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Impact of Weed Managements and Anthropogenic Stress on Quantitative Attributes of Plant Community Composition in Gopegarh Ecopark, Paschim Medinipur, West Bengal, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author SG designed the study and wrote the protocol. Authors SP and SR performed the identification of species and wrote the first draft of the manuscript. Authors RM and MK managed the analyses of the study. Author DK managed the literature searches and technical aspects. All authors read and approved the final manuscript.

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ABSTRACT

Eco-parks are generally set up worldwide for serving both recreational and conservation purposes of local biodiversity through limited maintenance. Gopegarh Eco Park was set by the Forest Department, Government of West Bengal in highlands bank of Kangsabati Kansai) river with a heritage 'Garh' area with remnants of Khan Raja's establishment in Midnapore, West Bengal. This park was a place to study for its rich resources of indigenous vegetation, insects and birds for students and researchers. Increased development for amusements including picnic shades and human accessibility, intense weeding and mud ovens are set up. This study to measure quantitative characteristics of plant communities by quardrat method in low, moderate and severely disturbed zones revealed gradual decrease in indigenous flora with time; specially, herbaceous vegetation. The vegetation is gradually turning towards a monodominant tree community of *Acacia auriculiformis*, in low and moderate disturbed sites and *Anacardium occidentale* in severely

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disturbed sites; both planted earlier. Species frequency, diversity and density are decreasing with stress. The frequent cutting and weeding is affecting intensely on the ecosystem; decreasing soil moisture, organic carbon and changes in pH. This practice may affect propagule formation, dispersal and establishment of herbs, shrub and tree species. The park may gradually lose the indigenous flora and the flora dependant fauna and its utility as *in situ* sustainable maintenance of biodiversity and a resource place for practical study by students and researchers.

Keywords: Anthropogenic stress; lateritic soill; monodominant trees; plant community; species diversity.

1. INTRODUCTION

Eco-parks all around the world have been set up for serving both purposes of recreational and sustainable maintenance of indigenous biodiversity. These parks provide facilities to enjoy nature as its own and help to grow the values and awareness among people to conserve nature. The concept of eco-park is usually adopted with the intention to conserve and sustain a large landscape with its own biodiversity and enhancing wildlife; along with a low cost managed park for nature lovers and common people.

But unfortunately in some cases to attract visitors and increase profit, different permanent or temporary set ups are developed unscientifically compromising with indigenous flora and other wild lives. Weed management also needs some scientific considerations, as in process, seasons and zones; to sustain the wildlife diversity and ecosystem balance and sound functioning of it [1]. These disturbances not only destroy the existing community of vegetation, affect food chains and food webs destroying the depended consumer fauna of insects, birds, small animals, their niches and distribution [2].

Weeding through total clearing, cutting, by controlled ground fire, application of herbicides; or particularly in dry seasons or onset of dry seasons, period of fruit setting or maturation, propagule dispersal affect severely [3]. These thorough cleaning not only affect upper-ground diversity but also to below ground perennial propagules, subsoil beneficial microflora [4] and symbiotic fungi [5]. These symbiotic or non-symbiotic beneficial rhizo-microflora play a vital role in nutrient cycling. Eradication of leaf litter and plant remaining also hampers the source of materials for decomposition and adding of nutrients to soil [6], turning soil infertile and erosion prone. Eradication of weeds throughout at a time may also affect the host plant dependent life cycles of butterflies and other insects [7]; break up of ecological food-webs may hamper birds and small animals also, ultimately the whole diversity. Anthropogenic disturbances are evident in such parks but exposure of maximum portion for access and amusement with or without set-up would affect the intention of the park. These parks not only act as *in-situ* conservation of rich endemic and indigenous wildlife also serves as a rich resource for education to students in local excursions for schools, colleges, University and research purposes.

Gopegarh Eco Park was set by the Forest Department, Government of West Bengal at the bank of Kansai river highlands in a heritage 'Garh' area with remnants of Khan Raja's establishment in Midnapore, West Bengal. This park covers rich biodiversity of plants, birds, insects, reptiles,mammels as per the board of the forest department. This park is a source for students and researchers for identification of plants and other wildlife for several decades and is a place where they obtains knowledge regarding those practices. In the last few years the parks have been more developed in its infrastructures and aesthetic views. But formation of picnic shades in vegetation rich pockets which need ovens and unscientific weeding have visibly reduced the frequency and intensity of indigenous plants as profusely before found and now found in adjacent areas in the river bank [8].

The study was conducted to measure the plant community quantitative attributes in two seasons of winter and late spring; in differently managed zones of least disturbed, moderately disturbed and severely disturbed. The least disturbed areas undergo manual weeding but least anthropogenic stress. Moderate disturbed zones with frequent weeding and human accessibility, severe disturbed areas with extensive weeding, burning and anthropogenic stress. All types of disturbances, weeding, burning and anthropogenic interference are taken into account. Soil conditions also studied and

diversity of different zones were compared. No such study was conducted in this park before. This study possibly could provide a clear picture of the impact of present management technique and action to be taken.

2 MATERIALS AND METHODS

Study area: The study site is located in Midnapore, Paschim Medinipur district of South West Bengal, within latitude 22.25° N and longitude 87.65° S Fig. (1). In this park dominant trees of natural dry deciduous forest in red lateritic soil are almost replaced by planted *Acacia auriculiformis, Eucalyptus* sp. and *Anacardium occidentale*. The area is beside the river Kansabati and the whole area is rich in indigenous herbaceous and shrub flora. This area shows four distinct seasons - winter, spring, summer and monsoon throughout the year. From the last ten years data of climate from Midnapore college Climate centre showed average rainfall is 1634.0 mm occurring mainly in monsoon of mid-June to August. The temperature ranges from 28˚C to 45˚C in the summer and 08˚C to 24˚C in the winter months. Soil is red lateritic rich in iron and aluminium content and poor in available nutrients.

Survey: A 10m X 10m quadrate was placed in six replicates at random in each of three differently managed zones of least disturbed L.d), moderately disturbed M.d) and severely disturbed S.d) in different locations of the forest, in two seasons of winter January) and Late spring April 1st week), 2019. All vegetation of trees, shrubs and undershrubs were taken in account. Soil sampling also was done from each quadrate up to 20 cm depth; for each zone, the soil samples were mixed and three composite samples were taken for testing. Soil testing was done for soil pH, moisture content [9], organic carbon content [10].

Plants in each quadrate were listed and identified, the number of individuals of each species was counted and girth at breast height GBH) at 1.3 m height from soil of trees and basal area of lower life forms were measured. Data we collected used to calculate the density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance, importance value index IVI) [11].

The Shannon-Weiner diversity Index, Species Richness Indices, Evenness Index, Dominance Index were calculated according to these following formulas:

1. Shannon – index diversity $(\overline{H}) = \sum\left(\frac{ni}{N}\right)\log\frac{ni}{N})$

$\begin{bmatrix} N = Total\ no.of\ individual\ in\ all\ quadrate. \\ ni = Total\ no.of\ a\ species\ in\ all\ quadrate. \end{bmatrix}$ [12]

2. Species richness measure =

R1 = $\frac{S}{\log N}$ [13]

R2 = $\frac{S}{\log A}$ [14]; R3 = $S/\sqrt{N}$ [15];

R = $\frac{S-1}{\log N}$ Margalaf index; [16]

$\begin{bmatrix} \mathrm{A} = \text{Area studied.} S = No.of\ species\ Total) \\ N = No.of\ individual\ of\ species\ Total) \end{bmatrix}$

3. Evenness index = $\frac{\overline{H}}{log\ S}$

4. Dominance index = $\sum\left(\frac{\mathrm{ni}}{\mathrm{N}}\right)^2$

$\begin{bmatrix} ni = No.of\ individuals\ of\ a\ species\ in\ all\ quadrates \\ N = No.of\ individuals\ of\ species\ in\ all\ quadrates \end{bmatrix}$

3. RESULTS AND DISCUSSION

During both season surveys we found weeding was done just before in all zones, ground burning in a few areas. In winter species diversity is comparatively higher than spring in all zones. In both seasons, species diversity was found maximum in the least disturbed L.d) zone, next in moderate disturbed M.d) and the lowest in severely disturbed S.d) zone. In L.d a total 17 species of 12 families, in M.d total 15 species belonging to 11 families and in S.d 11 species belonging to 8 families were observed total in two seasons. In winter a total 25 species, 24 genera belonging to 15 families; in spring, 17 species 16 genera and 13 families were observed. Ground flora of herbaceous plants were almost absent except in roadside places or near gardens dominated by Poaceae and Fabaceae. Mimosaceae is the dominant and frequent family, other frequent shrub families are Malvaceae, Verbenaceae; Asteraceae in only confined to severe disturbed zones.

In winter, in the least disturbed L.d) zone Table (1), most abundant plant found was *Triumfetta rhomboidea* followed by *Mimosa pudica*, least *Lantana camara*. In the moderate disturbed M.d) zone Table (2), most abundant was *Sida acuta*

followed by *Urena lobata, Mimosa pudica* is least found*; Triumfetta* was absent in this zone. In the severly disturbed S.d) zone Table (3), the most abundant species observed was *Eupatorium odoratum* followed by *Mimosa pudica* and *Sida acuta*. In this zone *T. rhomboidea, L. camara and U. lobata* all are absent. *Senna occidentales* was present in both M.d and S.d zones. Among trees, in both L.d and M.d zones *Acacia auriculiformis* and in S.d site *Anacardium occidentale* is most abundant, the former is both planted and naturally propagated another only planted.

Maximum density and relative density of species showed the same trends as the results for the abundance in L.d and M.d Table (1, 2). In L.d, the lowest number recored was *Mimusopos hexandra* and *Azadirachta indica;* in M.d of *Atlantia monophylla*. In S.d, *E. odoratum* showed maximum, then *S. acuta,* then *A. occidentale;* least by *Aegle marmelos* and *Swietenia mehogoni*, later planted.

The most frequent and relatively frequent species found in L.d were *Acacia auriculiformis, Litsea glutinosa, Sida acuta, Urena lobata;* while least found was *M. hexandra.* In M.d, the frequently found species were *A. auriculiformis, Litsea glutinosa, Sida acuta, U. lobata;* while the least frequent was *Atlantia monophylla, Acacia pennata, A. occidentale, M. pudica, Terminalia arjuna* not planted). In S.d zone, the maximum frequency and relative frequency were found for *A. occidentale, A. auriculiformis, E. odoratum*, *S. acuta* and *Elephantopus scaber*; and the lowest occurrence were recorded in *M. pudica, A. marmelos* and *S. mehogani.*

In late spring, in the least disturbed zone Table (4) heavy cutting activity was recorded. The most abundant species found were *A. auriculiformis,* followed by *Litsea glutinosa and Leea macrophylla;* while least found *Lantana camara.* In M.d zone Table (5), the most abundant species found were *S. acuta* followed by *U. lobata, M. pudica* and the least found were *Atlantia monophyla, A. occidentale and Terminalia arjuna.* The severe disturbed zones Table (6) was located near picnic spot, where a high abundance of *M. pudica*, planted *A. occidentale* and *S. occidentals* were found other five species of this zone showed same abundance. *Leea* is absent in moderate zone.
In the L.d zone, a high density and relative density showed similar trends as abundance; while the least noticed in *M. hexandra.* In M.d zone highest density and relative density were recorded by *S. acuta, U. lobata, A. auriculiformis, L. glutinosa, L.camara;* while the least abundant were *A. monophyla, A. occidentale* and *T. arjuna.* In the L.d zone, highest density was from *A. occidentale, M. pudica* and *S. occidentals* and the least abundance was recorded from *Aegle marmelos* and *Swietenia mehogoni*.

In spring, L.d site maximum frequency and relative frequency were noticed with *A. auriculiformis, L. glutinosa, L.camara, L. macrophylla, Streblus asper;* least was noticed in *A. occidentale, M. pudica, A. indica.* In M.d, maximum frequent was *A. auriculiformis, L. glutinosa, L. macrophylla, U. lobata, S. occidentales,* least frequent were *M. pudica* and*,T.arjuna.* In S.d zone, *A. auriculiformis and A. occidentale* showed maximum.

At least and moderate site *A. auriculiformis* is the dominant. *E.tereticornis* predominant in moderate, *T. rhomboidea* in winter, *Litsea glutinosa* in spring at least disturbed site. In severely disturbed site *A. occidentale* is dominant with subdominant *A. auriculiformis,* both planted. Importance value index IVI) showed a similar trend as dominance but *L. glutinosa* in L.d sites and *S. acuta* in M.d and S.d and *E. odoratum* in S. d sites also acquired the next position. *M. pudica* the only persisting non-tree species in both seasons though density of it and other common non-tree species decreased with stress, some though highly frequent in both sites, totally absent in S.d sites Figs. (2, 3, 4, 5).

All indices show differences among the zones among and during seasons and much within seasons Table (7). The highest Shannon's diversity index was repored in least disturbed zones during winter followed by spring. The Dominance index reached peak in severely disturbed site in spring, followed by in winter and moderately disturbed site in spring. The Evenness index was recorded with the highest reading in L.d site during spring and the lowest in M.d site during spring, otherwise not much differed. For species richness, R1 the highest reading was in moderate disturbed sites in both seasons, followed in L.d; R2 of severely disturbed sites were much lower than other sites in both seasons, difference in L.d in seasons also remarkable. R3 showed just opposite, as in S.d sites values are higher and least in L.d in winter. R_4 similar to R1 maximum values in moderate disturbed sites, least in severely disturbed. Biodiversity indices bring the diversity and abundance values of different habitats in the

same scale that is easy to compare and higher the value higher the species richness [17].

The natural vegetation of the surrounding area is characterized by dry deciduous mixed forest with several dominant and subdominant trees, small trees and climbers as *Diospyros* spp*, Madhuca longifolia*, *Terminalia* spp*. Strychnos nuxvomica, Hiptage benghalensis, Litsea glutinosa, Allangium salvifolium, Grewia asiatica, Bauhinia* spp. most of which were absent here. The indigenous herbaceous flora contains *Aristolochia indica, Canscora diffusa, Zornia diphyla, Meremia tridentata, Hemigraphis hirta, Coldenia procumbans, Desmodium* spp*., Alysicarpus* spp*. Barleria* spp*., Senecio* spp*, Sonchus* spp*, Justicia* spp*, Rungia* spp*, Leucus* spp*, Leonites, Lindernia* spp*, Mazus* spp*., Polygala* spp*. Striga, Sebastiana chaemaelia, Dioscorea* spp*.* [18] were abundant in the park in several years before [8], and found in regular student's excursions also but now almost absent or sparingly present in some pockets. Herbaceous vegetation now almost noted with grasses, like *Oplismenus burmannii, Digitaria spp, Eleusine indica, Cynodon dactylon, Dactyloctenium indicum and Desmodium triflorum and Alysicarpus vaginalis* in roadside and side of gardens.

The floristic composition is dominated by understory shrubs or under-shrubs, as small tree species and large shrubs are cut regularly hampering their growth. Within three months the cutting affected the community structure in next season that will surely affect the propagule dispersal. In natural forest, the vegetation maintains a structural and floristic diversity, stable over time with dynamic balance of introduction, mortality and growth [19]. Mature vegetation of different layers completely absent in any site here indicating severe stress in the ecosystem.

The community is turning towards the monodominant tree community of *A. auriculiformis* in L.d and M.d sites due to its high seed viability, establishment efficiency [16] and *A. occidentale* in S.d from some planted trees. The frequent cutting of other trees to bushes hampering their reproductive growth also facilitated its condition. Dominance index is noted increasing with stress. Monodominance is defined as when almost 60% of total trees belong to a single species or with >80% dominance [20,21]. Transformation of a mixed forest to an artificial monodominant introduced tree forest is not ecologically or aesthetically sound to fulfil the intention of the park. Variation of tree dominance, shifting of species composition, density due to habitat disturbance is a major issue [22]. Isolated parts from the original community often suffer from loss of diversity [23], but the small protected areas could be rich sources and storehousees of local biodiversity [24] if properly maintained.

As the soil is acid laterite, frequent loss of ground cover, particularly in drier months turned the soil more dry and nutrient poor reducing topsoil organic content and microbes responsible for nutrient cycling as depicted from organic carbon content (Table 4). The degree of stress is observed related to it. The degree of stress is also observed to enhance pH. Frequent and total clearing of surface vegetation leads the soil more erosion prone [25], with increasing pH and decreasing nutrient availability [26], as loss of vegetation cover affects litter decomposition and nutrient release [5]. This practice will ultimately affect natural distribution of herbaceous flora in the park. Expansion of biotic activity is often responsible for destruction of natural biodiversity resources and equilibrium between community and abiotic environment [27].

In S.d zone profuse *E. odoratum* was noticed in winter. This continuous practice of gap formation by cutting may change the ground or near ground vegetation with more common and invasive weeds [28] and exert pressure on native flora [29] particularly affects most the vulnerable local flora [30], which fail to establish [31]. Loss of indigenous flora also affects the dependent fauna because of habitat loss [6]. Land clearing may also affect on soil nutrient cycle by reducing beneficial soil microbes and symbiotic fungi [3,4] and leading to infertility. Reducing these stresses by stopping frequent burning and cutting, especially, in winter or summer months, let to grow indigenous shrubs, herbs and trees and conserve some sites as no entry for people may facilitate the re-enter of indigenous herbaceous flora along with fauna.

Table 1. Plant community structure in winter at Gopegarh eco park Forest in Least disturbed L.d) site

Name of the Species	Family	Abundance	Relative Density	Relative Frequency	Relative Dominance	IVI
Acacia auriculiformis	Mimosaceae	6.00	5.68	7.32	57.0280	70.0233
Eucalyptus tereticornis	Myrtaceae	3.00	1.89	4.88	5.7473	12.5181
Litsea glutinosa	Lauraceae	5.00	4.73	7.32	5.0514	17.1003
Clerodendrum infortunatum	Verbenaceae	6.33	5.99	7.32	0.1441	13.4548
Sida acuta	Malvaceae	9.33	8.83	7.32	0.2003	16.3501
Triumfetta rhomboidea	Malvaceae	50.00	31.55	4.88	24.9451	61.3689
Urena lobata	Malvaceae	10.00	9.46	7.32	0.0575	16.8383
Mimosa pudica	Mimosaceae	9.00	5.68	4.88	0.0727	10.6290
Aegle marmelos	Rutaceae	2.00	1.26	4.88	0.8445	6.9844
Azadirachta indica	Meliaceae	3.00	0.95	2.44	0.3592	3.7446
Elephantopus scaber	Asteraceae	7.00	6.62	7.32	0.0282	13.9698
Anacardium occidentale	Anacardiaceae	3.00	0.95	2.44	1.7386	5.1240
Eupatorium odoratum	Asteraceae	6.67	6.31	7.32	0.0144	13.6406
Leea asiatica	Vitaceae	5.00	4.73	7.32	0.2910	12.3399
Streblus asper	Moraceae	3.33	3.15	7.32	3.4520	13.9236
Mimusops hexandra	Sapotaceae	2.00	0.63	2.44	0.0185	3.0884
Lantana camara	Verbenaceae	1.67	1.58	7.32	0.0074	8.9017

Table 2. Plant community structure in winter at Gopegarh eco park Forest in moderate disturbed M.d) site

Name of the species	Family	Abundance	Relative density	Relative frequency	Relative dominance	IVI
Acacia auriculiformis	Mimosaceae	3.00	6.72	9.38	70.0312	86.1226
Eucalyptus tereticornis	Myrtaceae	2.00	2.99	6.25	13.8333	23.0684
Anacardium occidentale	Anacardiaceae	1.00	0.75	3.13	0.7003	4.5716
Sida acuta	Malvaceae	10.67	23.88	9.38	0.1992	33.4548
Lantana camara	Verbenaceae	4.33	9.70	9.38	0.0329	19.1094
Urena lobata	Malvaceae	9.33	20.90	9.38	0.2711	30.5417
Elephantopus scaber	Asteraceae	4.33	9.70	9.38	0.0329	19.1094
Acacia pennata	Mimosaceae	2.00	1.49	3.13	1.9453	6.5628
Senna occidentals	Caesalpiniaceae	2.67	5.97	9.38	0.1120	15.4572
Terminalia arjuna	Combretaceae	1.00	0.75	3.13	0.7003	4.5716
Mimosa pudica	Mimosaceae	6.00	4.48	3.13	0.0498	7.6524
Atlantia monophylla	Rutaceae	1.00	0.75	3.13	0.0778	3.9491
Litsea glutinosa	Lauraceae	2.67	5.97	9.38	11.2050	26.5501
Hemidesmus indicus	Asteraceae	1.50	2.24	6.25	0.0078	8.4966
Flacourtia indica	Salicaceae	2.50	3.73	6.25	0.8010	10.7823

Table 3. Plant community structure in winter at Gopegarh eco park Forest in severely disturbed S.d) site

Name of the species	Family	Abundance	Relative density	Relative frequency	Relative dominance	IVI
A.occidentale	Anacardiaceae	4.33	16.25	12.50	92.2284	120.978
A. auriculiformis	Mimosaceae	1.00	3.75	12.50	3.8587	20.1087
Azadirachta indica	Meliaceae	1.00	2.5	8.33	1.3812	12.2146
Eucalyptus tereticornis	Myrtaceae	1.00	2.5	8.33	1.8041	12.6374
Swietenia macrophylla	Meliaceae	1.00	1.25	4.17	0.1762	5.5928
Sida acuta	Malvaceae	4.67	17.5	12.50	0.1790	30.1790
Eupatorium odoratum	Asteraceae	8.33	31.25	12.50	0.1427	43.8927
Senna occidentalis	Casesalpinaceae	2.50	6.25	8.33	0.0440	14.6274
Mimosa pudica	Mimosaceae	7.00	8.75	4.17	0.0354	12.9520
Elephantopus scaber	Asteraceae	2.33	8.75	12.50	0.0138	21.2638
Aegle marmelos	Rutaceae	1.00	1.25	4.17	0.1364	5.5531

Table 4. Plant community structure in spring at Gopegarh Ecopark in least disturbed L.d) site

Name of the species	Family	Abundance	Relative density	Relative frequency	Relative dominance	IVI
Acacia auriculiformis	Mimosaceae	6.00	5.68	7.32	76.4342	89.4295
E. tereticornis	Myrtaceae	3.00	1.89	4.88	7.7031	14.4739
Litsea glutinosa	Moraceae	5.00	4.73	7.32	6.7703	18.8193
Mimosa pudica	Mimosaceae	9.00	5.68	4.88	0.0975	10.6538
Aegle marmelos	Rutaceae	2.00	1.26	4.88	1.1319	7.2718
Azadirachta indica	Meliaceae	3.00	0.95	2.44	0.4814	3.8668
A.occidentale	Anacardiaceae	3.00	0.95	2.44	2.3302	5.7156
Leea asiatica	Vitaceae	5.00	4.73	7.32	0.3900	12.4389
Streblus asper	Moraceae	3.33	3.15	7.32	4.6267	15.0983
Mimusops hexandra	Sapotaceae	2.00	0.63	2.44	0.0247	3.0947
Lantana camara	Verbenaceae	1.67	1.58	7.32	0.0099	8.9043

Table 5. Plant community structure in spring at Gopegarh ecopark Forest in moderate disturbed M.d) site

Name of the Species	Family	Abundance	Relative Density	Relative Frequency	Relative Dominance	IVI
A. auriculiformis	Mimosaceae	3.00	6.72	9.38	70.0312	86.1226
E. tereticornis	Myrtaceae	2.00	2.99	6.25	13.8333	23.0684
A. occidentale	Anacardiaceae	1.00	0.75	3.13	0.7003	4.5716
Sida acuta	Malvaceae	10.67	23.88	9.38	0.1992	33.4548
Lantana camara	Verbenaceae	4.33	9.70	9.38	0.0329	19.1094
Urena lobata	Malvaceae	9.33	20.90	9.38	0.2711	30.5417
Acacia pennata	Mimosaceae	2.00	1.49	3.13	1.9453	6.5628
Senna occidentales	Caesalpiniaceae	2.67	5.97	9.38	0.1120	15.4572
Terminalia arjuna	Combretaceae	1.00	0.75	3.13	0.7003	4.5716
Mimosa pudica	Mimosaceae	6.00	4.48	3.13	0.0498	7.6524
Atlantia monophylla	Rutaceae	1.00	0.75	3.13	0.0778	3.9491
Litsea glutinosa	Lauraceae	2.67	5.97	9.38	11.2050	26.5501

Table 6. Plant community structure in spring at Gopegarh eco park Forest in severely disturbed L.d) site

Name of the Species	Family	Abundance	Relative Density	Relative Frequency	Relative Dominance	IVI
A. occidentale	Anacardiaceae	4.33	16.25	12.50	92.5389	121.2889
Acacia auriculiformis	Mimosaceae	1.00	3.75	12.50	3.8717	20.1217
Azadirachta indica	Meliaceae	1.00	2.5	8.33	1.3859	12.2192
Eucalyptus tereticornis	Myrtaceae	1.00	2.5	8.33	1.8101	12.6435
Swietenia macrophylla	Meliaceae	1.00	1.25	4.17	0.1768	5.5934
Senna occidentalis	Caesalpiniaceae	2.50	6.25	8.33	0.0442	14.6275
Mimosa pudica	Mimosaceae	7.00	8.75	4.17	0.0355	12.9521
Aegle marmelos	Rutaceae	1.00	1.25	4.17	0.1369	5.5536

Table 7. Plant community structure and diversity indices among different sites in two seasons winter and spring) in Gopegarh Ecopark

Indices	Least disturbed L.d)		Moderate disturbed M.d)		Severely disturbed S.d)	
	Winter	Spring	Winter	Spring	Winter	Spring
Shannon's Index	1.027	0.940	0.983	0.868	0.860	0.751
Dominance Index	0.14114	0.13233	0.13633	0.17582	0.17688	0.22664
Evenness Index	0.835	0.903	0.836	0.804	0.826	0.832
Species Richness indices	R1 = 6.797	R1 = 5.51	R1 = 7.052 R2 =	R1 = 5.845	R1 = 5.78	R1 = 5.224
	R2 = 5.754	R2 = 3.723	5.077	R2 = 4.062	R2 = 3.723	R2 = 2.708
	R3 = 0.955	R3 = 1.101	R3 = 1.296	R3 = 1.129	R3 = 1.223	R3 = 1.372
	R4 = 6.397	R4 = 5.011	R4 = 6.582	R4 = 5.358	R4 = 5.255	R4 = 4.571

Table 8. Soil physicochemical characteristics of three different sites in Gopegarh Ecopark forest in winter and spring

Study zones	Winter			Spring		
	p^H	Moisture %	Organic carbon %	p^H	Moisture %	Organic carbon %
Least disturbed	6.28	10.2	0.228	6.30	8.62	0.208
Moderately disturbed	6.34	12.2	0.123	6.40	10.32	0.131
Severely disturbed	6.36	6.72	0.027	6.53	11.45	0.022

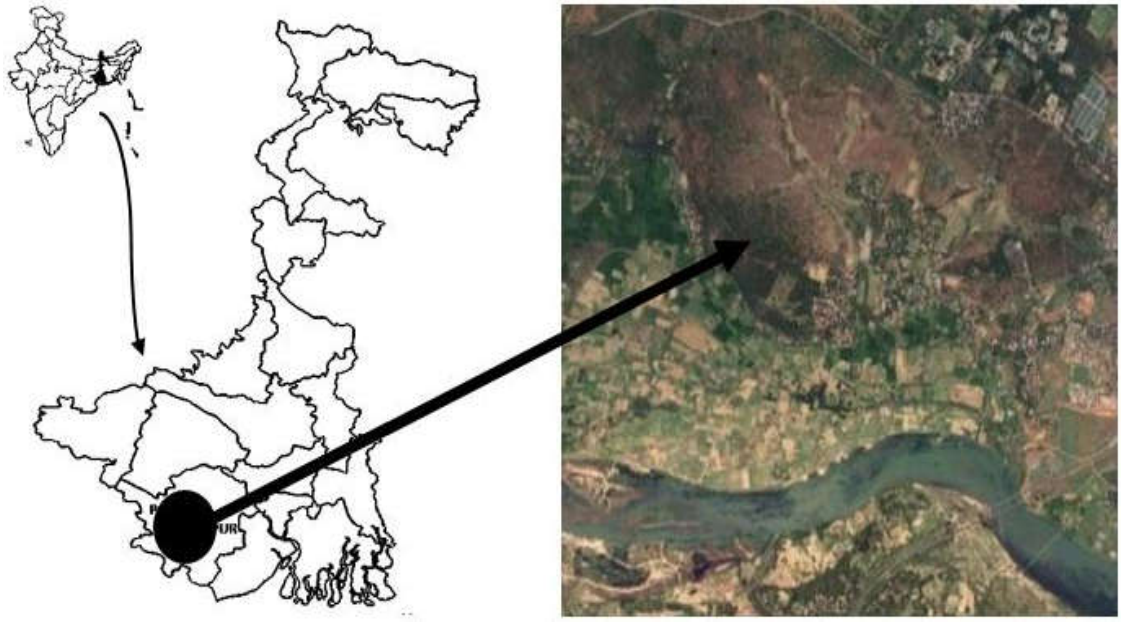

Fig. 1. The location of study area google map 2021)

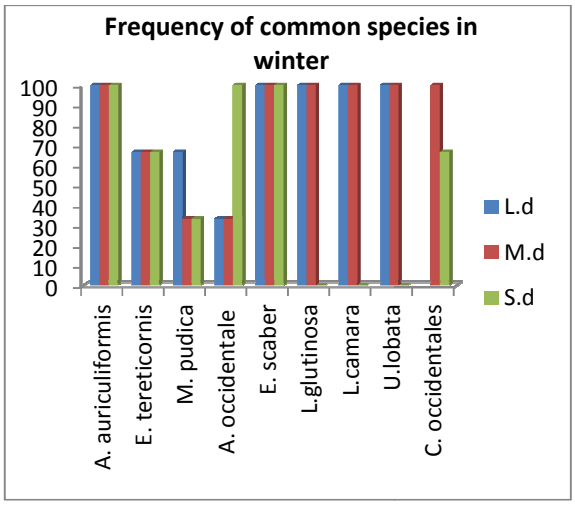

Fig. 2. Frequency of common plants in three sites in Winter

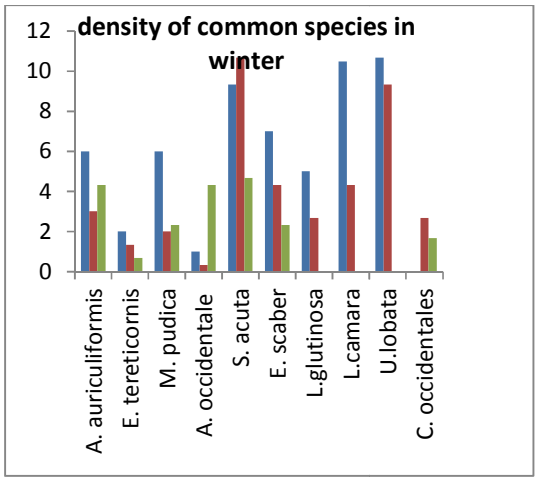

Fig. 3.Density of common plants in three sites in Winter

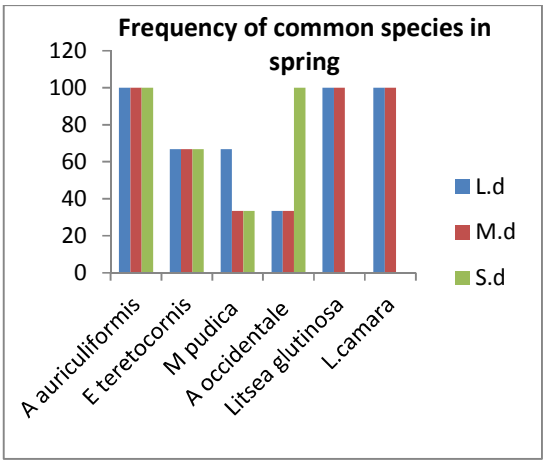

Fig. 4. Frequency of common plants in three sites in Spring

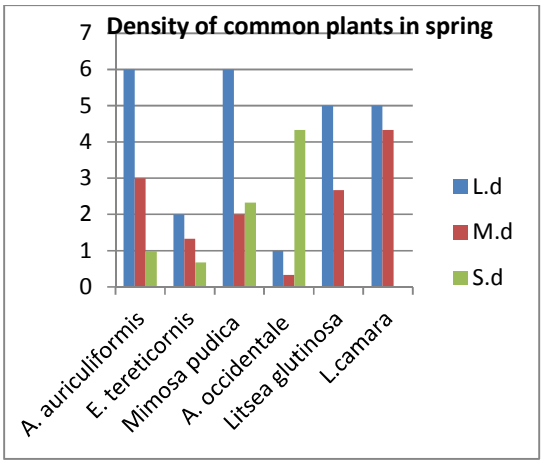

Fig. 5. Density of common plants in three sites spring

Fig. 6. Least disturbed spring vegetation with monodominance of *A. auriculiformis*

Fig. 7. moderately disturbed spring vegetation dominance of *A. auriculiformis*

Fig. 8. Highly disturbed zone in spring vegetation . Fig. 9. *Anacardium occidentale*

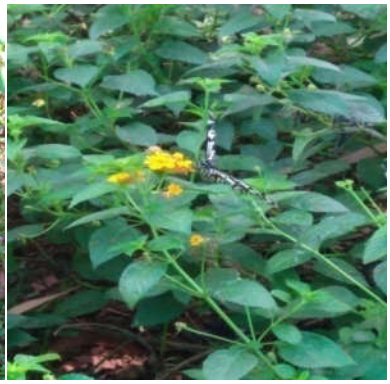

Fig. 10. *Triumfetta rhomboidea* and *Lantana camara* in winter

Fig. 11. *Mimusops hexandra* Fig. 12. *Litsea glutinosa*

Fig. 13. Field sampling in winter in gporegarh park.

Fig. 14. Least disturbed site in winter with *Sida acuta*, Triumfeta rhomboidea and *Urena loba* right)

4. CONCLUSION

The vegetation of eco-park is turning towards a monodominant tree community of planted trees, as other forest flora including annuals is regularly pruned. Species diversity, density and frequency are decreasing with stress intensity. The frequent cutting, weeding proceeding anthropogenic accessibility and interaction affecting intensely on the ecosystem, decreasing soil moisture, organic carbon, changes in pH etS., which depicts depleting of soil micro-flora. Poor soil nutrients and moisture affect ground herbaceous flora establishment. Frequent weeding by cutting, burning etc affects propagule formation, dispersal and establishment. The effect is detrimental to the whole ecosystem and wildlife. The park is gradually losing the indigenous flora and its utility as in situ conservation of biodiversity and a resource place for practical study by students.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Marshal EJP. Weeds and biotechnology. In Weed management handbook. 2007;75-92.
2. Blanco Y. The role of weeds as a component of biodiversity in

agroecosystems. Cultivos Tropicales. 2016;37(4):34-56.
3. Ehigiatero OA, Ayanta BD. Effects of land clearing techniques and tillage systems on runoff and soil erosion in a tropical rain forest in Nigeria. J.Env. Manage. 2011;92(11):2875-2880
4. Bhowmik A, Kukal SS, Saha D, Sharma H, Kalia A, Sharma S. Potential indicators of soil health degradation in different land use based ecosystems in the Shiwaliks of North West India.Sustainability. 2019;3908(11):1-17.
5. Sepp KS, Jarius T, Vasa M, Zobel, M, Opik M. Effects of l; and use onarbuscular mycorrhizal fungal communities in Estonia.Mycorrhiza. 2018;28(4):1-11.
6. Aponte C, Garcia LV, Marañõn T. Tree species effect on litter decomposed and nutrient release in medierranean Oak forest changes with time. Ecosystems. 2012;15(9).
7. Tam KC, Bonbrake T. Butterfly diversity, habitat and vegetation usage in Hong Kong urban parks. Urban ecosystems. 2020;19:2.
8. Samanta AK. Floristic diversity of Pathra and its adjoining areas, Paschim Medinipur district West Bengal. Int j. of basic and appl.SS. 2020;5:1-12.
9. Jackson ML. Soil chemical analyses. Prentice-Hall, New Delhi, India; 1973.
10. Walkley AJ, Black IA. Estimation of soil organic carbon by the chromic acid titration method. Soil Sciences. 1934;37:29-38.
11. Mishra R. Ecology workbook. Oxford publishing company, Kolkata; 1968.
12. Shannon CE, Weaver W. The mathematical theory of communication. Urbana University, Illinois Press; 1963.
13. Odum HT, Cantlon JE, Kornicker LS. An organizational hierchy postulate for the interpretation of Species- Individual distribution, species entropy, ecosystem evolution and the meaning of a species variety index. Ecology. 1960; 41(2) 395.
14. Gleason HA. On the relation between species and area. Ecology.1922;3(2):158-62
15. Menhinick EF. A comparison of some species individuals Diversity indices Applied to samples of field insects. Ecology.1964; 45(4): 859-861
16. Margalef R. Information theory in Ecology. General Systematics. 1958;3:36-71.
17. IIRS (Indian Institute of Remote Sensing). Biodiversity characterization at landscape level in North East India, using satelite remote sensing and GIS. Indian Institute of Remote Sensing.National Remote sensing Agency.) Dept. of space, Dehradun, Uttaranchal; 2002.
18. Prain D. Bengal plants. Vol I &II. Revised Edn, 1903), BSI, Calcutta; 1963.
19. Garbin ML, Carrijo TT, Sansever JBB, Sanchez Tapia A, Scarano FR. Subordinate nondominant, woody species promote the diversity of climbing plants. Perspective in plant Ecology, Evolution and Systematics.14:257-265
20. Hart TB. Seed, seeding and subcanopy survival in monodominant and mixed forest in Ituri Forest. African K J. of Tropical ecology. 1995;11:443-459.
21. Peh KSH, Lewis SL, Lloid J. Mechanism of monodomiance in diverse Tropical tree dominated systems. J of Ecol; 2011.
22. Mani S, Parthasarathy N. Tree population and above ground biomass changes in two disturbed tropical dry evergreen forests of peninsular India. Tropical Ecology. 2009;50:249-258.
23. Turner IM. Species loss in fragments of tropical rainforest. J. Appl. Ecol. 1996;33:200-219.
24. Turner IM, Corlett RT. Are fragments worth conserving? A reply. Trends in Ecol and Evolution. 1996;11:507-508.
25. Kaur Songho K, Jalota RK, Midmore DJ. Impact of tree clearing on soil pH and nutrient availability in grass species in central Queensland, Australia. Aust J. soil Res. 2005;43(1).
26. Maliyat SD, Dutt B. A contribution to the flora of Katarnia Ghats wildlife sanctuary, Baharaich district, Uttarradesh. J. of Econ, Taxonomy Bot. 2010;34:42-68.
27. Johnsone IM. Plant invasion windows; a time based classification of invasion potential. Biol. Rev. 1986;61:369-394.
28. Fisher J, Lindenmeyer DB, Manning AD. Biodiversity, ecosystem functioningand resilience in guilding principles for commodity production landscapes. Frontiers in Ecol. and Env. 2006;4:80-86.
29. Neldner VJ. Impacts of land use change on biodiversity in Australia.in: Land use in Australia- past ,present and future, 2018;115-125. DOI: 10. 22459/LUA.02.2018.0
30. Sharma GP, Rhaghubangshi AS. Tree population structure, regenerationand expected future composition at different levels of Lantana camara L. Invasion in the

Vindhyayan tropical dry deciduous forest in India. Lyonia. 2006;11: 25-37.

31. Barua IC, Deka J, Devi M. Invasive weeds and vegetation dynamics in Assam. The role of weed science in supply of food security of 2020. Proceedings of 24th Asian pacific weed science conference. Bandung, Indonesia. 2013;22-25.

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