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Comparative Vegetational Analysis and *Pinus roxburghii* Sarg regeneration in relation to their disturbances in some Chirpine forest of block Nowshera, district Rajouri, J and K, India

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Abstract

The present study aims to compare the vegetation of Chirpine forest and study the regeneration status of Chirpine in relation to their disturbances in block Nowshera, district Rajouri, J and K, India. Whole area was divided into five sites ((I=Chowki; II=Nowshera; III=Rajal Kote and Gharan Kaun; IV=Bhatta; V=Andhrooth)). The present study showed that, diversity index was invariably higher for trees followed by herbs, shrubs. 58 species were reported from the studied forest, out which 23 were trees, 13 were shrubs and 22 were herbs. Recruitment of shrubs and herbs in some sites showed the open type of canopy is highly disturbed site and investigated data also shows heavy deforestation and over grazing.

Key Words: Chirpine forest, regeneration status, disturbances, plant communities, species diversity.

Introduction

Biodiversity is the totality of genes, species and ecosystem in a region. Himalayan forest ecosystem has a major contribution to the mega-biodiversity of India. Therefore, the conservation and scientific management of this biodiversity for socioeconomic development, betterment of soil, live-stock and human assumes a great significance[1]. The lesser Himalayan region is colonized by subtropical broad leaved forest is dominated by Chirpine (*Pinus roxburghii*) and Oak (*Quercus*) species[2]. Various ecological aspects of biodiversity of this forest have been studied by various workers[3-9]. The vegetation of lesser Himalaya to alpine zone is led by vast exploitation of natural plant diversity or flora due to increasing anthropological pressures. Anthropogenic disturbances play an important role to change, loss recent phenomenon of climatic change, loss or maintenance of plant biodiversity and more recent phenomenon of climate change will also responsible for the change in species composition and other ecosystem activities[10]. Himalayan forest is considered to be globe's most depleted forest[11-13]. This has been attributed to the high population increase, associated with land use changes, socioeconomic transformation and unsustainable exploitation of natural forest resources[14-16].

Reduced regeneration of forest plant species mainly *Pinus roxburghii* in lesser Himalayan region due to extreme consumption of timer wood, fuel wood and other purposes by local residents. Lot of work have been done on regeneration of Chirpine, it still remain insufficient it can be reflected either on non regeneration or scarcity regeneration. A detailed quantitative vegetational analysis, species diversity, regeneration status brings out some tangible explanation on Chirpine regeneration under the prevailing disturbed condition. The present study aimed to compare vegetation of Chirpine forest of the study area and secondly relates Chirpine regeneration with disturbances.

Material and Methods

The study was carried out in subtropical Chirpine forest of block Noswera, district Rajouri, JandK Himalaya, India, which lies in between in latitude of 32^0-57/ to 33^0-17/N and longitude of 70^0-0/ to 74^0-33/ E and ranges from 470-1200m elevation above sea level. The block Nowshera lies in South-West of the district Rajouri and in Western circle of the Jammu division. It is bounded by block Rajouri in North, Kalakote and Sunderbani in East and Mirpur Pakistan in West and South. Most of the area is mountainous and rugged. Landscape consists of low lying undulating hills and valleys. Northwards topography become very steep and high is merging ultimately with Pir Panjal. Soil under forest is characterized by sandstone, shale, clay and calcareous sandstone in lower siwalik and massive, soft, coarse, sandstone with sub ordinate clay in upper siwalik. The annual rainfall ranges from 920-960mm. The minimum and maximum temperature throughout the year ranges from 9^0C to 32^0C.

Whole area is divided into five sites as per disturbances magnitude (I=Chowki; II=Nowshera; III=Rajal Kote and Gharan Kaun; IV=Bhatta; V=Andhrooth) shown in table-1. Phytosociological study was conducted during 2009-2010 using quadrats method. Plants were indentified with the help of plant taxonomist and the published regional forest flora of Jammu and Kashmir[17-18]. Tree layer was analysed by sampling of ten randomly placed quadrats of 10×10m size in each site. The size and number of samples was quantitatively analysed for abundance, density and frequency[19]. Importance Value Index

(IVI) for the tree layer was determined by sum of the relative frequency, relative density and relative dominance[20]. The distribution pattern of different species was studied by using ratio of abundance to frequency[21]. Tree species were considered to be individuals >30cm cbh (circumference at breast height) and sapling 10-30cm cbh and seedling <10cm cbh[22]. The shrubs layer and seedling were analyzed by sampling of quadrats of 5×5m and 1×1m randomly on each site. Thus relative value calculated and summed to get IVI. The regeneration status of trees in the all sites was studied by using the method[23] as good regeneration; if Seedling>Sapling>Adults; Fair regeneration, if Seedling > or ≤ Sapling ≤ Adults; poor regeneration only by Sapling stage but no Seedling. If species is present in adult stage it is considered as no regeneration. Species diversity was calculating by using Shannon Wiener Information Index[24] as: $H=\sum (ni/n) \log2 (ni/n)$ Where, **ni** is the IVI of the species and **n** the total IVI of all the species. The floral diversity and concentration of dominance was calculated by Simpson's Index (25) as: $Cd=\sum (ni/n)^2$. Where, **ni** is the IVI of the species and **n** the total IVI of all the species.

Results and Discussion

A total of 58 plant species were reported from the study area out of which 23 were trees, 13 were shrubs and 22 were herbs. IVI value for trees, shrubs and herbs were shown in table- 2, 3 and 4. Whole tables were observed that total tree species was dominant in site II followed by I=III>V>IV, while the shrubs species were higher in order of importance in site III followed by I>II>IV>V and in herb species was recorded for site II followed by IV>V>I=III. In tree species more diversity in terms of IVI was shown by *Pinus roxburghii* in site I, III, IV and V and *Acacia modesta* in site II. In case of shrubs *Carissa spinarum* shows more diversity in site I,II,II and IV while *Woodfordia fruticosa* in site V and in herbs *Cynodon dactylon* in site IandIV *Chrysopogon fulvus* in site II, II and V.

Higher diversity of shrubs like *Carissa spinarum* and *Cynodon dactylon* in site I and IV and recruitment of other herbs and shrubs species in the area showed open type of forest and is highly disturbed forest. Occurrence of *Pinus roxburghii* in adult stage in all the sites is shown by the old Chirpine type of forest but there was also noticed that markedly reduction in the number of seedling and sapling from the study area is directly affect the regeneration status of *Pinus roxburghii* due increasing anthropological activities in the forest area.

Value for species diversity and concentration of dominance are tabulated in table-5 and shown in figure-2. More species diversity was found in site II followed by I>III>V>IV and for shrubs more species diversity was shown in site V followed by IV>II>I>III and in herbs II>I>V>IV>II.

Mallotus philippensis showed good regeneration in almost all the studied sites, while *Acacia modesta* showed good regeneration in site III rest of the all showed fair as well as poor regeneration. *Pinus roxburghii* shown by the poor regeneration in all sites while rest of the all tree species showed very poor or no regeneration shown in table-2 and figure-1 (a,b,c,d and e).

Discussion

The dominant species of the study area was Chirpine (*Pinus roxburghii*), besides Chirpine, there are several others sub-tropical dry deciduous plant species. The present study indicate that plant diversity assessment by quantitative analysis of forest vegetation in different sites of the study area including disturbance effects which do not provide ecosystem recovery and widen the forest gap and fragmentation of the land in the region.

Chirpine forest showed greater variation in shrubs and herbs species richness. The species richness decreases due to increasing the biotic pressure and opening the tree canopy which arrest the regeneration some tree species. The opening of canopy covers increase of shrubs and herbs in highly disturbed forest. High species richness and diversity in the *Pinus roxburghii* -mixed broad leaved forest[26]. *Pinus roxburghii* - mixed broad leaved forest had the highest richness[27].

The present study reveals the alarmingly high rate of disturbances. It showed the site III and IV showed poor regeneration and recruitment of shrubs and herbs community form the open type canopy which form the highly disturbed forest. So as concern with regeneration status, it was good in site II followed by V>I>III>IV.

The overall observation showed that, *Mallotus philippensis* had good regeneration in all sites and *Pinus roxburghii* showed very poor regeneration in all sites due to the anthropological disturbances (such as fuel wood consumption, timber and also forest fire etc.), shown in figure-1 a,b,c,d,e and table-2.

Site IIIandIV shown more disturbed area due to colonization of villages near forest area and entrances of Gujjar and Bakarwal tribes in the study area. Day by day their activities are increasing in the forest area which leads to great forest destruction. They also employ forest fire which leads to great loss of seedling and sapling and also affect the regeneration of plants, mainly Chirpine. So the condition of Chirpine is very critical in the study sites. There was also noticed the recruitment of thorn species like *Euphorbia royleana, Carissa, Colebrookia* form the open thorn type of forest is the sign of high disturbance. It is also a type of thorn forest which ascended upon subtropical forest[28]. This area needs to protection by the forest department as well as district administration. Similarly populations of the *Pinus roxburghii* was decreasing and change into open degraded forest. Deforestation, over grazing was the major disturbing vegetational component suggested it to be Chirpine forest. *Carissa, Adhotoda* increasing continuous, deforestation and overgrazing[29].

Conclusion

We may conclude that in the study area seedling and sapling of Chir Pine forest decreasing rapidly and forest is under risk, will leads to greatest loss of forest biodiversity due to increasing anthropological activities inside the forest for obtaining better grazing opportunities, timber, fuel, fodder, medicine forest fire etc. So the Govt. as well as Forest Department should take active steps for the rejuvenation of forest and it will be vanished in future if not maintained properly.

Acknowledgement

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Table-1
Showing the selected site of the study area

Site	Site Name	Altitude	Longitude	Lattitude
I	Chowki	500-700m asl	$33^0$10.028/	$74^0$10.189/
II	Nowshera	500-600m asl	$33^0$10.068/	$74^0$16.230/
III	Rajal Kote and Gharan Kaun	500-800m asl	$33^0$10.227/	$74^0$18.466/
IV	Bhatta	700-900m asl	$33^0$12.058/	$74^0$14.363/
V	Andhrooth	800-1200m asl	$33^0$14.119/	$74^0$10.554/

Table-2
Showing the Species Diversity and Regeneration Status in terms of IVI of Tree of all sites

Name of Species	I			II			III			IV			V		
	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²	IVI/ 100m²
	Tree	Sapling	Seedling	Tree	Sapling	Seedling	Tree	Sapling	Seedling	Tree	Sapling	Seedling	Tree	Sapling	Seedling
Acacia modesta		75.14	30.03	103.80	136.06	119.32	28.1	41.35	79	-	-	-	-	-	-
Acacia catechu	-	-	-	8.98	19.46	-	-	-	-	-	-	-	-	-	-
Albizia lebbbeck	-	-	-	10.00	23.87	-	-	-	-	-	-	-	-	-	-
Bombax ceiba	10.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cassia fistula	-	-	-	7.42	-	-	36.8	27.36	19	-	-	-	-	-	-
Celtis eriocarpa	-	-	-	8.72	13.47	43.85	-	-	-	-	-	-	-	-	-
Dalbergia sissoo	46.03	23.63	39.02	4.93	-	-	41.7	22.47	7	14.06	-	-	-	-	-
Euphorbia royleana	-	-	-	11.38	21.72	-	-	-	-	-	-	-	-	-	-
Ficus palmata	14.51	25.41	-	-	-	-	-	-	-	-	-	-	8.31	10.37	-
Ficus roxburghii	8.10	12.40	-	-	-	-	15.6	-	-	-	-	-	-	-	-
Grewia optiva	-	-	-	21.54	6.35	-	-	-	-	-	-	-	-	-	-

Name of Species	I			II			III			IV			V		
	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2	IVI/ 100m^2
	Tree	Sapling	Seedling	Tree	Sapling	Seedling	Tree	Sapling	Seedling	Tree	Sapling	Seedling	Tree	Sapling	Seedling
Lannea coromandelica	8.10	-	-	24.48	23.03	30.84	15.6	16.51	-	-	-	-	-	-	-
Mallotus philippensis	27.12	61.82	88.36	30.29	31.27	105.94	34.7	116.7	119	29.43	57.24	250.18	27.40	62.81	38.90
Mangifera indica	10.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Morus alba	8.10	11.51	33.47	4.05	17.18	-	-	-	-	-	-	-	-	-	-
Olea cuspidata	26.16	43.31	-	-	-	-	9.72	-	-	17.52	-	-	-	-	-
Phyllanthus emblica	-	-	-	4.05	-	-	40.7	52.15	45	-	-	-	25.97	33.55	52.13
Pinus roxburghii	57.03	21.85	28.17	42.93	-	-	56.9	-	17	207.01	242.74	49.80	211.03	181.79	89.58
Pyrus pashia	8.10	12.40	80.95	-	-	-	6.47	11.9	14	-	-	-	8.68	-	78.95
Rhus parviflora	-	-	-	12.71	7.46	-	6.6	11.52	-	-	-	-	-	-	-
Terminalia bellerica	-	-	-	-	-	-	-	-	-	14.32	-	-	9.25	11.43	40.37
Terminalia chebula	-	-	-	-	-	-	-	-	-	-	-	-	9.25	-	-
Toona ciliata	46.85	12.40	-	4.51	-	-	6.92	-	-	17.57	-	-	-	-	-

Where, IVI=Impotance Value Index

Table – 3
Showing the Species Diversity in terms of IVI of Shrubs of all sites

Name of Species	I	II	III	IV	V
	IVI/100m^2	**IVI/100m^2**	**IVI/100m^2**	**IVI/100m^2**	**IVI/100m^2**
Shrubs					
Carissa spinarum	117.17	97.07	95.98	132.24	62.16
Colebrookia oppositifolia	-	-	12.15	-	-
Calotropis procera	6.00	-	-	-	-
Dodonaea viscosa	48.17	19.09	34.18	24.36	78.89
Ipomoea carnea	15.74	-	15.33	24.77	-
Justicia adhatota	32.92	77.76	59.66	-	-
Myrsine africana	9.70	-	6.13	-	16.69
Nerium indicum	-	14.48	-	-	-
Punica granatum	28.84	44.40	10.3	23.69	-
Vitex negundo	41.38	22.68	-	77.65	-
Woodfordia fruticosa	-	-	52.76	-	117.96
Ziziphus mauritiana	-	24.42	-	17.22	24.31
Acacia oburnea	-	-	13.34	-	-

Where, IVI=Impotance Value Index

Table – 4
Showing the Species Diversity in terms of IVI of Herbs of all sites

Name of Species	I	II	III	IV	V
	IVI/100m^2	**IVI/100m^2**	**IVI/100m^2**	**IVI/100m^2**	**IVI/100m^2**
Herbs					
Achyranthes aspera	29.46	5.69	12.8	-	-
Amaranthus viridis	-	-	-	8.84	-
Andropogon fascicularis	17.33	-	61.12	-	-
Chrysopogon fulvus	12.26	139.57	39.55	42.78	86.72
Cynodon dactylon	87.97	14.72	37.85	103.51	58.6
Cyperus niveus	-	-	-	-	9.35
Fragaria indica	-	-	-	4.98	-
Imperata arundinacea	-	-	-	8.83	23.07
Malvastrum coromandelianum	16.16	25.79	34.71	12.17	9.01
Micromeria biflora	-	16.02	-	-	-
Oenothera rosea	-	-	-	-	8.32
Oxalis corniculata	17.28	23.00	26.66	24.08	17.59
Parthenium hysterophorus	82.9	25.75	37.42	39.92	10.76
Paspalidium flavidum	-	5.11	-	-	-
Rumex dentatus	-	10.43	-	-	-
Setaria virdis	-	-	-	12.86	64.45
Sida acuta	-	-	-	6.66	-
Sida cordata	-	3.70	-	17.78	-
Silybum marianum	-	-	-	17.58	12.13
Stellaria media	-	15.51	-	-	-
Taraxacum officinale	11.71	10.99	15.43	-	-
Vervascum thapsus	-	3.49	-	-	-

Where, IVI=Impotance Value Index

Table – 5
Showing the Species Diversity(S D) and Concentration of Dominance (C d) for Tree, Shrubs and Herbs of all sites

		I	**II**	**III**	**IV**	**V**
Tree	S D	15.95	20.81	14.34	6.28	8.37
	C d	1.00	0.17	0.11	0.50	0.51
Shrubs	S D	8.51	6.63	10.08	5.46	4.02
	C d	0.22	0.21	0.19	0.28	0.28
Herbs	S D	9.82	17.67	8.96	14.99	11.69
	C d	0.20	0.25	0.13	0.18	0.18

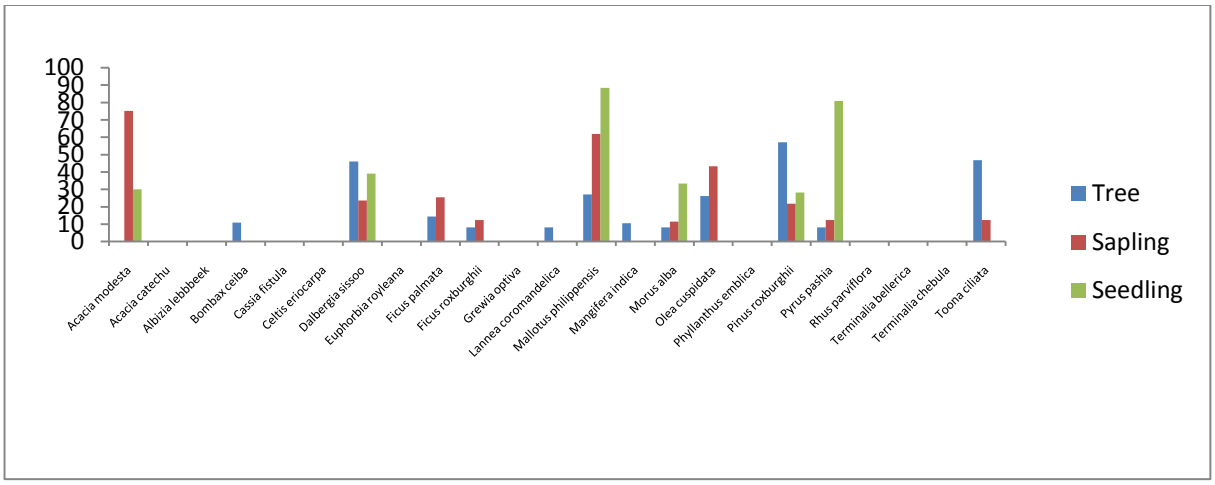

Figure – 1(a)
Showing the Diversity and Regeneration Status of site I in terms of IVI and Species

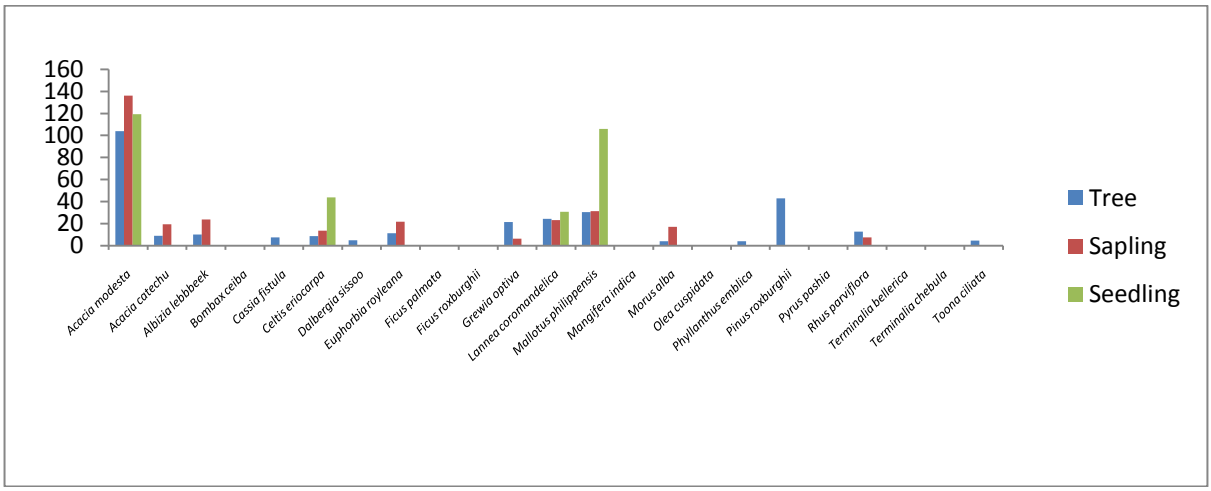

Figure – 1(b)
Showing the Diversity and Regeneration Status of site II in terms of IVI and Species

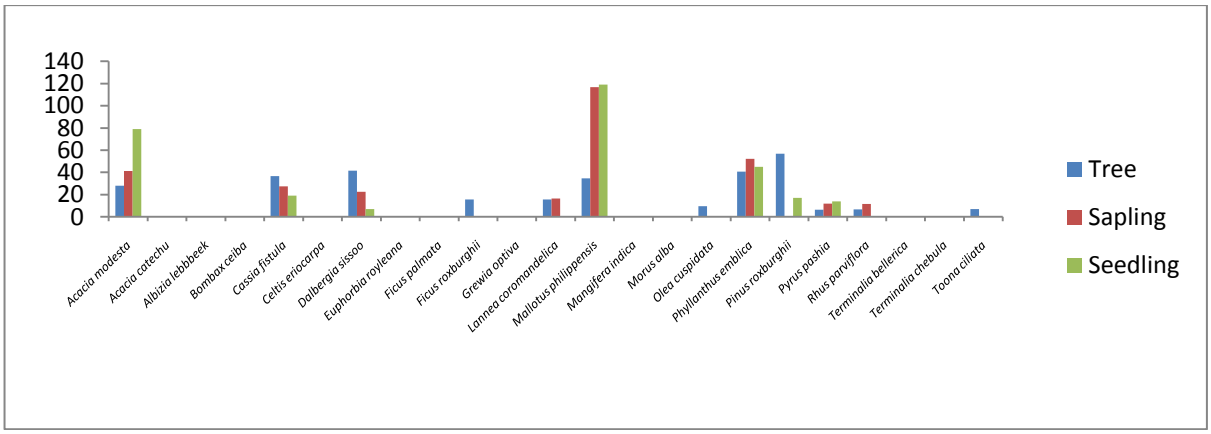

Figure - 1(c)
Showing the Diversity and Regeneration Status of site III in terms of IVI and Species

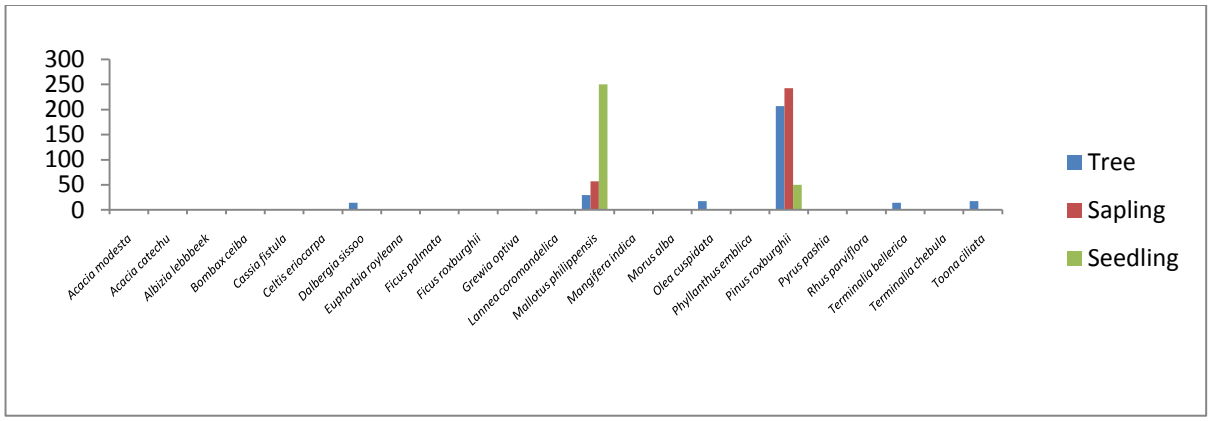

Figure – 1(d)
Showing the Diversity and Regeneration Status of site IV in terms of IVI and Species

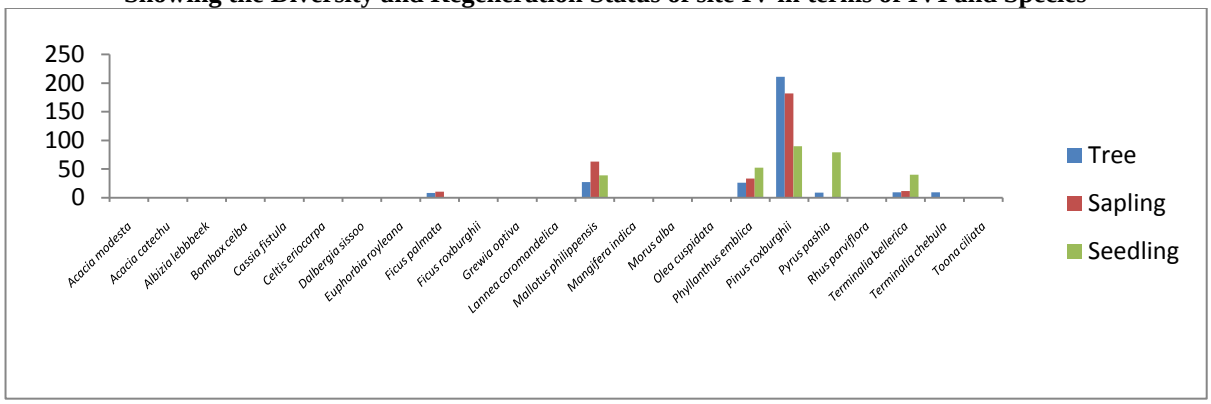

Figure - 1(e)
Showing the Diversity and Regeneration Status of site V in terms of IVI and Species

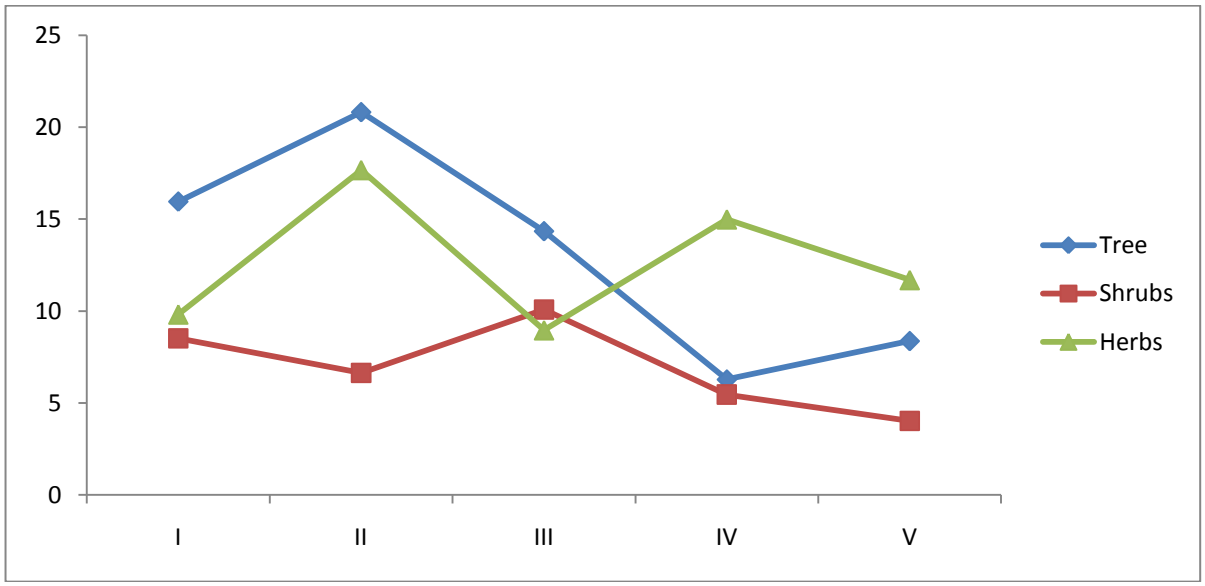

Figure – 2
Showing the Species Diversity (Shannon Wiener Information Index) of Tree, Shrubs and Herbs on one side and all sites on another side