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Article *in* Advances in Bioresearch · January 2018

DOI: 10.15515/abr.0976-4585.9.1.915

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Advances in Bioresearch
Adv. Biores., Vol 9 (1) January 2018: 09-15

Print ISSN 0976-4585; Online ISSN 2277-1573
Journal's URL:http://www.soeagra.com/abr.html
CODEN: ABRDC3
DOI: 10.15515/abr.0976-4585.9.1.915

Advances in Bioresearch

ORIGINAL ARTICLE

Floristic Composition and Diversity of homegardens in Angara Block, Ranchi, Jharkhand

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ABSTRACT
The study focused on the composition and diversity of plant species in homegarden of four selected villages of Angara block of Ranchi, Jharkhand. A total of 101 plant species (21 tree, 10shrubs, 13 sapling, 11 seedling and 46 herbs) belonging to 43 families were recorded. In the tree layer Verbenaceae, Rhamnaceae Anacardiaceae and Leguminosae in sapling layer Rhamnaceae, Verbenaceae and Anacardiaceae, in seedling layer, Rhamnacea,Verbenaceae and Moraceaein shrubs layer Caricaceae,Moringaceae and Verbenaceae were most dominant family. However, in herbs layer Poaceae, Brassicaceae, Solanaceae Cucurbitaceae and Malvaceae were most dominant family.Density of tree, sapling, seedling, shrubs and herbs were 840, 170,140,1160 and 102320 stems ha^{-1} respectively. The basal cover of tree, sapling, seedling, shrubs and herbs were39.26, 0.62, 0.62, 11.07 and 45.09 respectively. Diversity indices of different villages of study area the Shannon index of tree, sapling, seedling, shrubs and herbs were 3.46, 2.77, 2.50, 2.27 and3.67, respectively. Similarly, Simpson's index of tree layer were 0.12 , sapling layer 0.17,sapling layer 0.18 , shrubs layer 0.25 and herb layer 0.11 and Species richness of the tree, sapling, seedling, shrub and herb were 2.22, 1.36,1.01, 0.72 and 1.91, respectively. Equitability were 1.24of tree layer, 1.33 of sapling layer, 1.40 of seedling layer, 1.27 of shrub layer, 1.17 of herb layer. Beta diversity lies between1.31 to 2.63S of the tree, sapling, seedling, shrub and herb layer. The practice of indigenous agroforestry homegarden is an integral component in Jharkhand and play crucial role in supplying vegetables, fruits, fuel wood, small timber, herbs and spices etc for their daily requirement. These homegardens serves as an important source of food and that also maintains productivity, protect natural resources, minimize environmental impacts and provide economic and social needs.
***Keywords**: Homegarden, diversity, household, Jharkhand.*

Received 24.07.2017 Revised 10.08.2017 Accepted 22.12.2017

How to cite this article:
Shailesh Kumar Sinku, P.R. Oroan, and Abhay Kumar. Floristic Composition and Diversity of homegardens in Angara Block, Ranchi, Jharkhand. Adv. Biores., Vol 9 [1] January 2018.09-15.

INTRODUCTION

The species composition, plant diversity and management level vary considerably depending on the soil, climate, market, cultural opportunity and cultural background of the people. Homegardens of individual holdings generally cover small areas of land and are established around homesteads. Homegardens are unique agroforestry systems. The intensive land-use systems *i.e*. homegardens involving the deliberate management of multipurpose trees and shrubs (the woody component) grown in intimate association with herbaceous species (mainly annual, perennial, and seasonal agricultural crops), and livestock, are all managed within the compounds of individual homes. They are widespread throughout the tropics and are of immense importance in the socioeconomic structure of the rural communities [7, 14]. They provide both economic and social benefits that are essential to the nutritional welfare and security of the household. The basic function of homegardens is subsistence production, particularly in rural areas [5]. Because of the high plant species diversity existing in homegardens, a wide spectrum of multiple-use products can be generated with relatively low labour, cash, or other external inputs [1, 13]. Jharkhand as the name indicates the land of forest cover. The state of Jharkhand is bountiful creation in the lap of nature. The native population of Jharkhand were aware of the importance of trees to their lives from the ancient period, thus homestead farming or home gardening is a historical tradition that has evolved in many tropical countries over a long period of time. It is generally understood to be a system for the

production of subsistence crops for the cultivator and his/her family. Numerous terms are used to denote these practices: mixed garden horticulture, home gardening, Javanese home gardening, compound farming, mixed or house gardening, kitchen gardening, household gardening, and homestead agroforestry. In Jharkhand, homegardens serve diverse functions that range from satisfying household needs through biodiversity conservation to landscape stability. Nevertheless, these and other traditional farming systems were once targets of conversion because they were unjustifiably being judged as primitive and less productive [15]. The residual effect of such mal conceptions partly accounts for the apparent lack of attention to the system on the part of modern agriculture. Since then, the role of human-managed ecosystems in conservation is being recognized; and the deeply rooted notion that biodiversity conservation is possible only within agricultural landscape (Harvey *et al.,* 2008). Therefore, the approach of conserving biodiversity while sustaining agricultural productivity, indigenous cultures, and rural livelihoods is increasingly being advocated.In India, though several studies been conducted for plant diversity on natural forest but no work has yet been done on species composition and vegetation cover of in the homegarden system. There is an evident gap of biodiversity value in homegardens system in terms of its species composition and diversity. There is an urgent need of such type of study that may be helpful in developing appropriate strategy for effective management of these valuable biological resources. Therefore, the present study is conducted to composition and inventorying the plant diversity of traditional agro forestry systems in Jharkhand. Keeping all these facts in view, the present studies is being proposed with the objectives of identify the species composition of homegardens and find out the species diversity and richness of homegardens.

MATERIALS AND METHODS

A study was conducted in the homegardens of 120 randomly selected sample household in four selected villages of Angara Block of Ranchi District from February to July, 2015. The randomly selected villages are Singari, Gutidih, Janum and Rangamati Villages of Sursu, Tati, Angara and Nawagarh Panchayat respectively. A total of 120 household selected from 4 Panchayats of 30 households have homegardens from each village.All species present in each sampled homegardens were identified by the local or botanical name that was confirmed by using the regional and local flora of Bihar and Jharkhand and Flora of British India. The phytosociological analyses have been carried out by laying randomly placed quadrates in each homegarden of 5m x 5m size. In each quadrate, GBH (girth at breast height) of individual (≥ 30 cm girth) trees have been measured. In centre of each 5m x 5m quadrate, a 2m x 2m area was marked for enumeration of saplings (individuals >10cm-≤30 cm girth) and seedlings (individuals < 10 cm girth). Stem girth of adult and sapling have been measured at 1.37m from the ground and for seedling at 10 cm from the ground. Shrubs have been measured in 2m x 2m sub quadrate at base. The herbaceous vegetation have been measured within 1m x 1m quadrate.

Quantitative analysis

The important quantitative analysis such as density, frequency and abundance of tree species, shrubs and herbs species were determined as per Curtis and McIntosh [2].

Frequency

$$\text{Frequency}(\%) = \frac{\text{Number of quadrats in which the species occurred}}{\text{Total number of quadrats studied}} \text{X}100$$

Density

$$\text{Density} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats studied}}$$

Abundance

$$\text{Abundance} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats in which the species occurred}}$$

Relative frequency

$$\text{Relative frequency} = \frac{\text{Number of occurrence of the species}}{\text{Number of occurrence of all the species}} \text{X}100$$

Relative Density

$$\text{Relative density} = \frac{\text{Number of individual of the species}}{\text{Number of individual of all the species}} X100$$

Relative Dominance

$$\text{Relative dominance} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all the species}} X100$$

Importance Value Index

IVI=Relative Frequency+ Relative Density+ Relative Dominance

Species diversity

Species diversity indices have been determined using basal cover values. Shannon –Wiener information function (Shannon and Weaver, 1949) was used for the species diversity.

$H' = -pi \log_2 pi$

Where, pi is the proportion of total stand basal area represented by the i^{th} species.

The working formula given by Smith [12] will be used here

$H' = 3.3219[\log_{10}N - (\Sigma Ni \log_{10} Ni / N)]$

Where, Ni is the total basal cover of species i and N is the total basal cover of all the species. The factor 3.3219 is used to convert the index value to $\log_2$.

Concentration of dominance

Concentration of dominance have been measured by Simpson's Index [9]

$Cd = \Sigma (Ni / N)^2$

Where, Ni and N are same as explained above and it varies between 0-1.

Equitability

Equitability (e) will be calculated as suggested by Pielou [11]

$e = H' / \ln S.$

Where, H' =Shannon index and

S =the number of species.

Species richness

Species richness have been calculated following Marglef, [6].

$d = S-1 / \ln N.$

Where, S =Total number of species,

N =Basal area of all species (m^2 ha^{-1})

RESULTS AND DISCUSSION

The tree layer, total of 16 tree species belonging to 11 families *i.e*. Leguminosae, Rhamanaceae, Verbenaceae, Myrtaceae,Cornaceae, Moraceae, Bombacaceae, Sapotaceae, Anacardiaceae, Meliaceae and Combretaceae were encountered. Overall, the family Leguminosae had the highest number of species followed by Verbenaceae and Myrtaceae. Total density and basal area of tree species was found 840 (stems ha^{-1}) and 39.26 (m^2ha^{-1}), respectively. The maximum frequency occurred in *Ziziphus mauritiana* (33.33%) followed by *Gmelinaar borea* (30.00%) and minimum frequency was found in *Alangium lamarckii, Derris indica, Maduca longifolia, Melia azedarach, Tamarindus indica and Terminalia arjuna* (3.33%) whereas, in case of density similar trends was found *i.e.* the maximum density was in *Ziziphus mauritiana* (190stem ha^{-1}*)* followed by *Gmelina arborea* (160 stem ha^{-})and minimum in *Madhuca longifolia, Tamarindus indica* and*Terminalia arjuna*(10 stem ha^{-1}*).* The highest basal area was recorded in *Gmelinaar borea* (9.01 m^2 ha^{-1}) followed by *Artocarpus heterophyllus* (5.73 m^2 ha^{-1})and lowest in *Terminalia arjuna* (0.52 m^2 ha^{-1}). The importance value of tree species ranges from 58.97 to 4.41. The highest importance value index was recorded in *Gmelinaar borea* (58.97) followed by *Ziziphus mauritiana* (53.25) and the lowest in *Terminalia arjuna* (4.41), which are given in Tables-1.

The Sapling layer, total of 8 species belonging to the family of Rhamanaceae (5 species) and Verbenaceae (3 spp.) were encountered, which are showed in Table-2.The total density and basal area of sapling species was recorded 170 (stems ha^{-1}) and 0.62 (m^2ha^{-1}), respectively. The maximum frequency found in *Ziziphus mauritiana* (20.00%) followed by *Gmelinaar borea*(6.67%) and rest all the species found minimum i.e. 3.33%. whereas, the maximum density was found in *Ziziphus mauritiana* (50stems ha^{-1}) followed by *Gmelinaar borea* (30 stems ha^{-1})and minimum was found in *Alangiumla marckii, Artocarpus heterophyllus* and *Melia azedarach* (10stems ha^{-1}).Basal area was maximum in *Ziziphus mauritiana* (0.21 m^2 ha^{-1}) followed by *Gmelinaar borea*(0.10 m^2ha^{-1})and minimumin *Artocarpus heterophyllus* and *Bauhinia variegata*(0.02 m^2ha^{-1}). The IVI value of sapling species varied between 105.33 and 16.31. The

maximum was showed in *Ziziphus mauritiana* (105.33) followed by *Gmelinaar borea*(48.35) and the minimum was in *Artocarpus heterophyllus* (16.31).

The Seedling layer,total of 6 families were recorded(Table-3). The total density and basal area was found 140 (stems ha^{-1}) and 0.62 (m^2 ha^{-1}), respectively. The highest frequency occurred in *Artocarpus heterophyllus, Derris indica, Gmelinaar borea* and *Ziziphus mauritiana*(6.67%) and minimum was found in *Alangium lamarckii* and *Bauhinia purpurea* (3.33%) whereas, in case of density, the highest density was recorded in *Derris indica, Gmelinaar borea* and *Ziziphus mauritiana* (30stems ha^{-1}) followed by *Alangium lamarckii* and *Artocarpus heterophyllus*(20stems ha^{-1}) and minimum was in *Bauhinia purpurea*(10stems ha^{-1}).The highest basal area was recorded in *Ziziphus mauritiana*(0.21 m^2 ha^{-1})followed by *Gmelinaar borea* (0.10 m^2 ha^{-1})and lowest was in *Bauhinia purpurea* and *Derris indica*(0.02 m^2 ha^{-1}). The importance value of seedling species ranges from 70.31 to 25.35. The maximum importance value index was showed in *Ziziphus mauritiana*(70.31) followed by *Gmelinaar borea* (60.27) and the minimum IVI was in *Bauhinia purpurea*(25.35). The Shurbslayer, total of 6 families were recorded. The total density and basal area was found 1060 (stems ha^{-1}) and 11.07 (m^2 ha^{-1}), respectively. The maximum frequency occurred in *Carica papaya*(20.00%) followed by *Moringa oleifera* (13.33%) and minimum was found in *Dendrocala musstrictus* (3.33%) whereas, in case of density, the maximum was found in *Musa paradisiacal* (410 stems ha^{-1}) followed by *Lantana camara*(260 stems ha^{-1})and minimum was found *Vitex negundo* (70stems ha^{-1}*).*

Table 1: Species structure of tree layer of Angara Block

No.	Botanical Name	Common Name	Family	F	D	BA	RD	RF	RBA	IVI
1	*Alangium lamarckii* Thw.	Dela	Cornaceae	3.33	20	0.53	2.38	1.89	1.34	5.61
2	*Artocarpus heterophyllus* Lamk.	Kathal	Moraceae	10.00	50	5.73	5.95	5.66	14.59	26.20
3	*Bauhinia variegata*Linn.	Kachnar	Leguminosae	20.00	80	3.56	3.57	5.66	3.42	12.65
4	*Bauhinia purpurea*Linn.	Koinar	Leguminosae	10.00	30	1.34	9.52	11.32	9.06	29.90
5	*Bombax ceiba*Linn.	Semal	Bombacaceae	10.00	30	2.55	3.57	5.66	6.49	15.72
6	*Derris indica*(Lam.) Bennet.	Karanj	Leguminosae	3.33	20	1.38	2.38	1.89	3.51	7.77
7	*Gmelinaar borea*Linn.	Gamhar	Verbenaceae	30.00	160	9.01	19.05	16.98	22.94	58.97
8	*Maduca longifolia*(J.Konig) J.F.Macbr.	Mahua	Sapotaceae	3.33	10	0.93	1.19	1.89	2.36	5.44
9	*Mangifera indica*Linn.	Mango	Anacardiaceae	13.33	60	2.46	7.14	7.55	6.27	20.96
10	*Meliaazedarach*Linn.	Bakain	Meliaceae	3.33	40	1.16	4.76	1.89	2.94	9.59
11	*Psidium guajava*Linn.	Amrud	Myrtaceae	13.33	60	0.89	7.14	7.55	2.27	16.96
12	*Syzygium cumini*(Linn.) Skeels.	Jamun	Myrtaceae	6.67	20	0.54	2.38	3.77	1.36	7.52
13	*Tamarindus indica*Linn.	Imli	Leguminosae	3.33	10	3.12	1.19	1.89	7.94	11.02
14	*Tectona grandis*linn.f.	Teak	Verbenaceae	10.00	50	0.95	5.95	5.66	2.41	14.03
15	*Terminalia arjuna*Bedd.	Arjun	Combretaceae	3.33	10	0.52	1.19	1.89	1.33	4.41
16	*Ziziphusmauritiana*Lamk.	Ber	Rhamnaceae	33.33	190	4.62	22.62	18.87	11.76	53.25
	Total				840	39.26	100	100	100	300

Where, F=Frequency (%), D=Density (stems ha^{-1}), BA=Basal Area (m^2 ha^{-1}), RF=Relative Frequency, RD=Relative Density, RBA=Relative Basal Area and IVI=Importance Value Index.

Table 2: Species structure of Sapling layer of Angara Block

No.	Botanical Name	Common Name	Family	F	D	BA	RD	RF	RBA	IVI
1	*Alangiumlamarckii*Thw.	Dela	Cornaceae	3.33	10	0.06	5.88	7.14	10.05	23.07
2	*Artocarpusheterophyllus* Lamk.	Kathal	Moraceae	3.33	10	0.02	5.88	7.14	3.28	16.31
3	*Bauhinia variegata*Linn.	Kachnar	Leguminosae	3.33	20	0.02	11.76	7.14	13.56	32.47
4	*Bauhinia purpurea*Linn.	Koinar	Leguminosae	3.33	20	0.08	11.76	7.14	2.56	21.47
5	*Gmelinaarborea*Linn.	Gamhar	Verbenaceae	6.67	30	0.10	17.65	14.29	16.42	48.35
6	*Meliaazedarach*Linn.	Bakain	Meliaceae	3.33	10	0.05	5.88	7.14	8.66	21.69
7	*Psidiumguajava*Linn.	Amrud	Myrtaceae	3.33	20	0.08	11.76	7.14	12.41	31.31
8	*Ziziphusmauritiana*Lamk.	Ber	Rhamnaceae	20.00	50	0.21	29.41	42.86	33.06	105.33
	Total				170	0.62	100	100	100	300

In case of basal area, the maximum found in *Musa paradisiacal* (5.85 m^2 ha^{-1})followed by *Carica papaya* (2.75 m^2 ha^{-1})and minimum in *Vitex negundo*(0.06 m^2 ha^{-1}).The importance value of shrub species ranges from 107.35 to 17.46. The importance value index of shrub species was showed maximum in *Musa paradisiacal* (107.35) followed by *Carica papaya* (69.65) and minimum IVI was in *Dendrocala musstrictus* (17.46) which are showed in Table-4.Similar to our findings, Kabir & Webb [4].

The Herb layer,total of 23 species of herbs belonging to 15 families were encountered. Brassicaseae, Gramineae, Amryllidaceae are the most dominant families showed in Table-5. The total density and basal area was recorded as 102320 (stem ha^{-1}) and 45.09 (m^2ha^{-1}), respectively. The maximum frequency occurred in *Brassica juncea* (33.33%) followed by *Solanum lycopersicum* (30.00%) and minimum was found in *Centella asiatica, Marsilea minutrea* and *Solanummelongena (*3.33%). whereas, in case of density the maximum density was found in *Brassica juncea*(25,180 stems ha^{-1}) followed by *Triticum aestivum*(12,830 stems ha^{-1})and minimum in *Coccinia grandis* (20stems ha^{-1}).In case of basal area, the maximum found in Brassica juncea (18.25 m2 ha−1) followed by Allium cepa (10.36 m2 ha−1) and minimum was found in *Centella asiatica* and *Marsilea minuta* (0.02 m2 ha−1). The importance value of herb species varied from 76.71 to 2.30. *Brassica juncea* showed highest value of IVI (76.71) followed by *Allium cepa* (38.13) and lowest was in *Marsilea minuta* (2.30).

Table 3: Species structure of Seedling layer of Angara Block

No.	Botanical Name	Common Name	Family	F	D	BA	RD	RF	RBA	IVI
1	*Alangiumlamarckii*Thw.	Dela	Cornaceae	3.33	20	0.05	14.29	10.00	12.56	36.85
2	*Artocarpusheterophyllus*Lamk.	Kathal	Moraceae	6.67	20	0.08	14.29	20.00	14.42	48.71
3	*Bauhinia purpurea*Linn.	Koinar	Leguminosae	3.33	10	0.02	7.14	10.00	8.20	25.35
4	*Derris indica*(Lam.) Bennet.	Karanj	Leguminosae	6.67	30	0.02	21.43	20.00	17.09	58.52
5	*Gmelinaarborea*Linn.	Gamhar	Verbenaceae	6.67	30	0.10	21.43	20.00	18.84	60.27
6	*Ziziphusmauritiana*Lamk.	Ber	Rhamnaceae	6.67	30	0.21	21.43	20.00	28.88	70.31
	Total				140	0.62	100	100	100	300

Table 4 : Species structure of shrubs layer of Angara Block

No.	Botanical Name	Common Name	Family	F	D	BA	RD	RF	RBA	IVI
1	*Carica papaya* Linn.	Papaya	Caricaceae	20.00	140	2.75	13.21	31.58	24.87	69.65
2	*Dendrocalamusstrictus* (Roxb.)Nees	Bamboo	Bambuseae	3.33	100	0.31	9.43	5.26	2.76	17.46
3	*Lantana camara*Linn.	Putush	Verbenaceae	10.00	260	0.12	24.53	15.79	1.04	41.36
4	*Moringaoleifera*Lamk.	Sahjan	Moringaceae	13.33	80	1.99	7.55	21.05	17.95	46.55
5	*Musa paradisiaca*Linn.	Banana	Musaceae	10.00	410	5.85	38.68	15.79	52.88	107.35
6	*Vitexnegundo*Linn.	Sindwar	Lamiaceae	6.67	70	0.06	6.60	10.53	0.50	17.63
	Total				1060	11.07	100	100	100	300

Species diversity, the number of species in a community is ecologically important. In order to get a better picture of plant species diversity, various diversity indices (ecological models) were calculated for Singari village. Species diversity pattern *i.e.* Shannon index (H'), Simpson's index (Cd), Species richness (d) and Equitability (e) for tree, sapling, seedling, shrub and herb layers of homegardens of Angara block are given in Table-6. Sahoo *et al*. [10] reported that the Shannon Weiner index for both trees and shrubs were maximum in the small homegarden (H´=3.28) and minimum in medium sized homegardens in North-East India. The diversity indices estimated for homegarden plants as H'=1.561, (Shannon-Winner diversity), Species Richness (R=25.868), Species Evenness (E=0.789), Simpson's Diversity Index (λ=0.059) and Diversity Index (DI =0.022) in the 6 rural villages (Ariyaperumalvilai, Azhagiapandiapuram, Elankadai, Maravankudiyiruppu, Thandanayagankonam) of Kanyakumari District, Tamil Nadu [8].

CONCLUSION

The homegardens ensure crop diversification, provide diversified products through low in amount but nutritious in nature and conserve plant genetic resources.Among tree species *Gmelinaar borea, Tectona grandis* and fruit species *Mangifera indica*, *Artocarpus heterophyllus* and *Ziziphus mauritiana* were most preferred species. *Mangifera indica, Ziziphus mauritiana* and *Artocarpus heterophyllus*as in important cash growing crop. Awareness progamme to the villagers to obtain the maximum benefit of the homegarden.

Table 5: Species structure of Herbs layer of Angara Block

No.	Bot. Name	Com. Name	Family	F	D	BA	RD	RF	RBA	IVI
1	*Allium cepa*Linn.	Onion	Amaryllidaceae	16.67	9560	10.36	9.34	5.81	22.97	38.13
2	*Amaranthus viridis*Linn.	Bhajisag	Amarantaceae	6.67	2880	0.09	2.81	2.33	0.19	5.33
3	*Amaranthus caudatus* Linn.	Gandari Sag	Amarantaceae	10.00	3650	1.26	3.57	3.49	2.79	9.84
4	*Amaranhtus gangeticus*Linn.	Lal Sag	Amarantaceae	6.67	1500	1.17	1.47	2.33	2.60	6.39
5	*Brassica juncea*Linn.	Sarso	Brassicaceae	33.33	25180	18.25	24.61	11.63	40.47	76.71
6	*Brassica oleracea*Linn	Gobhi	Brassicaceae	6.67	540	1.36	0.53	2.33	3.03	5.88
7	*Capsicum annum* Linn.	Mircha	Solanaceae	10.00	510	0.21	0.50	3.49	0.46	4.44
8	*Centella asiatica*Linn.	Beng.Sag	Apiaceae	3.33	1160	0.02	1.13	1.16	0.05	2.35
9	*Chenopodium album* Linn.	Betua Sag	Chenopodiaceae	13.33	6240	0.42	6.10	4.65	0.92	11.67
10	*Coccinia grandis*(L.) Voigt.	Kundri	Cucurbitaceae	6.67	20	0.03	0.02	2.33	0.08	2.42
11	*Colocasiaantiquorum*Schott.	Kacchu	Araceae	13.33	490	0.81	0.48	4.65	1.80	6.93
12	*Commelinabenghalensis*Linn.	Kenah Grass	Commelinaceae	13.33	3180	0.19	3.11	4.65	0.42	8.18
13	*Cucurbitapepo*Linn.	Kohra	Cucurbitaceae	6.67	30	0.09	0.03	2.33	0.20	2.55
14	*Cyperusrotundus*Linn.	Motha Sag	Cyperaceae	20.00	8140	0.27	7.96	6.98	0.59	15.52
15	*Marsileaminuta*Linn.	Sunsunia Sag	Marsiliaceae	3.33	1120	0.02	1.09	1.16	0.04	2.30
16	*Pisumsativum*Linn.	(Chna) Mator	Fabaceae	26.67	6680	1.02	6.53	9.30	2.27	18.10
17	*Polygonumplebejum*R.Br.	Chimti sag	Polygonaceae	20.00	4440	0.07	4.34	6.98	0.17	11.48
18	*Raphanus sativus*Linn.	Muli	Brassicaceae	6.67	1130	0.19	1.10	2.33	0.41	3.84
19	*Sacciolepisindica* Linn.	SawaGaas	Poaceae	6.67	4300	0.27	4.20	2.33	0.61	7.14
20	*Solanumlycopersicum*Linn.	Tomato	Solanaceae	30.00	6280	4.53	6.14	10.47	10.05	26.65
21	*Solanummelongena*Linn.	Baigan	Solanaceae	3.33	1340	1.81	1.31	1.16	4.01	6.49
22	*Solanumtuberosum*Linn.	Aloo	Solanaceae	6.67	1120	0.34	1.09	2.33	0.76	4.18
23	*Triticumaestivum*Lam	Wheat	Gramineae	16.67	12830	2.30	12.54	5.81	5.11	23.46
	Total				102320	45.09	100	100	100	300

Table 6: Diversity pattern of trees, saplings, seedlings, shrubs and herb layer of Angara Block

Layers	Shannon index (H')	Simpson's index (Cd)	Species richness (d)	Equitability (e)	Beta diversity
Tree	3.46	0.12	2.22	1.24	1.31
Sapling	2.77	0.17	1.36	1.33	2.63
Seedling	2.50	0.18	1.01	1.40	1.83
Shrub	2.27	0.25	0.72	1.27	1.67
Herb	3.67	0.11	1.91	1.17	2.00

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