

Agroforestry Species Systems of the Charlands of Bangladesh

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ABSTRACT

The production systems in char and allied land are agro-based with profound culturing of trees where potential of its development with rearing of animals is immense. Studies are undertaken to explore the agroforestry and environmental systems and their improvement or development in charlands of Bangladesh. The technical works designed using multiple questionnaire guidelines tools. The variables are site, respondent and level. The AEZ 2, 7, 8, 10 and 12 are the major sites of the present study. The general reason as stated by the respondents that trees requirement safe at least six-month aerobic soils are favored in charlands. The major species chosen dominantly in the char agricultural production systems have been determined. Distinction of opinion of national and local level respondents regarding introduction of fruit species are found. In case of community forest tree species neem is in top of the dominance and less dominant is jarul. The results of studies show sharp variation in the existing and preferred species for char agricultural lands. It is recommended that the Charland Agroforestry technical package should be formulated considering the local Agro-Ecological requirements for indigenous species. Short duration sandy soil loving crops are to be introduced with required improvement. Mixed tree species systems are likely to be promising and adopted in this area. More emphasis must be given to indigenous species and indigenous practices for agroforestry production systems in the charlands.

Keywords: *Agroforestry, Charlands, Indigenous species*

INTRODUCTION

Agriculture being the most important sector of Bangladesh economy. It is contributing 13.6% to the country's Gross Domestic Product (GDP) and employing more than 40% of total labor force (BBS, 2018). Around 75% of the people living in rural areas of which 60% depends on agriculture for their livelihood (Rana, et. al, 2017).

Total forest area is 25, 79,387 hectares, which is 17.48% of country's total area (BBS-2018). It is necessity for a country covers at least 25% area as forest area of its total area for environmental safety. Scope of horizontal expansion of true forest land in Bangladesh is very difficult due to population dynamics and its pressure for agricultural and residential purpose. So, to cover or mitigate the environmental hazard the vertical Agroforestry expansion creates the land use capability in multi-functional way (Alam and Sarkar, 2011, UNDP/FAO. 1988.)

In Bangladesh, bars and islands formed by river deposition are known as chars. 'Char' is a territory of land surrounded by the waters. River water is a critical resource for the char land life and economic growth, cultural interaction and environmental development (Chowdhury, 2010; Rana, et. al., 2017, Miah and Hussain, 2010.).

Chars in Bangladesh have been distributed into five sub-areas: the Jamuna, the Ganges, the Padma, the Upper Meghna and the Lower Meghna rivers. There are other areas of riverbed chars in Bangladesh, along the Tista and the Old Brahmaputra rivers. The flow of old Brahmaputra and the Tista river always shift from their own course. In monsoon they frame new char land with deposition of silt, sand, clay which come from upper stream flow. Char dwellers always shift their habitats with shifting of land reclamation and environmental sustainability. Agroforestry also improve the physical, chemical properties of soil and reduces soil loss, cover the climate change mitigation for sustainability of the environment systems (Sobola et al. 2015). There are 6,66,000-hectare char land in 65 Upazilla under 17 districts in Bangladesh (Karim, et. al, 2017). In view of this situation the present piece of research is formulated with the objectives to identify the dominant agroforestry systems of the char lands. By this study, practicing of agroforestry systems as characterized King (1989) and Nair (1998) with effective valuable species and establishment of acceptable agroforestry models will provide functional land use system in char entisol lands.

METHODS AND MATERIALS

Research methodology usually encompasses the procedures followed to analyze and interpret the data gathered. The study is survey type. The primary data have been collected through field level investigation.

Variables:













A. Site

1. Kurigram- Jamalpur– (Upazila–Roumari, Rajibpur and Sarishabari) AEZ 2- Active Tista Floodplain, AEZ 7- Active Brahmaputra - Jamuna Floodplain and AEZ 8 - Young Brahmaputra and Jamuna Floodplain.
2. Sirajganj-Tangail – (Upazila – Kazipur, Chouhali and Bhuapur) AEZ 7- Active Brahmaputra - Jamuna Floodplain and AEZ 8 - Young Brahmaputra and Jamuna Floodplain.
3. Pabna-Manikganj, Shariatpur - (Upazila - Bera, Sujanogor, Shibaloy and Naria) AEZ 7 - Active Brahmaputra – Jamuna Floodplain, AEZ 8 - Young Brahmaputra and Jamuna Floodplain, AEZ 10 - Active Ganges Floodplain and AEZ 12 - Lower Ganges River Floodplain.

B. Respondent as Service/Consumer/Technical. Literate employees, Farmers and Professionals.

C. level:

National/ Regional/ Local. National, Regional and Local

Study Sites		
		
Kurigram	Nageswari	Roumari
		
Char Rajibpur	Sarishabari	Kazipur
		
Chouhali, Chouhali Punorbason	Bhuapur	Bera
		
Sujanogor	Shibaloy	Naria

RESULTS AND DISCUSSION

The results are interpreted and recommendations from the findings are thus formulated. The results are arranged as per site variables.

Tree Domination in the Charlands

The results of survey found tree domination are given in the table 1 to 3 and figs 1 to 3. The results show that the grand mean of response is about 34% indicating that the tree species included in the studies are significant. Table 1 to 3 and the figs 1 to 3 shows that the most dominant tree species found in the char land (characterized by Agro-Ecological Zones) are neem (85%), palmyra palm (80%) and sissu (78%). The less dominant tree species are alder (12%), kadam (14%), banana (15%), mango (15%) and gliricidia (8%). The general reason as stated by the respondent that trees requirement safe at least 6 month aerobic soil are favored in char lands but it must be compatible with cereal cropping system (Karim, 2014. 2015).

Table 1: Tree domination percentage by functional beneficiaries in charlands

Tree	Serviceman Literate	Consumer Farmer	Tec person Professional	Mean
Acacia	61	59	65	61.7
Alder	15	8	12	11.7
Bamboo	22	34	35	30.3
Banana	14	16	14	14.7
Betelnut	24	27	36	29.0
Cane Bet	19	9	22	16.7
Chatim	18	27	19	21.3
Coconut	42	30	28	33.3
Eucalyptus	71	72	31	58.0
Gliricidia	8	6	10	8.0
Hijal	12	22	12	15.3
Jarul	24	20	25	23.0
Jiga	26	37	32	31.7
Kapok	31	30	32	31.0
Kodom	18	7	18	14.3
Lambu	22	36	39	32.3
Mango	13	15	16	14.7
Mahogoni	56	47	45	49.3
Neem	92	86	77	85.0
Palmyra	84	71	86	80.3
Pitraj	15	15	24	18.0
Pummelo	18	12	42	24.0
Sisso	67	85	82	78.0
Mean	33.6	33.5	34.9	34.0

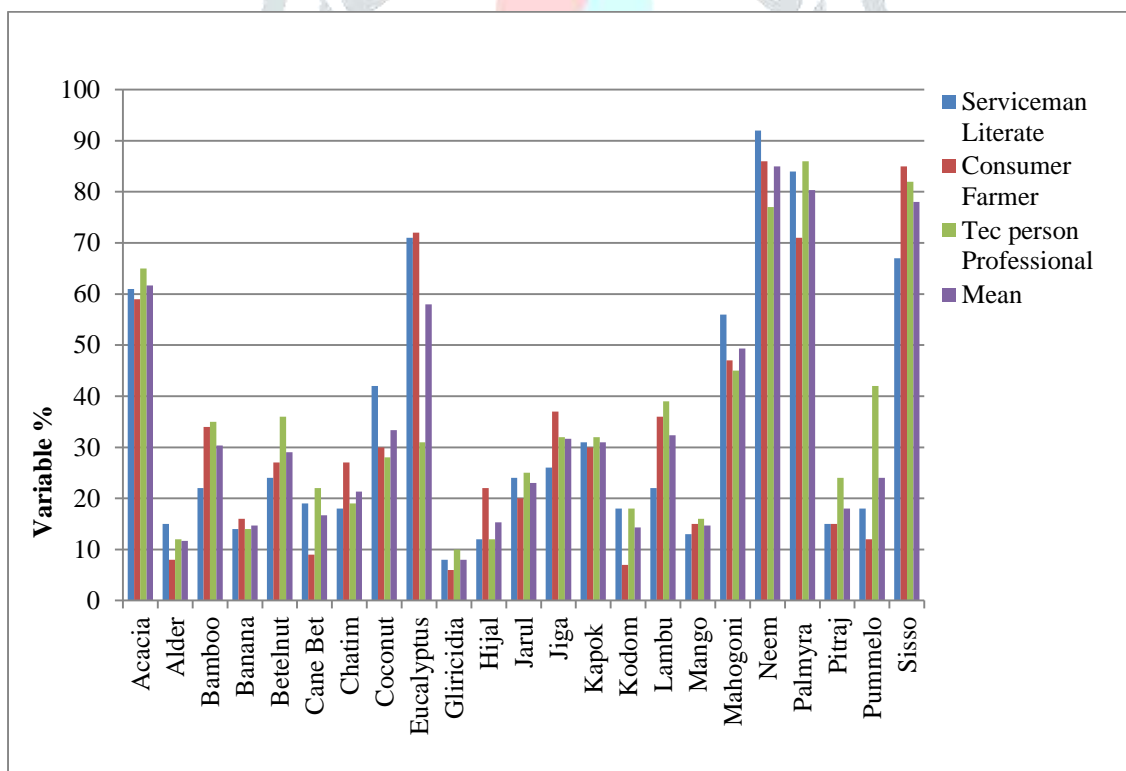


Figure1: Tree domination percentage in char lands as per species type

Table2: Tree domination percentage by functional level in char lands

Tree	National level	Regional level	Local level	Mean
Acacia	50	69	66	61.7
Alder	15	10	10	11.7
Bamboo	38	28	25	30.3
Banana	20	13	11	14.7
Betelnut	40	24	23	29.0
Cane Bet	17	21	12	16.7
Chatim	22	18	24	21.3
Coconut	34	35	31	33.3
Eucalyptus	50	65	59	58.0
Gliricidia	13	4	7	8.0
Hijal	8	18	20	15.3
Jarul	20	22	27	23.0
Jiga	33	31	31	31.7
Kapok	25	33	35	31.0
Kodom	16	16	11	14.3
Lambu	33	33	31	32.3
Mango	26	11	7	14.7
Mahogoni	28	48	72	49.3
Neem	87	85	83	85.0
Palmyra	92	79	70	80.3
Pitraj	29	11	14	18.0
Pummelo	18	26	28	24.0
Sisso	79	80	75	78.0
Mean	34.5	33.9	33.6	34.0

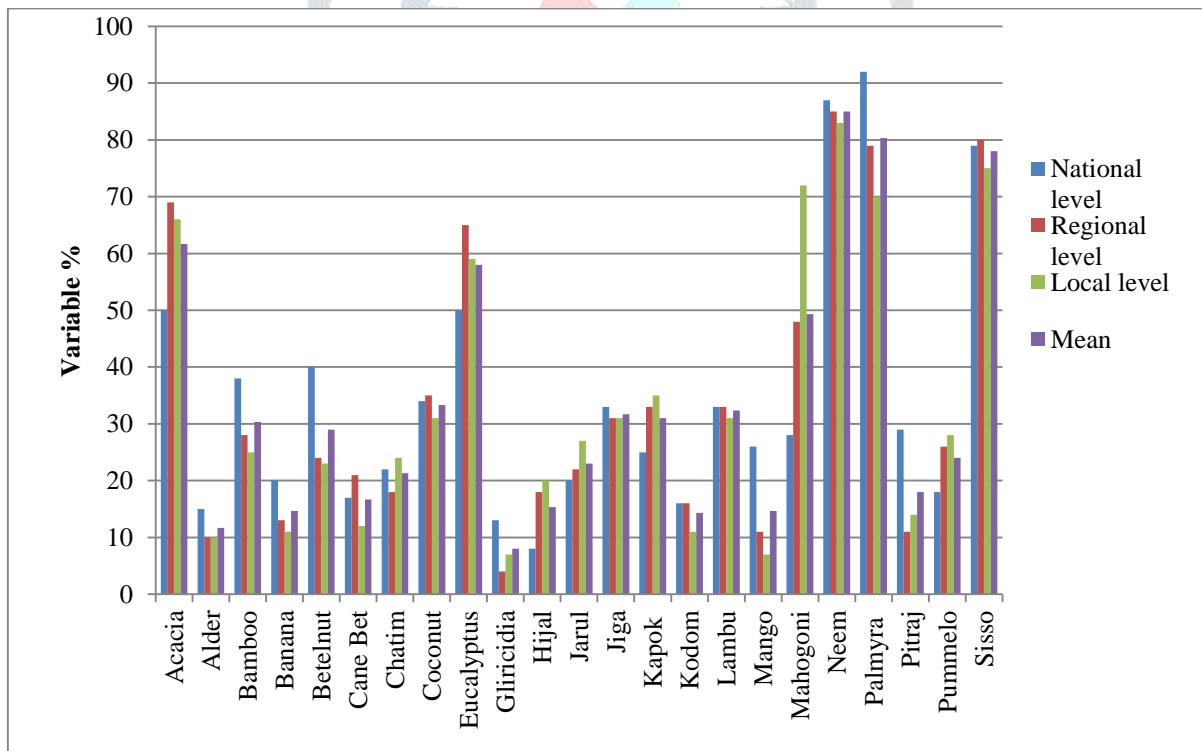


Figure 2: Tree domination percentage in char lands as per species type

Table 3: Mean results of major trees

Tree	Mean
Acacia	61.7
Alder	11.7
Bamboo	30.3
Banana	14.7
Betelnut	29.0
Cane Bet	16.7
Chatim	21.3
Coconut	33.3
Eucalyptus	58.0
Gliricidia	8.0
Hijal	15.3
Jarul	23.0
Jiga	31.7
Kapok	31.0
Kodom	14.3
Lambu	32.3
Mango	14.7
Mahogoni	49.3
Neem	85.0
Palmyra	80.3
Pitraj	18.0
Pummelo	24.0
Sisso	78.0
Mean	34.0

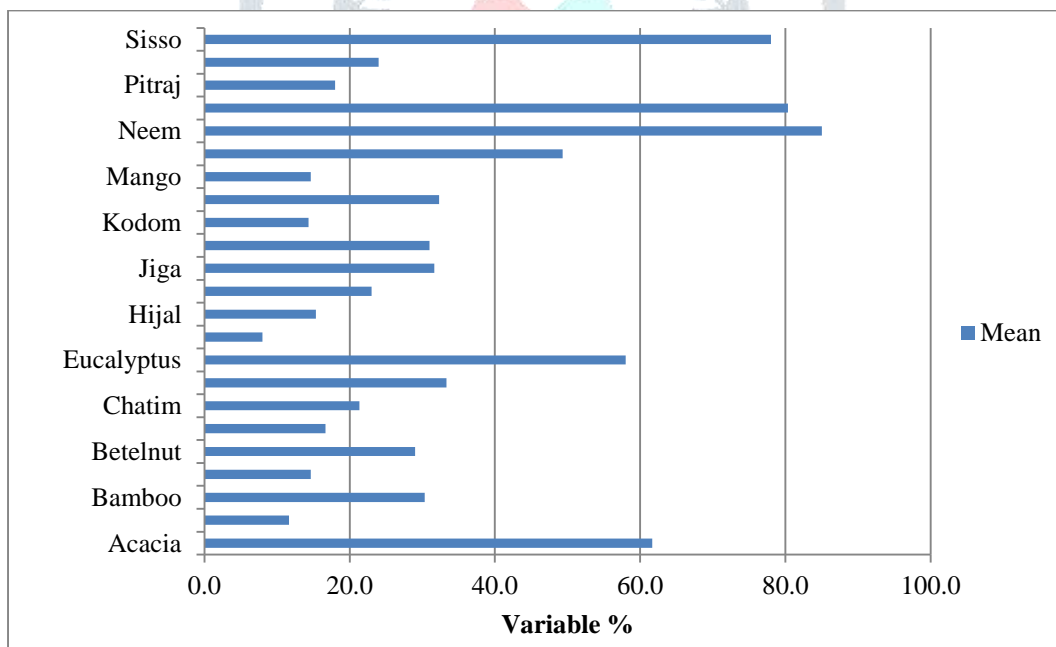


Figure 3: Mean results of tree species domination percentage

Mean results of tree domination given in the table 3 and fig 3. show that the variation occurring within species are significant.

Crops dominating the char lands

Table 4: Crop domination percentage by functional beneficiaries in char lands

Crops	Serviceman Literate	Consumer Farmer	Tec person Professional	Mean
Cucumber	61	67	88	72.0
Rice	32	65	24	40.3
Brinjal	39	42	44	41.7
Betel leaf	14	24	23	20.3
Ginger	30	37	22	29.7
C-bean	63	37	39	46.3
Sungrass	54	32	19	35.0
Chili	68	72	63	67.7
Wheat	11	22	23	18.7
Cheena	12	12	30	18.0
Turmaric	29	24	24	25.7
Data	41	46	48	45.0
Kaon	48	37	51	45.3
Grasspea	71	46	48	55.0
Okra	18	13	26	19.0
Murta	47	42	43	44.0
Jute	13	15	16	14.7
Maize	69	82	85	78.7
Sweet gourd	82	86	77	81.7
Sugarcane	34	34	57	41.7
Blackgram	35	41	42	39.3
Mesta	31	36	49	38.7
Watermelon	84	65	79	76.0
Mean	42.9	42.5	44.3	43.2

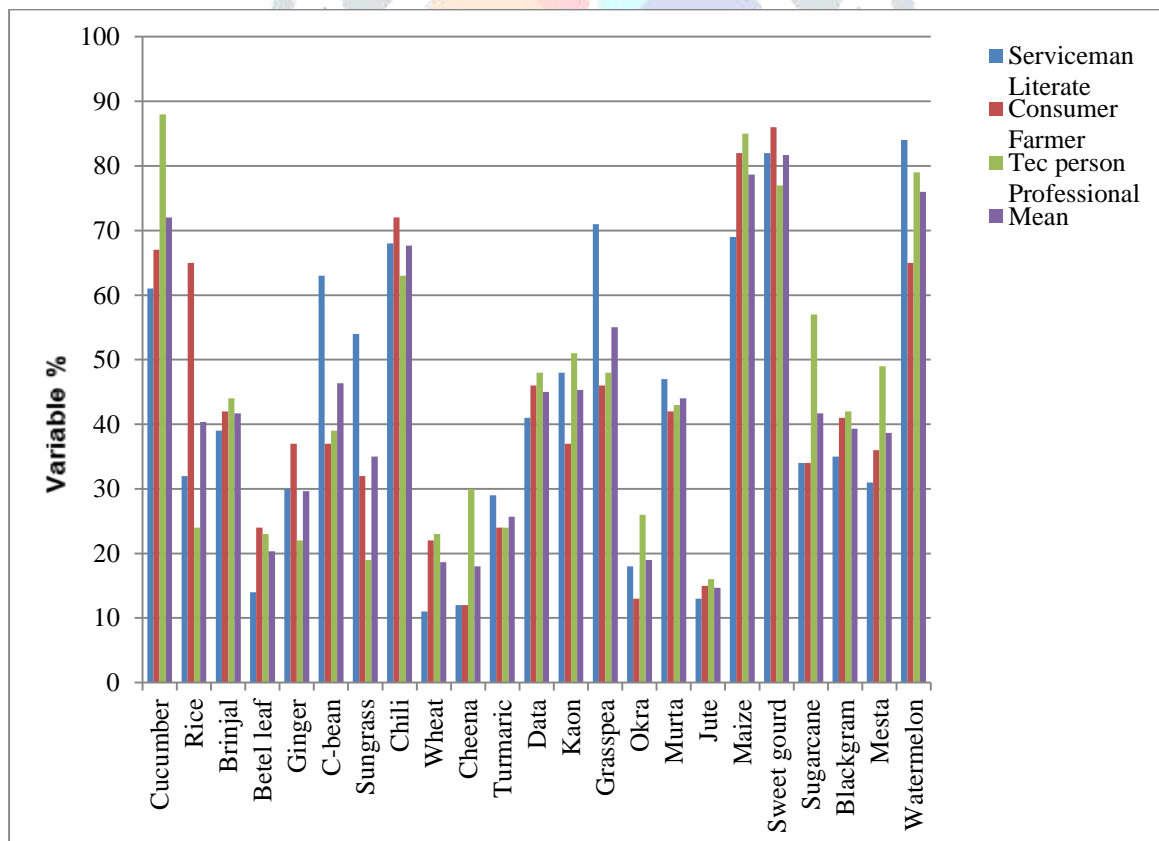
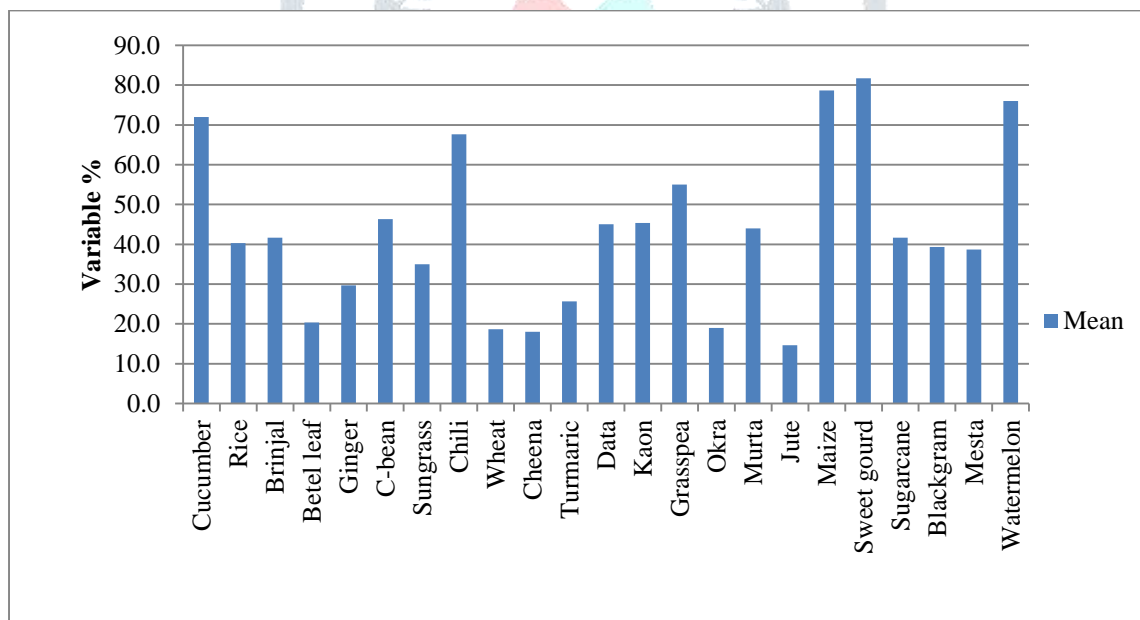


Figure 4: Crop domination percentage in char lands as per species type

Table 5: Mean response crop domination

Crops	Mean	%
Cucumber	72.0	7.2
Rice	40.3	4.0
Brinjal	41.7	4.2
Betel leaf	20.3	2.0
Ginger	29.7	3.0
C-bean	46.3	4.6
Sungrass	35.0	3.5
Chili	67.7	6.8
Wheat	18.7	1.9
Cheena	18.0	1.8
Turmeric	25.7	2.6
Data	45.0	4.5
Kaon	45.3	4.5
Grasspea	55.0	5.5
Okra	19.0	1.9
Murta	44.0	4.4
Jute	14.7	1.5
Maize	78.7	7.9
Sweet gourd	81.7	8.2
Sugarcane	41.7	4.2
Blackgram	39.3	3.9
Mesta	38.7	3.9
Watermelon	76.0	7.6
Mean	43.2	99.4

**Figure5: Mean results of crops domination percentage**

The results given in table 4 & 5 and figure 4 & 5 show that the major crops in the Char agricultural systems are sweet gourd (82%), maize (79%), watermelon (76%), cucumber (72%), chili (68%). The less dominant crops are wheat (19%), cheena (18%), okra (19%) and jute (15%).

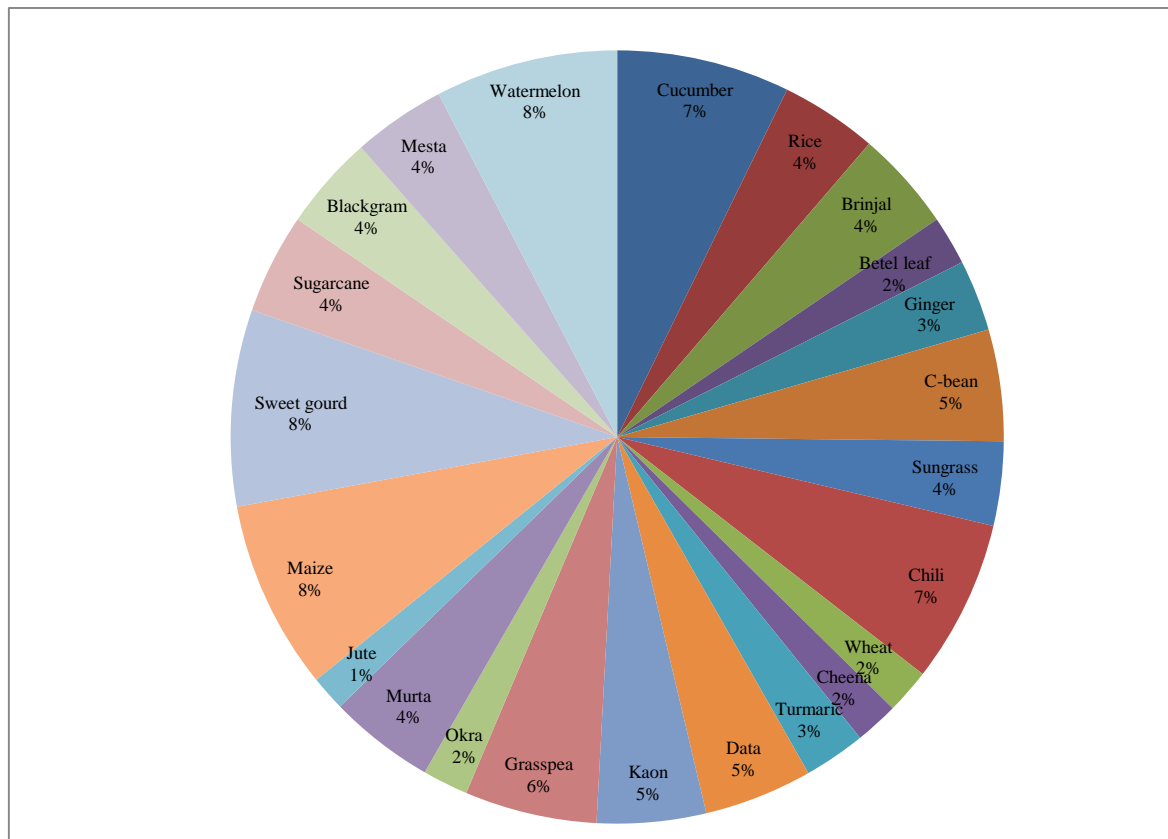


Figure 6: Pie-chart showing the percent of crop coverage

Fruit species now dominating the char lands.

Table 6: Fruit species domination percentage by level

Species	National level	Regional level	Local level	Mean
Pineapple	18	24	22	21.3
Watermelon	27	29	23	26.3
Coconut	75	48	36	53.0
Date palm	55	46	55	52.0
Guava	61	32	19	37.3
Lemon	73	53	42	56.0
Orange	15	20	23	19.3
Banana	24	11	70	35.0
Papaya	34	52	64	50.0
Mango	58	56	49	54.3
Litchi	40	52	46	46.0
Wood litchi	31	41	35	35.7
Amlaki	46	43	36	41.7
Grape	15	16	13	14.7
Jujube	52	46	36	44.7
Dragon	18	24	26	22.7
Lotkon	25	31	24	26.7
Bel	38	29	27	31.3
Amra	22	27	23	24.0
Jalpai	40	41	40	40.3
Daowa	17	23	27	22.3
Chalta	25	32	33	30.0
Mean	36.8	35.3	35.0	35.7

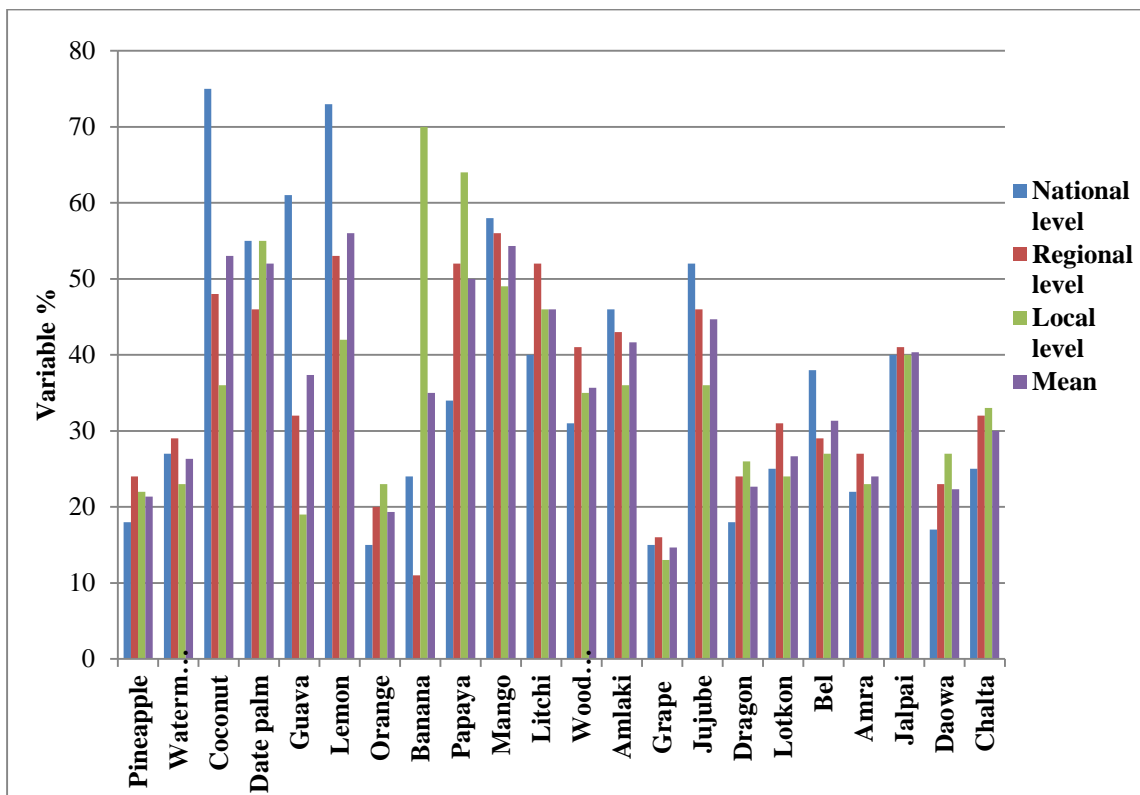


Figure 7: Fruit species domination percentage by level.

Table 7: Fruit species domination percentage by functional beneficiaries in char lands

Species	Serviceman Literate	Consumer Farmer	Tec person Professional	Mean
Pineapple	22	21	21	21.3
Watermelon	24	24	31	26.3
Coconut	46	64	49	53.0
Date palm	49	59	48	52.0
Guava	40	39	33	37.3
Lemon	48	67	53	56.0
Orange	18	13	27	19.3
Banana	34	39	32	35.0
Papaya	51	53	46	50.0
Mango	48	64	51	54.3
Litchi	51	38	49	46.0
Wood litchi	43	19	45	35.7
Amlaki	39	41	45	41.7
Grape	20	5	19	14.7
Jujube	38	54	42	44.7
Dragon	27	10	31	22.7
Lotkon	23	20	37	26.7
Bel	37	29	28	31.3
Amra	22	28	22	24.0
Jalpai	39	40	42	40.3
Daowa	20	24	23	22.3
Chalta	25	35	30	30.0
Mean	34.7	35.7	36.5	35.7

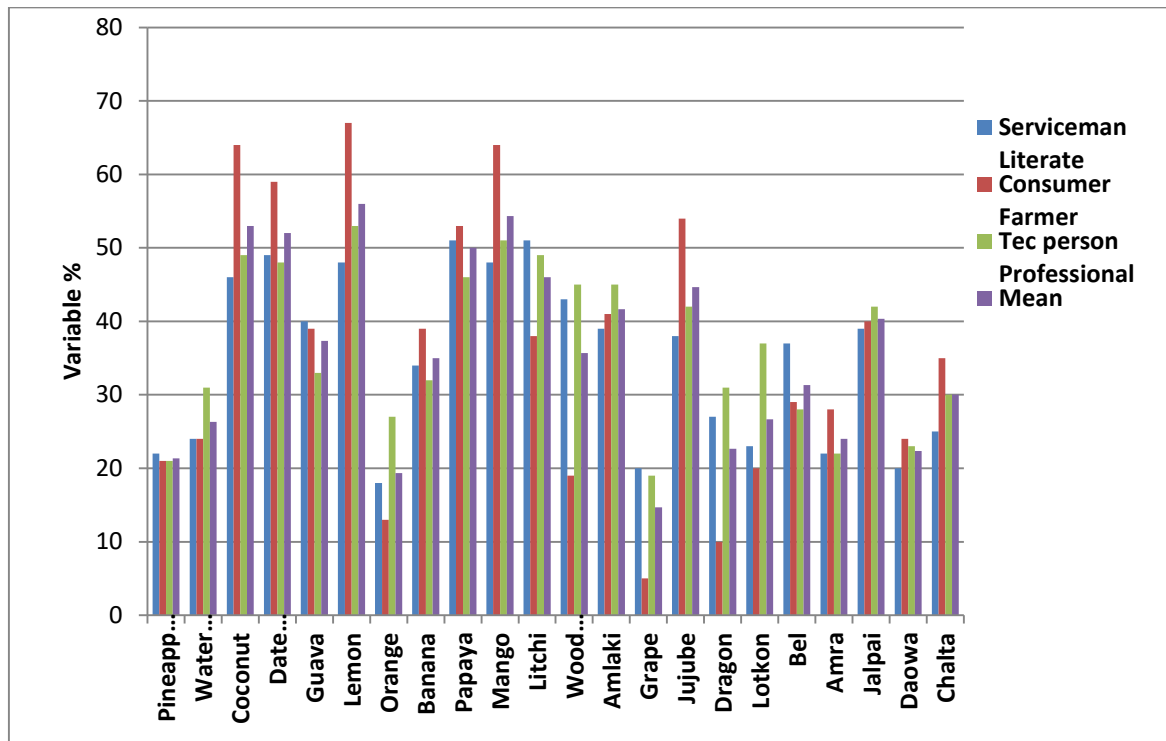


Figure 8: Fruit species domination percentage by functional beneficiaries in char lands

The results given in table 6 & 7 and figure 7 & 8 shows the fruit species domination, among them lemon (56%), coconut (53%), date palm, papaya, jujube and mango are preferred by the farmer consumers. It has been found that the national level respondents give more importance to several modern fruit trees but the local respondents show significantly less interest for those fruit species.

Community Forest Tree Species (CFTS) now dominating the char lands

Table 8: CFTS domination percentage by functional beneficiaries in char lands

Tree	Serviceman	Consumer	Tec person	Mean
	Literate	Farmer	Professional	
Mander	30	20	21	23.7
Cassia	36	21	20	25.7
Kapok	16	17	15	16.0
Bamboo	65	70	59	64.7
Jarul	5	4	8	5.7
Pitraj	11	13	16	13.3
Gliricidia	13	15	21	16.3
Sisso	63	67	66	65.3
Coconut	18	22	19	19.7
Betelnut	63	63	69	65.0
Neem	68	75	74	72.3
Palmyra Palm	27	26	27	26.7
Telikadom	21	26	29	25.3
Mahogoni	42	39	48	43.0
Date palm	12	16	12	13.3
Mean	32.7	32.9	33.6	33.1

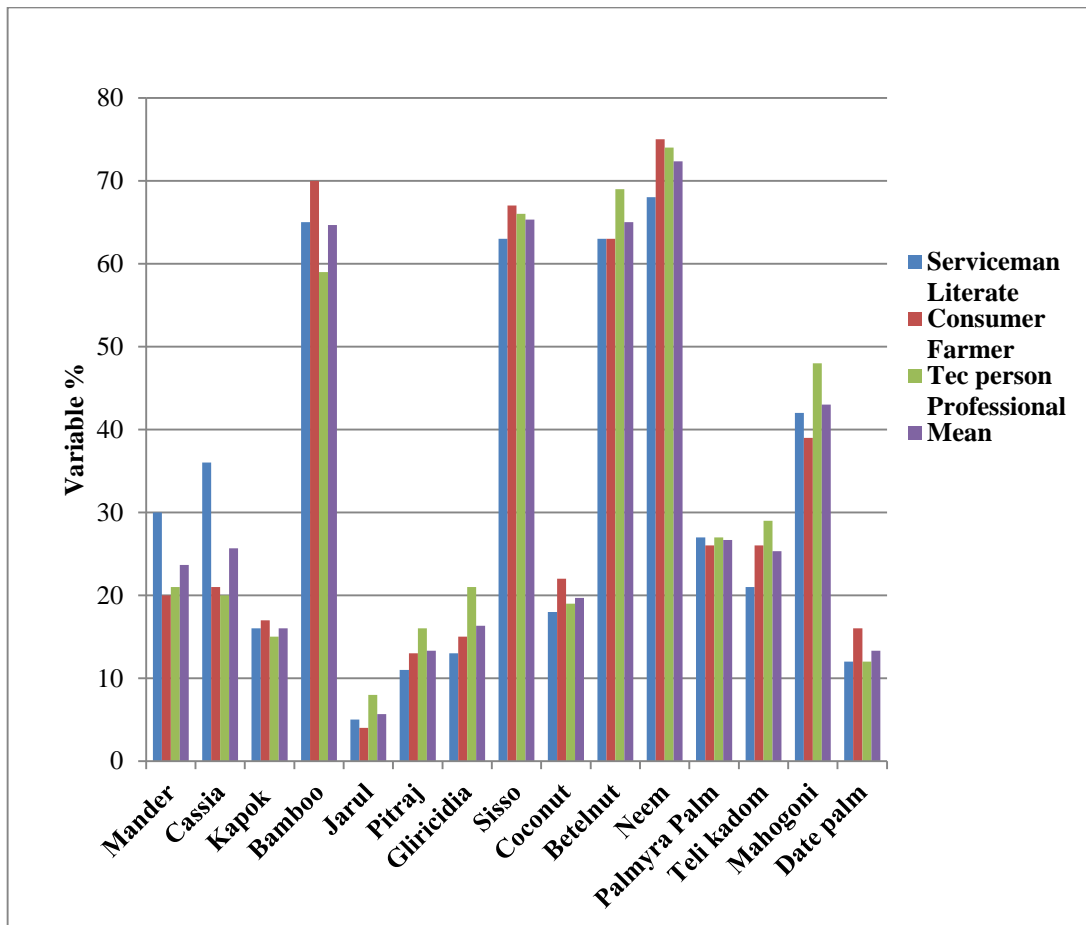


Figure 9: CFTS domination percentage in char lands

Table 9: CFTS domination percentage by level in char lands

Tree	National level	Regional level	Local level	Mean
Mander	23	23	25	23.7
Cassia	25	22	30	25.7
Kapok	11	18	19	16.0
Bamboo	59	65	70	64.7
Jarul	7	8	2	5.7
Pitraj	11	16	13	13.3
Gliricidia	15	13	21	16.3
Sisso	68	66	62	65.3
Coconut	26	15	18	19.7
Betelnut	70	65	60	65.0
Neem	74	69	74	72.3
Palmyra Palm	30	26	24	26.7
Telikadom	26	27	23	25.3
Mahogoni	44	44	41	43.0
Date palm	15	14	11	13.3
Mean	33.6	32.7	32.9	33.1

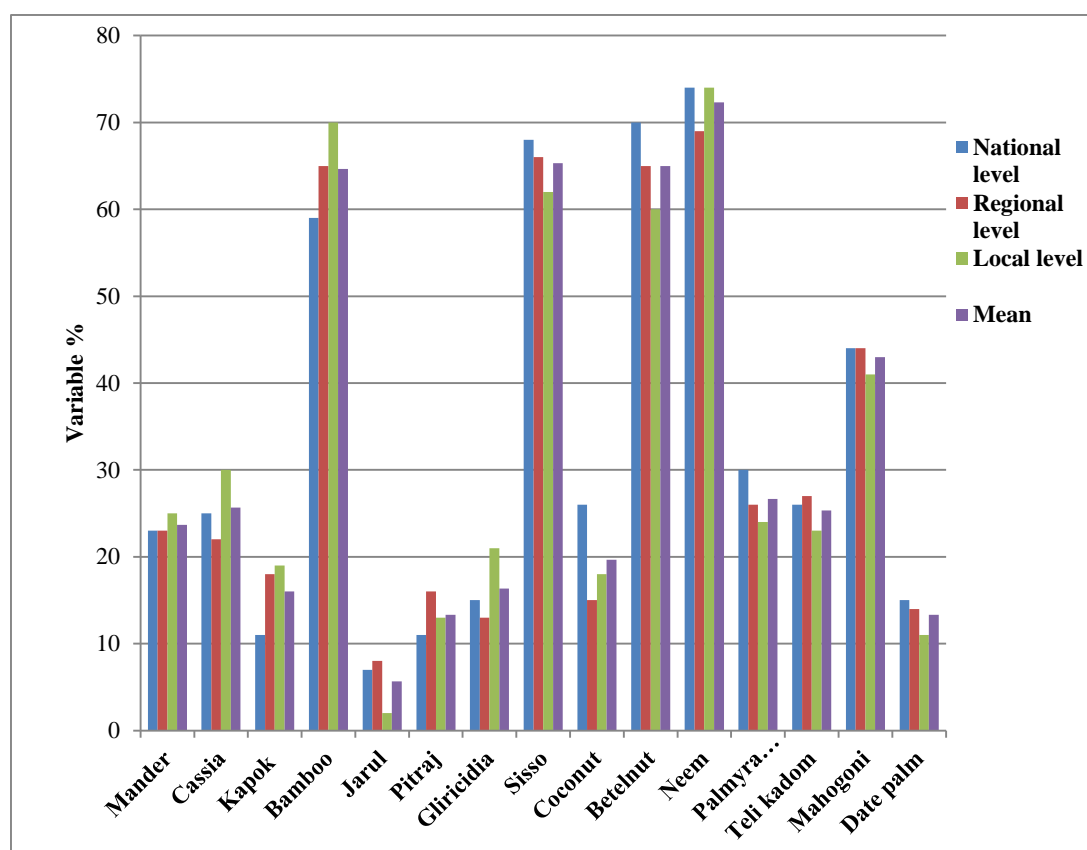


Figure 10: CFTS domination percentage by level in char lands

The results given in table 8 & 9 and figure 9 & 10 found the Community Forest Tree Species domination show neem (72%), bamboo, sisso, betelnut (65%). The less dominant tree is jarul (6%).

SUMMARY

The findings of this research entitled 'Studies on the Agroforestry species Systems of the Charlands of Bangladesh' are summarized here.

1. The production systems in chars and allied land are agro-based with profound culturing of trees where potential of its development with rearing of animals is immense. The present study has been undertaken to explore the agroforestry and environmental systems and their improvement or development in charlands of Bangladesh.
2. The general reason as stated by the respondents that trees requirement safe at least six month aerobic soil are favored in charlands.
3. National & local level respondents are of diverse opinion regarding introduction of fruit species in char lands.
4. In case of community forest tree species Neem in top of the dominance and less dominant is jarul. In case of crop species sweet gourd is in top of the dominance and less dominant is jute. The results of studies show sharp variation in the existing and preferred species for char agricultural lands.

RECOMMENDATIONS

Considering the environmental aspects and production systems followings are recommendations for char lands:

1. Short duration sandy soil loving crops are to be introduced with required improvement.
2. Mixed tree species systems are likely to be promising and adopted in this area.
3. In the Charland Agroforestry technical package should be formulated considering the local Agro-Ecological requirements.
4. Emphasis must be given to indigenous species and indigenous practices for Agroforestry production systems in the charlands of Bangladesh.

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BIOGRAPHIES

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Dr. Md. Sadrul Amin Khan is a development professional has proven experience in the field of Agriculture & Environmental Science in different Institution since 1986. Presently he is working American Independent University, California, USA (Bangladesh Center) as Professor, Department of Environmental Science & Chairman, Department of Research and Development. Dr. Amin is engaged in research activities throughout his professional career more than 46 years and participated many international conferences and seminars in home and abroad. He is the member of Education Commission Academic Council, Regent Board, Selection Committee, Planning and Finance Committee HSTU and Life Member of Krishibid Institution Bangladesh.