			√		√			√			√	
Drying of the river by pumping out water			√	√			√						
Denudation		√				√	√	√	√	√	√		√
Soil erosion	√	√	√	√	√	√	√	√	√	√	√	√	√
Drought	√	√	√	√	√	√	√	√	√	√	√	√	√
Agriculture		√	√	√	√	√	√	√	√	√	√	√	√
Urbanization	√			√								√	
Road construction	√			√								√	

A total of 226 species of flowering plants belonging to 173 genera and 66 families were found in all the study sites. Dicot was represented by 185 species, 140 genus and 53 families of plants in the region surrounding the lake. A total of 37 species of monocot plants belonging to 23 genera and 11 families were found. Two species of ferns found. The dicot, monocot and fern percentage depicted in figure 2. Grasses and Cyprus formed the majority of the herbs. *Cyperus* though seasonal were found throughout the year in the riverine ecotone area.

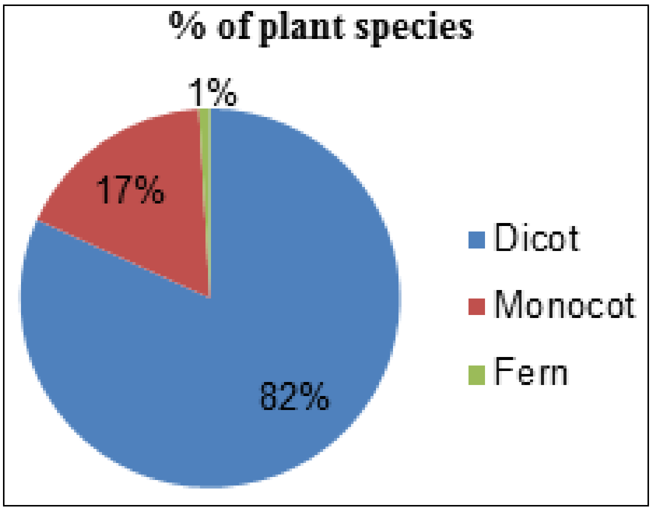

Fig 2: Characterization of plants of Dharampur hills of Western Ghats

When we consider the phytosociological and growth habit of plants of the hills of Dharampur, we find that both herbs, and trees both predominate the study region with 42 % and 41% followed by climbers, creeper and shrub at as is shown in figure 3. Herbaceous flora was dominantly from Poaceae, Fabaceae and Asteraceae. The dominance of herbal flora was mainly due to the climatic factor of high temperature and high humidity as is prevalent in all tropical regions. Most of the herbal flora in our study region was perennial grasses. Seasonal herbaceous weeds such as Cyperaceae, Fabaceae and Asteraceae family were abundant during the rainy season. Maximum trees in these open forests belonged to Fabaceae, Apocynaceae, Malvaceae, Moraceae, Combretaceae and Meliaceae. Fabaceae family has the tree, herbs, shrubs, climbers as well creepers and hence the largest dominant family in the areas. Most trees were deciduous and hardy species which is common in tropics. Among plantation trees Anacardiaceae, Lamiaceae and Sapotaceae are the most abundant families.

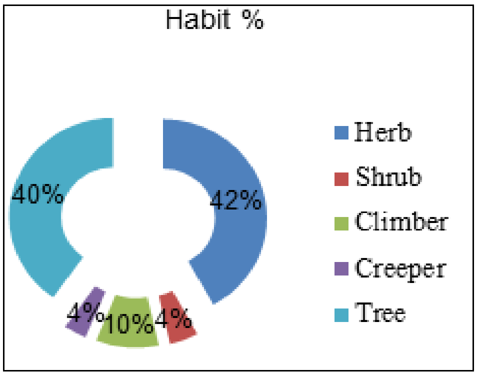

Fig 3: Phytosociological characterization of plants of Dharampur hills of Western Ghats

Fabaceae, Asteraceae, and Malvaceae were seasonal annuals. *Acacia nilotica*, *Acacia mearnsii*, *Leucaena leucocephala* and *Bambusa bamboos* were found in all the sites, found as trees and bushes. Except for the last one, all the other trees are introduced plants and have become invasive due to their ability to draw water from much deeper layers of soil than most of the plants native to India. This is due to their ability to form deeper roots than most of the native plants and ability to require less space to survive as compared to native, these exotics outcompete all other native plants and will reduce the plant diversity of the area concerned and lead to the establishment of invasive species only. The relative abundance of plant families in the area depicted in figure 4.

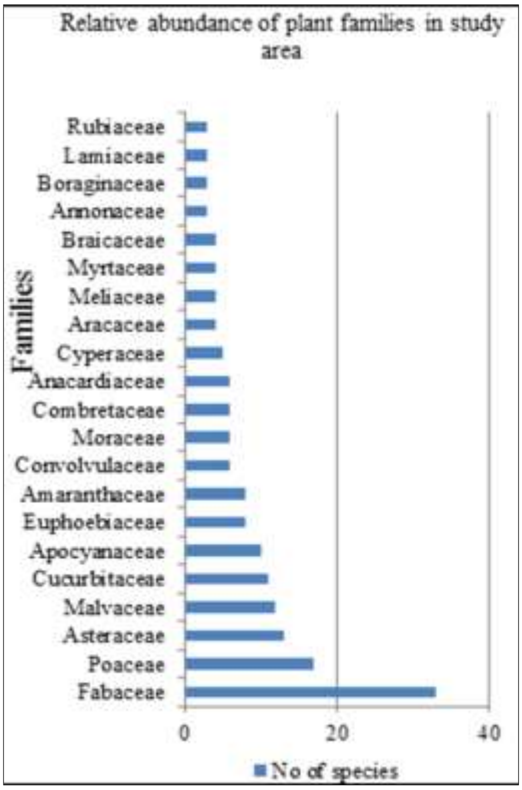

Fig 4: Relative Abundance of plant families of plants of Dharampur hills of Western Ghats

Ipomoea, *Cyperus*, *Alternanthera*, and *Euphorbia* was perennial herb observed in all the study sites followed by *Cassia* and *Corchorus* which are rainy season annuals, also found in all study sites seasonally. *Ludwigia repens* was recorded only from one study site of Maan River. *Vallisneria* species observed from a few sites. Various species of *Ipomoea* also found in the entire river banks also a common plant in tropical regions. *Colocasia esculenta* found seasonally in all the riverbanks and road sites are natural in humid ecotones of tropical areas. It is a native medicinal plant having ant diabetic properties in its leaves [10] and antimicrobial properties in its corm [8]. The relative numbers of species of a particular genus are shown in figure 5.

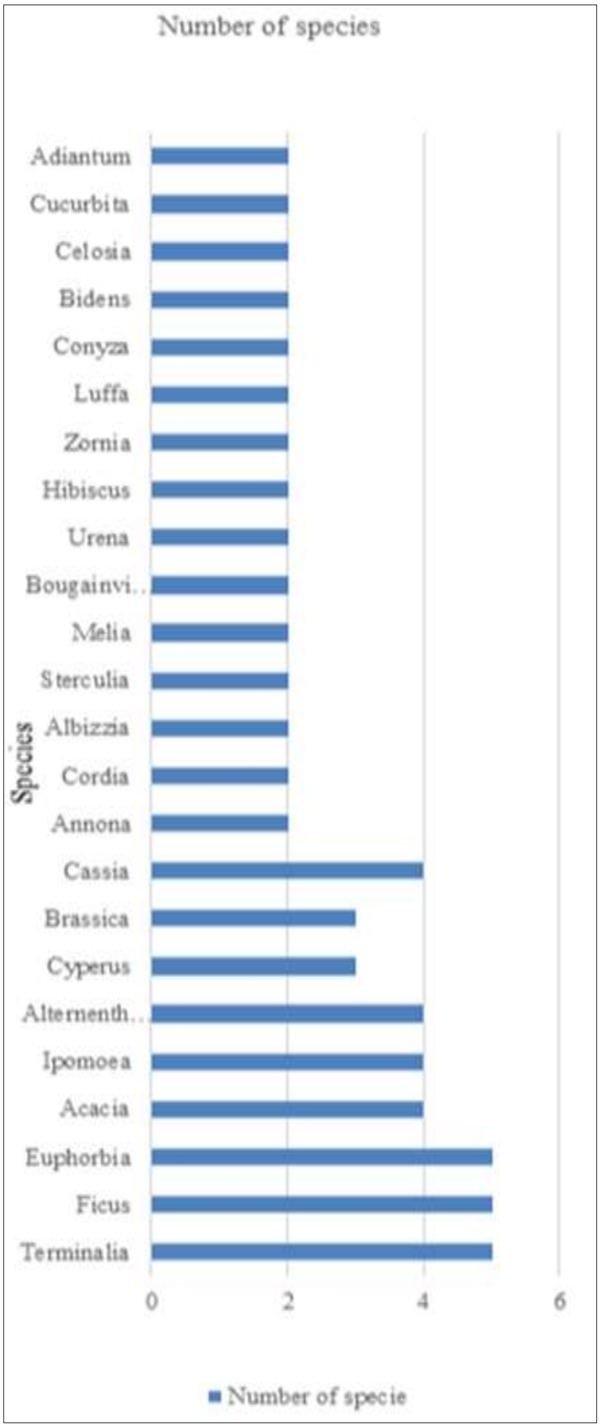

Fig 5: Relative number of species of genus plants of Dharampur hills of Western Ghats

The ecological dominance of trees was determined by the Important Value Index of various tree species of our study area is enlisted in Table 2. Highest frequencies of *Acacia mearnsii*, *Tectona grandis*, *Terminalia crenulata*, and *Carissa carandas* observed indicating mixed dry deciduous tropical climate. The high relative density of *Acacia mearnsii, Carissa carandas, Tectona grandis, and Anacardium occidentale* observed. High relative dominance of *Sterculia guttata*, *Terminalia catappa*, *Terminalia crenulata* which are endemic species indicates a tremendous potential to restore the open forests of Dharampur and convert it into a dense forest. Highest IVI observed for *Terminalia crenulata* followed by *Sterculia guttata*, *Acacia mearnsii*, *Tectona grandis*, *Carissa carandas* and *Anacardium occidentale.*

The ecological status of various weeds is determined by frequency, abundance, and density of the species. The various phytosociological attributes such as frequency, abundance and density of various weeds are depicted in Table 3. *Tephrosia purpurea* has the highest frequency followed by *Ammania baccifera*, *Alternanthera tenella*, *Bridella squamosa* and *Cassia tora*. *Ipomoea balsamina* has the highest abundance followed by *Canna indica, Colocasia esculenta*, *Euphorbia tithymaloides* and *Tarlmounia elliptica*. The maximum density of *Tephrosia purpurea* was found followed by *Abelmoschus moschatus, Ammania baccifera*, *Cassia tora* and *Euphorbia roylena.* Agricultural plants and grasses were excluded from quantitative analysis.

Table 2: Ecological dominance of trees based on Important Value Index of tree species of Dharampur Hills

Tree name	Relative Frequency	Relative Density	Relative Dominance	IVI
Acacia auriculiformis	1.40	2.37	1.17	4.94
Acacia mearnsii	5.59	8.29	0.15	14.03
Acacia nilotica	3.59	2.89	0.29	6.78
Ailanthus altissimia	0.20	0.39	0.15	0.75
Albizzia lebbeck	1.00	1.05	1.69	3.75
Albizzia saman	2.79	2.63	1.81	7.24
Alstonia scholaris	0.20	0.53	1.37	2.10
Anacardium occidentale	2.59	5.66	1.12	9.38
Annona reticulata	1.60	2.37	0.68	4.64
Annona squamosa	0.20	0.79	0.77	1.76
Anogeissus latifolius	1.60	1.32	0.62	3.53
Artocarpus heterophyllus	1.20	1.05	0.88	3.13
Azadirachta indica	1.20	0.79	1.54	3.53
Bambusa bamboos	3.19	3.16	0.05	6.40
Bauhinea purpurea	1.00	0.79	0.51	2.30
Bombax ceiba	1.00	0.66	0.31	1.96
Boswellia serrata	0.60	0.66	0.48	1.73
Butea monosperma	0.60	0.39	0.91	1.90
Cassia alata	0.20	0.13	0.11	0.44
Cassia simea	0.20	0.26	0.14	0.60
Callistemon	0.20	0.53	0.22	0.94
Calotropis gigantia	0.20	0.39	0.05	0.64
Capparis decidua	4.99	3.29	1.59	9.87
Crateva religiosa	0.20	0.13	1.39	1.72
Carica papaya	1.20	1.05	0.46	2.71
Carissa carandas	5.79	6.18	0.02	11.99
Casuarina equisetifolia	0.60	0.39	0.08	2.07
Caesalpinea pulcherima	0.20	0.79	0.54	1.53
Ceiba pentendra	1.40	1.32	1.40	4.11
Cocos nucifera	0.80	0.79	0.39	2.97
Cordia dichotoma	0.40	0.26	0.63	1.29
Cordia sebastianna	0.20	0.13	0.74	1.07
Dalbergia melanoxylon	2.59	1.71	0.05	4.35
Delonix regia	1.40	0.92	1.53	3.84
Derris heterophylla	0.60	0.39	1.25	2.24
Ensete superbum	1.40	0.92	1.28	3.60
Eucalyptus	1.80	1.58	1.34	4.72
Ficus arnoltiana	1.00	0.66	0.42	0.27
Ficus bengalensis	0.80	0.53	3.08	4.41
Ficus carica	0.20	0.13	0.79	1.12
Ficus racemosa	1.00	0.92	1.03	2.95
Ficus religiosa	2.00	1.71	1.16	4.86
Gliricidium sepium	1.60	1.18	0.60	3.38
Hyphane indicum	0.20	0.26	1.85	2.31
Lannea coromandelica	3.19	3.68	0.35	7.23
Leucaena leucocephala	2.59	1.71	3.08	7.39
Madhuca longifolia	1.00	0.79	3.25	5.04

Mangifera indica	2.20	1.58	3.50	7.27
Manilkara zapota	0.40	0.39	1.40	2.20
Melia azadiracht	0.60	0.53	1.56	2.68
Morinda citrifolia	1.00	0.79	0.85	2.63
Moringa olifera	1.00	0.79	0.83	2.62
Musa paradisica	0.40	0.66	1.54	2.60
Mitragyna parviflora	0.60	0.79	1.42	2.81
Neolamarkia cadamba	0.20	0.26	3.47	4.21
Oroxylum indicum	1.60	1.32	1.45	4.36
Peltophorum pterocarpum	0.40	0.53	2.26	3.19
Phoenix dactylifera	0.80	0.53	1.45	2.77
Phyllanthus embellicus	1.20	1.05	0.46	2.71
Pithecelobium dulce	0.80	0.66	0.96	2.41
Plumeria	0.20	0.13	0.14	0.47
Polyalthia longifolia	0.80	0.92	0.09	1.81
Psidium guajava	0.60	1.05	1.06	2.71
Roystonia regia	0.20	0.39	1.34	1.93
Saraca ashoka	0.20	0.13	0.45	0.78
Sterculia guttata	2.79	2.11	9.27	14.17
Syzigium cumini	0.60	0.53	1.40	2.53
Tabermontana	0.2	0.13	0.42	0.75
Tectona grandis	5.39	3.55	3.25	12.19
Terminalia arjuna	0.60	0.39	3.08	4.07
Terminalia catappa	1.00	0.66	4.53	6.19
Terminalia crenulata	5.39	5.39	4.39	15.17
Toona ciliata	0.4	0.26	3.11	3.77
Vitex negundo	2.40	5.26	0.29	7.95
Zanthoxylum armateum	0.20	0.13	0.32	0.65

Table 3: Phytosociological attributes of various weeds in Dharampur hills

Herbaceous Vegetation (Weeds)	Frequency	Abundance	Density
Abelmoschus moschatus	0.28	4.67	1.29
Abrus precatorius	0.03	3.00	0.09
Acalypha indica	0.06	2.25	0.14
Achyranthus aspera	0.15	3.70	0.57
Adiantum	0.06	6.00	0.37
Adhatoda vasica	0.03	2.50	0.08
Amaranthus spinosus	0.08	2.00	0.15
Agave mexicana	0.28	1.17	0.32
Ageratum conyzoides	0.12	5.63	0.69
Alternanthera tenella	0.34	1.00	0.34
Alysicarpus vaginalis	0.03	1.00	0.03
Ammania baccifera	0.35	3.48	1.23
Amaranthus spinosus	0.06	2.25	0.14
Argemone mexicana	0.05	3.67	0.17
Bidens alba	0.03	1.00	0.03
Bidens pilosa	0.05	1.00	0.05
Blumea lacera	0.09	9.50	0.88
Boerhavia	0.02	1.00	0.02
Bougainvillea	0.08	1.00	0.08
Brassica juncea	0.20	3.00	0.60
Bridella squamosa	0.34	0.95	0.32
Calotropis procera	0.26	1.65	0.43
Canna indica	0.02	11.0	0.17
Canscora diffusa	0.03	4.50	0.14
Cassia alata	0.06	2.00	0.12
Cassia tora	0.29	4.00	1.17
Cassia occidentalis	0.20	2.00	0.40
Catharanthus indicus	0.02	2.00	0.03
Cayratia trifolia	0.02	1.00	0.02
Celosia argentia	0.25	1.00	0.25
Celosia cristata	0.03	3.00	0.09
Cleome viscosa	0.08	5.00	0.38
Colocasia	0.28	8.22	2.28
Conyza bipinatifida	0.18	2.33	0.43
Corchorus aestuans	0.14	1.00	0.14
Croton	0.02	4.00	0.06

Cucumis anguria	0.02	1.00	0.02
Cuscuta reflexa	0.06	1.00	0.06
Emilia sonchifolia	0.03	3.50	0.11
Euphorbia prostate	0.31	2.90	0.89
Euphorbia roylena	0.22	5.29	1.14
Euphorbia tithymaloides	0.02	7.00	0.11
Hibiscus furcellatus	0.12	3.88	0.48
Hibiscus tiliaceaos	0.12	4.38	0.54
Hibiscus spinosa	0.02	7.00	0.11
Hyptis suaveolens	0.02	3.00	0.05
Impatiens balsamina	0.03	12.00	0.37
Ipomoea alba	0.03	6.50	0.20
Ipomoea carica	0.05	6.67	0.31
Ipomoea carnea	0.18	4.25	0.78
Lantana camera	0.08	1.00	0.08
Lindernea crustacean	0.29	1.00	0.29
Ludwigia repens	0.02	1.00	0.02
Luffa operculata	0.09	1.00	0.09
Malachra capitate	0.12	3.50	0.43
Mimosa pudica	0.02	1.00	0.02
Momordica charanthia	0.02	2.00	0.03
Operculina turpenthum	0.25	1.00	0.25
Opuntia	0.02	3.00	0.05
Pergularia daemia	0.05	1.00	0.05
Persicaria glabrus	0.05	2.67	0.12
Phyllanthus embellicus	0.06	6.75	0.42
Ricinus communis	0.03	5.50	0.17
Rungia pectinate	0.23	4.80	1.11
Sida rhomboidifolia	0.08	3.20	0.25
Solanum xanthocarpum	0.06	3.75	0.23
Sonchus asper	0.03	4.50	0.14
Sphaeranthus indicus	0.09	3.50	0.32
Tarlmounia elliptica	0.02	7.00	0.11
Tephrosia purpurea	0.38	4.84	1.86
Trianthema portulacastrum	0.05	2.67	0.12
Tricodesma amplexicaule	0.15	3.90	0.60
Tridex procumbens	0.09	1.00	0.09
Urena sinusa	0.22	2.79	0.60
Vallisneria repens	0.02	10.00	0.15
Woodfordia fructicosa	0.11	1.14	0.12
Wrightia tinctoria	0.06	1.75	0.11
Xanthium strumarium	0.09	1.17	0.11
Ziziphus strumarium	0.25	1.00	0.25
Zornia biphylla	0.11	2.14	0.23
Zornia gibbosa	0.09	2.17	0.20

Jaccardian index is shown in table 4 and table 5 to show the level of similarity between the vegetation compositions of the different study sites of Dharampur hills. Table 4 depicts the level of similarity in the weeds. Site 2 showed some similarities with sites 4, 5, 7, 9, 10, 11 and 12. Site 6 and 8 also showed similarities. Sites 1, 3 and 13 showed high heterogenicity with all other sites. Little similarity observed both spatially and temporally in the species diversity of the weeds in the study area indicating a low level of anthropogenic stress. Weeds though appear useless so far their economic value is concerned, has ethnobotanical importance. They also act as a source of nectar for butterflies thus has a very important ecological role. The observed heterogeneity in weed composition indicates that the geographic, climatic and anthropogenic conditions of the spots are capable of sustaining a diverse range of flora.

The tree similarity between various sites depicted in table 5. Site 2 has more similarity to Sites 5,9, 10 and 12. Site 1, 6 and Site 7 have similar tree species. Site 4 and 8 showed similarities in specie composition. Sites 3 and 13 were the most diverse and did not show many similarities with other sites. The number and type of trees showed immense variation in the different sites except those that are planted for horticultural purposes. It was observed that the number of woody trees in an area had a relation of whether they were in inaccessible steep slopes or gentle slope areas. In gentle slope areas mostly were used for horticultural and timber plantation purposes so have the same type of trees. In steep slope area, native and endemic species found. Diverse horticultural crops found in site 3 and 13 causing its lack of homogeneity.

Table 4: Jaccardian Index for weeds of study sites of Dharampur hills

Site	1	2	3	4	5	6	7	8	9	10	11	12	13
1		0.32	0.22	0.26	0.26	0.46	0.40	0.30	0.34	0.28	0.69	0.30	0.16
2	0.32		0.18	0.30	0.37	0.26	0.45	0.27	0.26	0.45	0.35	0.44	0.28
3	0.22	0.18		0.32	0.19	0.28	0.21	0.26	0.19	0.15	0.20	0.19	0.14
4	0.26	0.30	0.32		0.32	0.52	0.37	0.31	0.21	0.30	0.31	0.34	0.22
5	0.26	0.37	0.19	0.32		0.26	0.33	0.19	0.33	0.40	0.37	0.43	0.24
6	0.46	0.26	0.28	0.52	0.26		0.37	0.41	0.38	0.31	0.42	0.28	0.20
7	0.40	0.45	0.21	0.37	0.33	0.37		0.40	0.37	0.43	0.50	0.35	0.28
8	0.30	0.27	0.26	0.31	0.19	0.41	0.40		0.41	0.35	0.31	0.24	0.22
9	0.34	0.26	0.19	0.21	0.33	0.38	0.37	0.41		0.40	0.38	0.35	0.20
10	0.28	0.45	0.15	0.30	0.40	0.31	0.43	0.35	0.40		0.42	0.48	0.29
11	0.69	0.35	0.20	0.31	0.37	0.42	0.50	0.31	0.38	0.42		0.40	0.21
12	0.30	0.44	0.19	0.34	0.43	0.28	0.35	0.24	0.35	0.48	0.40		0.31
13	0.16	0.28	0.14	0.22	0.24	0.20	0.28	0.22	0.20	0.29	0.21	0.31	

Table 5: Jaccardian index for trees of the study sites of Dharampur hills

Site	1	2	3	4	5	6	7	8	9	10	11	12	13
1		0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.05	0.00	0.14
2	0.04		0.21	0.38	0.38	0.21	0.39	0.18	0.29	0.39	0.30	0.28	0.22
3	0.00	0.21		0.24	0.33	0.21	0.24	0.23	0.25	0.19	0.21	0.13	0.05
4	0.00	0.38	0.24		0.38	0.31	0.40	0.15	0.26	0.23	0.18	0.26	0.11
5	0.00	0.38	0.33	0.38		0.36	0.40	0.21	0.29	0.30	0.29	0.26	0.17
6	0.00	0.21	0.21	0.31	0.36		0.34	0.35	0.23	0.29	0.19	0.23	0.17
7	0.00	0.39	0.24	0.40	0.40	0.34		0.30	0.29	0.29	0.36	0.25	0.14
8	0.00	0.18	0.23	0.15	0.21	0.35	0.30		0.25	0.27	0.29	0.24	0.24
9	0.00	0.29	0.25	0.26	0.29	0.23	0.29	0.25		0.29	0.31	0.23	0.15
10	0.04	0.39	0.19	0.23	0.30	0.29	0.29	0.27	0.29		0.21	0.35	0.24
11	0.05	0.30	0.21	0.18	0.29	0.19	0.36	0.29	0.31	0.21		0.26	0.21
12	0.00	0.28	0.13	0.26	0.26	0.23	0.25	0.24	0.23	0.35	0.26		0.21
13	0.14	0.22	0.05	0.11	0.17	0.17	0.14	0.24	0.15	0.24	0.21	0.21	

As farmers tend to prefer economically beneficial crops and trees we find more variety of economically important vegetation along the road connected sites. Agricultural stripes used to grow rice in the rainy season and other vegetables during the winter month. During summer most lands were left to fallow except the land strip along the rivers. We can see less homogeneity in plant species composition amongst the study sites. Heterogenicity in tree and weed diversity is an indicator of low degradation of the ecosystem thus less disturbance. We observe that human has altered the tree species composition by introducing plantation of economically profitable plants such as horticultural crops.

The dominance of grasses also indicates high temperature and predominately arid climate as it's a subtropical area and also a human-induced alteration of plant composition. To maintain the ecological balance of hills and enhance the vegetation the native biodiversity should be conserved by reducing disturbance factors such as the introduction of agricultural and horticultural crops in forested areas, alteration of land use from forested to grassland, constriction in the form of roads and tourism resorts are to be reduced. Less abundance of riverine macrophytic growth in most parts of the rivers is due to the seasonal fluctuation in the water level of these rivers due to natural cause, enhanced by pumping of water from the river to water the agricultural and horticultural tracks along the river banks.

4. Conclusion

Highest IVI are seen of deciduous or drought-tolerant evergreen trees. The highest frequency of ephemeral or annual weeds observed. Exotic tree species found, indicating the risk of competitive exclusion of native species. If we consider planktonic forms of life throughout the study period no algal bloom or cyano bloom was found. We can infer that the phosphate and nitrate level of the river water was not so high as to cause eutrophication despite their location in agricultural areas. Thus we conclude seasonality and alteration of land use patterns are the main drivers of vegetation diversity of this region. There is a huge diversity of trees and weeds when we compare the study plots using the Jaccardian index, which is an indicator of a low level of anthropogenic interference. Little anthropogenic influence is in the form of deforestation and denudation of soil by multiple times harvesting the grasses should be stopped. A correlation between land use patterns and the status of the surrounding ecosystem was concluded. In order to preserve the biodiversity of these hilly ranges, we have accessed the floristic diversity of the area to create an inventory of the same.

5. References

1. Bole PV, Pathak JM. *Flora of Saurashtra*. Botanical Survey of India, Calcutta, India, 1988, 553.
2. Chust G, Chave J, Condit R, Aguilar S, Lao S, Pérez R. Determinants and spatial modeling of tree β-diversity in a tropical forest landscape in Panama. Journal of Vegetation Science. 2006; 17(1):83-92.
3. Ciccarelli D. Mediterranean coastal sand dune vegetation: influence of natural and anthropogenic factors. Environmental management. 2014; 54(2):194-204.
4. Das A, Desai J. Spatial Variance in Soil Parameters and their Evaluation using Multivariate Analysis Technique. International Journal of Science and Research. 2019; 8:1893-1898.
5. Davidar P, Rajagopal B, Mohandass D, Puyravaud JP, Condit R, Wright SJ, *et al*. The effect of climatic gradients, topographic variation and species traits on the beta diversity of rain forest trees. Global Ecology and Biogeography. 2007; 16(4):510-518.

6. Hubbell SP. The unified neutral theory of biodiversity and biogeography, Princeton University Press, New Jersy, USA, 2001, 32.
7. Jain SK. The vegetation of the Dangs district in Gujarat. Nelumbo. 1963; 5(3-4):351-361.
8. Krishnapriya TV, Suganthi A. Biochemical and phytochemical analysis of colocasia esculenta (L.) Schott tubers. International Journal of Research in Pharmacy and Pharmaceutical Sciences. 2017; 2(3)**:**21-25.
9. Lande R. Anthropogenic, ecological and genetic factors in extinction and conservation. Population Ecology. 1998; 40(3):259-269.
10. Nakade D, Mahesh S, Kiran N, Vinayak S. Phytochemical screening and antibacterial activity of western region wild leaf of Colocasia esculenta. Int. Res. J. Biol. Sci. 2013; 2:18-21.
11. Nekola JC, White PS. The distance decay of similarity in biogeography and ecology. Journal of biogeography. 1999; 26(4):867-878.
12. Parthasarathy N, Karthikeyan R. Plant biodiversity inventory and conservation of two tropical dry evergreen forests on the Coromandel coast, south India. Biodiversity & Conservation. 1997; 6(8):1063-1083.
13. Shah GL. Flora of Gujarat state. Sardar Patel University press, Vallabh Vidyanagar, India, 1978.
14. Shah GL, Yadav SS, Menon AR. Biological spectrum of the flora of Gujarat State. Nelumbo. 1981; 23(1-2):25-29.
15. Vashi BG. Floristic, phytosociology and Ethnobotanical study of Umarpada forest in South Gujarat. Ph.D. Thesis, Veer Narmad South Gujarat University, Surat, India, 1985.
16. Zhu J, Mao Z, Hu L, Zhang J. Plant diversity of secondary forests in response to anthropogenic disturbance levels in montane regions of northeastern China. Journal of Forest Research. 2007; 12(6):403-416.