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## Plant Biodiversity in the Homesteads of Saline Area of Southeastern Bangladesh

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**Abstract:** Sixty-two useful plant species were identified during the study period. Among them 30.9% fruits, 29.09% timber, 34.54% vegetables and 5.45% were spices species. Number of vegetable species was found the highest (19 spp.) followed by fruit (17 spp.), timber (16 spp.) and spices (3 spp.). Only 17 fruit, 13 timber, 17 vegetable and 2 spices species were found in all region. Coconut, country bean, Karai and chilli were found the most prevalent. Inter species diversity was highest (0.879) in the vegetable species. Coconut was found 98.63% in homestead followed by mango (96.72%), banana (91.6%) and betel nut (93.44%).

**Key words:** Biodiversity, saline area, homestead, species identification

### Introduction

Plant biodiversity is the variability between plant kingdom and the ecosystem complex in which they occur. In true sense it is the plant genetic wealth of a country or an area. The tropical forests are regarded as the richest in Plant biodiversity. But Bangladesh has only 5 to 6% forest area (Bashar, 1999), which is far below the international standard (25%). It has 15.4 million homesteads occupying 0.3 million hectares of land (Abedin and Quddus, 1990). Homestead represents a land use system involving deliberate management of multipurpose trees and shrubs in intimate association with seasonal vegetables (Fernandes and Nair, 1990). Economically and genetically important materials selected by both human and nature, adapted in the environment, are the components of homesteads. From the conservation point of view, homesteads are the *in situ* conservation sites of wide range of plant biodiversity.

Sometimes homesteads contained rare and very important materials. Most of the homesteads of landlord houses contained improved cultivars of different fruits and other aesthetic plants, which are very much important from horticultural and breeding point of view. There is a bright scope of exploitation of such rare but quality materials.

Greater Noakhali, is on the Bay of Bengal occupies an area of 5985 sq. km. It is situated between 22° to 23°15' N latitude and 90°30' to 91°45' E longitude. The ecological hazards hitting the area are frequent cyclones and storm surges of various intensities and exceptionally high tides resulting in salt water flooding of agricultural lands. The homesteads are often on raised lands and small. The potentiality of home gardening is limited to some extent due to salinity. Considering the above facts the study was undertaken to study the diversity of plant species in homesteads and its possible use in crop improvement.

### Materials and Methods

The locations of the study were Farming Systems Research and Development (FSRD) site Noakhali, Multilocation Testing (MLT) site Laxmipur and MLT site Feni of greater Noakhali district. Thirty selected homesteads of each location were surveyed following two methods namely, formal survey and informal survey and focused group discussions. Data for plant biodiversity of the homesteads were collected using questionnaire. Each homestead was visited twice, in winter and in summer. Information was recorded through interviews of family members like head of the family, housewife and others. Data were collected mainly on name and number of the plant species and name and number of major morphotypes per species.

Population was not recorded in case of herbaceous plants and crops like banana, pineapple, bamboo etc. weeds, and medicinal and ornamental plants were excluded from the survey. Plant

biodiversity was described under the following heads, species richness, inter species diversity, relative prevalence of species and inter species diversity.

**Species richness:** Species richness measures the number of species within area. Homestead plants of the three locations were grouped into four categories namely fruits, timber (non-fruit tree), vegetables and spices. Proportions of different plant groups were also calculated.

**Inter species diversity:** The most commonly used formula of calculating inter species diversity 'Simpson Index (D)' suggested by Simpson (1949) was used in this study.

**Relative prevalence (PR) of species:** Percent of homesteads containing a particular species is one of the indicators of the relative prevalence of that particular species in that area. Percent of homesteads receiving the plant species were calculated for all the species at all the three regions. Relative prevalence of species was calculated by using the following formula:

$$PR = \frac{\text{Population of the species per homestead}}{\text{Percent homesteads with the species.}} \times$$

These relative prevalence values were used to rank the species in different regions according to Millat- e-Mustafa (1997). The mean dominance rank was determined by pooling the entire set of data of all the three regions.

### Results and Discussion

Almost all the homesteads had mixed vegetation with various annual and perennial trees and seasonal vegetables. The study revealed that a wide variety of plant species was found in the study areas. More than 62 useful species were identified in the homesteads of FSRD site, Atkapalia, MLT site Lakshipur and MLT site Feni. Among them 30.91% were fruit, (perennial and annual), 29.09% were timber, 34.54% were vegetables (summer and winter) and 5.45% were spices species (Table 1). The distribution pattern of the plant species was influenced by macro and micro environmental factors of the homesteads and needs of the family members.

Abedin and Quddus (1990) studied six agro-ecologically different locations of Bangladesh including Barind tract, and observed average tree population to be the lowest in Barind tract, which supports the findings of the present study. Manan (2000) reported 114 useful species in his recent study in the three regions of Bangladesh. Anam (1999) reported only 28 tree species in his study in the plain area of Barind tract.

Number of species in each of 3 locations of the study area is

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Table 1: Species richness of different plant groups at greater Noakhali

Regions	Fruits tree	Timber tree	Vegetables	Spices	Total
FSRD site, Atkapalia	18.00	17.00	18.00	5.00	58.00
MLT site Lakshmipur	17.00	7.00	18.00	2.00	44.00
MLT site Feni	21.00	17.00	20.00	4.00	62.00
Average	19.00	13.67	18.67	3.67	54.67
All Percent	17.00 (30.9)	16.00 (29.09)	19.00 (34.54)	3.00 (5.45)	55.00

Table 2: Inter species diversity of different plant groups at the homesteads in greater Noakhali

Regions	Fruits tree	Timber tree	Vegetables	Spices	Total
FSRD site, Atkapalia	0.822	0.817	0.910	0.690	0.809
MLT site Lakshmipur	0.899	0.733	0.740	0.650	0.756
MLT site Feni	0.866	0.871	0.894	0.717	0.837
Average	0.862	0.807	0.846	0.686	0.812
All	0.854	0.853	0.879	0.705	0.823

Table 3: Distribution of fruit species in the homesteads of greater Noakhali

Species	% Homestead containing the species			
	FSRD site, Atkapalia	MLT site Lakshmipur	MLT site Feni	All
Mango ( <i>Mangifera indica</i> )	96.67	88.24	100.00	96.72
Jujube ( <i>Zizyphus jujuba</i> )	86.67	70.59	100.00	86.88
Coconut ( <i>Cocos nucifera</i> )	98.10	99.40	97.80	98.60
Jackfruits ( <i>Artocarpus heterophyllus</i> )	60.00	41.18	100.00	65.57
Wood apple ( <i>Aegle mermelos</i> )	20.00	17.65	13.33	18.03
Star fruits ( <i>Averrhoa carambola</i> )	43.33	35.29	86.67	52.46
Litchi ( <i>Litchi chinensis</i> )	16.67	23.53	20.00	19.67
Velvet apple ( <i>Diospyros discolor</i> )	0.00	0.00	66.67	16.39
Bullocks heart ( <i>Anona reticulata</i> )	60.00	41.18	0.00	40.98
Palm ( <i>Borassus flabellifer</i> )	63.33	52.94	100.00	70.49
Date palm ( <i>Phoenix sylvestris</i> )	90.00	41.18	100.00	80.32
Banana ( <i>Musa</i> spp.)	93.33	70.58	100.00	90.16
Amlaki ( <i>Phyllanthus embelica</i> )	30.00	17.64	0.00	19.67
Guava ( <i>Psidium guajava</i> )	90.00	58.82	100.00	85.24
Caranda ( <i>Carissa carandus</i> )	0.00	0.00	46.67	11.47
Pomelo ( <i>Citrus grandis</i> )	43.33	0.00	86.67	42.62
Papaya ( <i>Carica papaya</i> )	50.00	64.71	100.00	67.21
Black berry ( <i>Eugenia jambolana</i> )	53.33	11.76	93.33	52.46
Pineapple ( <i>Anonus comosus</i> )	10.00	5.88	13.33	9.84
Water melon ( <i>Citrullus lanatus</i> )	3.33	0.00	0.00	0.00
Custard apple ( <i>Anona squamosa</i> )	40.00	0.00	86.67	22.95
Hog plum ( <i>Spondias mangifera</i> )	16.67	5.88	20.00	26.23
Pome granite ( <i>Punica granatum</i> )	0.00	5.88	86.67	31.14
Cashew nut ( <i>Anacardium oxydentale</i> )	33.33	5.88	0.00	1.64
Olive ( <i>Elaeocarpus floribundus</i> )	3.33	5.88	0.00	18.03
Wax apple ( <i>Syzygium samarangense</i> )	10.00	5.88	20.00	1.64
Rose apple ( <i>Eugenia javanica</i> )	0.00	5.88	6.67	11.48
Betelnut ( <i>Areca catechu</i> )	45.00	82.36	100.00	93.44

found lower than those found by Manan (2000) and Abedin and Quddes (1990). Millat-e-Mustafa (1997) identified 92 perennial plant species at 4 sites of the country. Islam (1998) found 77 species in his study of homestead-agroforestry at Rangpur. Sellathural (1997) found 237 useful species in Yatinuwara area in Kandy district of Sri Lanka. Jose (1991) identified 179 plant species in Kerala homesteads and Soemarawato (1987) listed 179 plant species in West Java homesteads. In another study, Michon (1983) enumerated 500 species in a village in Java. Bashar (1999) identified 136 useful species in the homesteads while surveyed in Gazipur.

**Inter-species diversity:** Species diversity index is a measure, which renders considerable ecological insight. Simpson index (1949) of species diversity (D) varied among different groups of plant species (Table 2). Diversity was found higher for vegetable species (0.879) in the homesteads of the study area (3 regions as a whole) followed by fruit (0.854), timber and spices. Bashar (1999) and Sellathural (1997) found higher diversity in fruit species. But the values were higher than the present findings. Fruits occupied the second position and spices were the last. Diversity index varied with different plant groups as well as different regions. There is a general agreement among the authors about the complexity of homestead displayed in diversity (Millat-e-

Mustafa, 1997a). Higher diversity was found at MLT site Feni followed by FSRD site Atkapalia and MLT site Lakshmipur. These values were higher than that of Kerala homesteads (Kumar *et al.*, 1994). So, Bangladesh has the moderate to higher inter species plant biodiversity in the homesteads.

**Relative prevalence of species:** Frequency of occurrence of a particular species in an area is one of the indicators of its biodiversity at that area.

**Fruit:** It is observed from Table 3 that coconut was found in 98.63% household at Noakhali. While mango, banana, betel nut and date palm, were found at more than 60% homesteads of Noakhali. Abedin and Quddus (1990) found mango at 95% homesteads of Tangail and at above 67% homesteads of Ishurdi, Jessore, and Rangpur. Alam *et al.* (1990) observed that mango, jackfruit, coconut and banana were available at more than 65% homesteads of Jessore.

**Timber:** Mahogani, badhi and neem was found at 50% homesteads of the study area. (Table 4). Abedin and Quddus (1990) found neem at 33% homesteads of Rajshahi and at 35% homesteads of Rangpur.

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Table 4: Distribution of timber species in the homesteads of greater Noakhali

Species	% Homestead containing the species			
	FSRD site, Atkapalia	MLT site Lakshmpur	MLT site Feni	All
Mahogani ( <i>Swietenia macrophylla</i> )	63.33	47.05	98.00	68.85
Sissoo ( <i>Dalbergia sissoo</i> )	23.30	0.00	6.67	13.11
Teak ( <i>Tectona grandis</i> )	26.66	11.76	60.00	31.14
Akashmoni ( <i>Acacia auriculiformis</i> )	16.60	0.00	20.00	13.12
Eucalyptus ( <i>Eucalyptus camaldulensis</i> )	16.66	0.00	6.67	9.84
Minjiri ( <i>Cassia samea</i> )	0.00	0.00	0.00	0.00
Chapalish ( <i>Artocarpus chaplasha</i> )	6.66	0.00	40.00	13.11
Koroi ( <i>Albizia procera</i> )	85.00	7.59	96.00	93.44
Neem ( <i>Azadirachta indica</i> )	63.33	11.76	86.67	55.73
Tamarind ( <i>Tamarindus indica</i> )	53.33	0.00	93.33	49.18
Garzan ( <i>Diplorocarpus turbinatus</i> )	3.33	0.00	6.67	3.28
Shal ( <i>Shorea robusta</i> )	3.33	0.00	0.00	1.64
Raintree ( <i>Samanea saman</i> )	40.00	23.52	40.00	36.07
Ipil-Ipil ( <i>Leucaena leucocephala</i> )	26.67	0.00	0.00	13.11
Krishnachura ( <i>Delonix regia</i> )	13.33	11.76	93.33	32.79
Babla ( <i>Acacia nilotica</i> )	26.67	0.00	53.33	26.23
Kadam ( <i>Anthocephalus cadamba</i> )	16.67	52.94	100.00	47.54
Pithraj ( <i>Amoora rohitoa</i> )	3.33	5.88	40.00	13.11
Silk cotton ( <i>Bombax malabaricum</i> )	26.67	23.53	40.00	29.51
Palash ( <i>Butea monosperma</i> )	0.00	5.88	6.67	3.28
Pain ( <i>Toona ciliata</i> )	6.67	0.00	66.67	19.67
Sonalo ( <i>Cassia fistula</i> Linn.)	20.00	29.41	93.33	40.98
Mandar ( <i>Erythrina indica</i> )	46.67	11.76	93.33	49.18
Domur ( <i>Ficus racemosa</i> )	10.00	0.00	73.33	22.95
Badhi ( <i>Lannea coromandelica</i> )	53.33	41.17	93.33	60.65
Jarul ( <i>Lagerstroemia filios reginae</i> )	3.33	0.00	20.00	6.56
Champa ( <i>Michelia champaca</i> )	3.33	0.00	13.33	4.92
Debdaru ( <i>Polyalthia longifolia</i> )	3.33	0.00	26.67	9.84
Gamar ( <i>Gmelina arborea</i> )	10.00	6.00	26.67	11.47

Table 5: Distribution of vegetable species in the homesteads of greater Noakhali

Species	% Homestead containing the species			
	FSRD site, Atkapalia	MLT site Lakshmpur	MLT site Feni	All
Indian Spinach	70.00	17.65	0.00	34.43
Spinach	60.00	0.00	6.67	19.67
Red amaranth	36.67	11.65	13.30	36.06
Stem amaranth	60.00	23.53	66.67	39.34
Kang Kong	33.33	0.00	0.00	14.75
China copi	30.00	0.00	13.33	6.56
Mustard	6.67	0.00	0.00	4.92
Cauliflower	10.00	5.88	60.00	19.67
Cabbage	6.67	0.00	60.00	18.03
Olcopi	0.00	0.00	0.00	0.00
Broccoli	0.00	0.00	0.00	0.00
Sweet gourd	80.00	70.59	100.00	83.61
Cucumber	30.00	35.29	40.00	34.43
Ribbed gourd	16.67	17.64	46.67	24.59
Sponge gourd	20.00	52.94	100.00	49.18
Ash gourd	10.00	29.41	53.33	26.23
Bitter gourd	6.67	11.76	13.33	9.84
Kakrol	16.67	0.00	6.67	9.84
Snake gourd	23.33	17.64	46.66	27.87
Pointed gourd	0.00	0.00	6.67	1.64
Bottle gourd	60.00	82.35	93.33	75.41
Country bean	66.67	88.24	100.00	81.96
Yard long bean	26.67	11.76	13.33	19.67
Brinjal	50.00	41.17	100.00	60.65
Tomato	63.33	5.88	100.00	57.38
Okra	30.00	5.88	6.67	18.03
Potato	16.67	5.88	46.67	21.31
Sweet potato	46.67	0.00	33.32	31.15
Taro	0.00	5.88	86.67	22.95
Potato yam	6.67	41.18	93.33	37.70
Radish	33.33	5.88	86.67	39.34
Turnip	3.33	0.00	0.00	1.64
Carrot	3.33	0.00	0.00	26.23
Sugar bet	6.67	0.00	0.00	24.59

Table 6: Distribution of spices species in the homesteads of greater Noakhali

Species	% Homestead containing the species			
	FSRD site, Atkapalia	MLT site Lakshmpur	MLT site Feni	All
Chilli	96.00	23.53	80.00	54.09
Onion	90.00	2.94	66.67	19.67
Garlic	20.00	5.88	13.33	36.06
Zinger	36.67	0.00	40.00	1.64
Turmeric	10.67	5.88	66.67	8.19
Coriander	16.67	0.00	6.67	6.56

**Vegetables:** Country bean was found at 81.96% homesteads of Noakhali. Whereas sweet gourd, brinjal were found at more than 50% homesteads of the study area (Table 5). Abedin and Quddus (1990) found country bean at 95% homesteads of Patuakhali and at 48% homesteads of Tangail.

**Spices:** Among the spices chili was found at more than 54% homestead of the study area (Table 6). Relative prevalence value of common species considering 90 households as a whole none of the species was found in every homestead of all the regions. Species found at least one homestead in each region were screened out. Only 17 fruit, 13 timber, 17 vegetables and 2 spices species were found common at all regions.

**The RP values of common fruit, timber, vegetables and spices**

**Fruit:** Among 17 fruit species, common at all regions, coconut was found the most prevalent in study area. On the basis of mean dominance, coconut, mango ranked top followed by jackfruit, guava and jujube. Chowdhury and Satter (1992) found coconut as the most prevalent among the fruit species followed by jackfruit, date palm, banana and mango (Table 7). The least ranked fruit species was karamja. But Anam (1999) found mango as the most prevalent among the horticultural species followed by guava, jackfruit, coconut and jujube.

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Table 7: Relative prevalence of common fruit species found in the homestead of the greater Noakhali

Species	FSRD site, Atkapalia	MLT site, Lakshmipur	MLT site, Feni	All
Mango	2133.11	849.26	5173.33	2524.27
Jujube	257.11	101.47	526.67	272.05
Coconut	3183.33	1900.00	1633.33	2496.72
Jackfruits	290.00	72.06	900.00	331.09
Wood apple	18.00	3.31	4.44	10.35
Star fruits	49.11	22.06	150.22	60.19
Litchi	4.44	16.18	6.67	7.74
Velvetapple	0.00	0.00	84.40	5.11
Bullocks heart	150.00	23.16	0.00	56.44
Palm	183.66	92.65	946.67	296.99
Date palm	1449.00	48.89	920.00	842.78
Banana	5721.33	472.06	3186.67	3582.91
Amlaki	14.00	5.51	0.00	6.12
Guava	600.00	84.56	753.33	469.55
Carandus	0.00	0.00	28.00	1.69
Pumelo	95.33	0.00	190.67	69.17
Papaya	86.66	109.19	580.00	182.90
Black berry	165.33	6.62	1319.11	270.03
Pineapple	3.00	3.67	26.67	7.90
Water melon	0.00	0.00	0.00	0.0
Custard apple	0.11	0.00	127.11	8.65
Hog plum	53.33		8.00	21.07
Pome granite	3.33	1.10	121.33	14.29
Cashew nut	0.00	0.36	0.00	0.11
Olive	13.33	1.47	0.00	4.43
Wax apple	0.33	1.10	10.67	1.08
Rose apple	1.66	0.73	1.33	2.82
Betel nut	6934.66	1750.00	1326.67	4240.15

Table 8: Relative prevalence of common timber species found in the homestead of the greater Noakhali

Species	FSRD site, Atkapalia	MLT site, Lakshmipur	MLT site, Feni	All
Mahogany	1851.44	435.29	1660.00	1438.00
Sissum	87.11	0.00	0.89	24.51
Segun	31.11	7.35	304.00	61.78
Akashmoni	20.00	0.00	12.00	9.67
Eucalyptus	7.77	2.20	2.22	3.06
Minjiri	0.00	0.00	0.00	0.00
Chapalish	0.66	0.00	69.33	6.23
Kori	6130.00	811.76	3306.00	3858.72
Neem	179.44	2.94	0.67	112.39
Tamarind	8177.00	0.00	196.44	85.46
Garzan	0.77	0.00	373.33	0.59
Shal	0.22	0.00	1.78	0.05
Rain tree	734.66	26.47	0.00	357.69
Ipil-IPil	1496.00	0.00	96.00	361.84
Krishnachura	3.55	2.20	0.00	29.95
Babla	80.88	0.00	255.11	50.74
Cadamba	11.11	102.57	96.00	92.74
Pithraj	0.11	0.36	453.33	2.79
Silk cotton	35.55	5.88	29.33	26.12
Palash	0.00	1.47	26.67	0.26
Pain	4.00	0.00	0.44	18.06
Sonalo	18.00	12.87	168.89	102.12
Mandar	402.88	25.73	734.22	647.40
Domur	4.66	0.00	3167.11	43.27
Badhi	1245.77	82.35	493.78	1024.19
Jarul	0.44	0.00	1499.55	12.25
Champa	0.88	0.00	0.00	1.05
Debdaru	0.11	1.84	4.44	1.93
Gamar	17.66		10.67	12.42

**Timber:** Among the 18 timber species, common at all regions, Kori was found the most prevalent at FSRD site Atkapalia and cadamba was at MLT site Lakshmipur and Feni population level (Table 8). Anam (1999) found koro as the most prevalent among timber species followed by raintree, akashmoni and mehogoni.

Table 9: Relative prevalence of common vegetable species found in the homestead of the greater Noakhali

Species	FSRD site, Atkapalia	MLT site, Lakshmipur	MLT site, Feni	All
Indian Spinach	4606.00	18.75	0.00	1309.33
Spinach	1772.22	0.00	66.67	515.99
Red amaranth	11690.00	1102.94	453.33	4644.18
Stem amaranth	1404.44	4411.76	1871.11	3021.77
Kang Kong	1147.00	0.00	0.00	277.42
China copi	166.66	0.00	71.11	89.22
Mustard	233.33	0.00	0.00	56.44
Cauliflower	21.11	367.65	1800.00	498.25
Cabbage	27.77	0.00	1980.00	183.28
Olcopi	0.00	0.00	0.00	0.00
Broccoli	0.00	0.00	0.00	0.00
Sweet gourd	1341.33	202.94	2666.67	1300.69
Cucumber	67.00	24.26	144.00	74.49
Ribbed gourd	11.11	5.51	388.89	60.47
Sponge gourd	24.00	92.64	1153.33	191.07
Ash gourd	5.33	14.70	103.11	22.79
Bitter gourd	1.33	6.62	22.22	6.45
Kakrol	66.11	0.00	4.44	20.80
Snake gourd	67.66	9.96	379.55	99.59
Pointed gourd	0.00	0.00	2.67	0.16
Bottle gourd	154.00	185.29	64711.00	168.26
Country bean	3337.78	843.75	4213.33	3073.09
Yard long bean	246.22	3.67	18.67	97.71
Brinjal	2441.67	156.98	4566.667	2198.52
Tomato	5826.67	73.53	5233.36	3522.57
Okra	1092.00	91.91	66.67	441.06
Potato	638.89	77.20	5444.44	1086.54
Sweet potato	3688.22	0.00	1266.667	1501.72
Taro	0.00	18.38	14300.00	950.01
Potato yam	100.00	61.76	404.44	333.16
Radish	2750.00	110.29	10920.00	3008.87
Turnip	16.11	0.0	0.00	3.89
Carrot	13.33	0.0	0.00	141.47
Sugar bet	0.00	0.0	0.00	0.00

Table 10: Relative prevalence of common spices species found in the homestead of the greater Noakhali

Species	FSRD site, Atkapalia	MLT site, Lakshmipur	MLT site, Feni	All
Chilli	12684.00	451.47	21493.36	4376.65
Onion	793.33	0.00	9866.67	603.06
Garlic	1894.44	110.29	355.55	2453.64
Zinger	0.00	0.00	1813.33	4.03
Turmeric	468.89	0.00	10222.22	113.41
Coriander	186.67	0.00	66.67	45.15

**Vegetables:** Out of 21 vegetable species, common at all regions, sweet gourd was found most prevalent at FSRD site Atkapalia and country bean was at both MLT site Lakshmipur and Feni (Table 9). On the basis of mean dominance rank, country bean occupied top position followed by taro, sweet gourd, Indian spinach and bottle gourd. The least ranked vegetable species was kangkong. Momin *et al.* (1990) found country bean and bottle gourd as the most prevalent vegetable species in the homesteads.

**Spices:** In case of spices chilli, garlic and turmeric were found common in all the regions. Based on the present study it may be concluded that wide range of plant biodiversity existed in the homestead of the greater Noakhali. Among the plant species, inter species diversity of vegetable species was the highest followed by fruit in the homesteads. Coconut in fruits group and Country bean in vegetables was most prevalent species in the homestead. Therefore, intensive research should be undertaken to improve the most prevalent vegetables, spices, fruits and timber species (Table 10).

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