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## Transformative Harvests: Agricultural Diversification and Economic Resilience in the Chattogram Hill Tracts of Bangladesh

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### ARTICLE

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### ABSTRACT

This study investigates the scope, diversity, and economic potential of crop and fruit cultivation in the Chattogram Hill Tracts (CHT) of Bangladesh, focusing on Baghaichari Upazila in the Rangamati district. Using a sample of 102 households, the research employs both descriptive and econometric analyses to evaluate how agricultural diversification influences productivity, yield, and environmental sustainability. Primary data collected through structured questionnaires, complemented by secondary sources, were analyzed using regression models to determine the factors affecting production outcomes. The findings reveal that paddy and litchi are the most profitable crops, while mango shows notable potential for future expansion. The region's varied agroclimatic conditions enable the cultivation of a wide range of fruits and crops such as citrus, turmeric, ginger, banana, dragon fruit, mustard, and pineapple. However, the study also highlights environmental challenges including soil erosion and biodiversity loss associated with shifting cultivation and monocropping practices. Regression results indicate that family income and farm size significantly influence paddy and mango production, while farming experience and machinery ownership have substantial effects on litchi output. The research underscores the need for sustainable farming practices, technological adaptation, and supportive government policies to balance productivity with environmental preservation. By emphasizing crop diversification as a strategy for economic resilience, this study contributes to understanding how sustainable agricultural transformation can enhance livelihoods and ecological balance in the CHT region.

### 1. Introduction

The Chattogram Hill Tracts (CHT) in Bangladesh, a biocultural diversity hotspot, have seen a significant economic transformation through agricultural diversification. Historically reliant on traditional subsistence farming, the region now cultivates a variety of crops and fruits, including tangerine, mango, litchi, and more. This shift has not only boosted agricultural productivity but also contributed to regional economic growth and social development (Saha, 2025; Saha, 2023). The CHT's geographical and climatic diversity has facilitated this transition, offering opportunities for high-value crop cultivation. Surplus production has created export opportunities, further enhancing economic prospects and living standards in the area.

Agriculture remains the backbone of Bangladesh's economy, supporting livelihoods, ensuring food security, and contributing significantly to GDP and employment.

Within this national context, the Chattogram Hill Tracts (CHT)—comprising the districts of Rangamati, Khagrachhari, and Bandarban—represent a region of immense ecological and economic significance. Characterized by rugged topography, diverse climatic conditions, and rich biodiversity, the CHT has historically been dependent on traditional subsistence farming practices such as shifting cultivation or jhum. While jhum holds deep cultural and historical value among indigenous communities, its unsustainable continuation has contributed to land degradation, deforestation, and declining soil fertility. Consequently, there is a growing need to transition toward more sustainable and diversified agricultural systems that can simultaneously promote economic resilience and environmental stability.

Agricultural diversification—the process of cultivating a wider range of crops and integrating high-value fruits and vegetables into farming systems—has emerged as

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a powerful tool for sustainable rural development. In regions like the CHT, diversification not only improves food and nutrition security but also enhances income opportunities by reducing farmers' dependence on a single crop or market. The shift toward cultivating high-value crops such as mango, litchi, pineapple, citrus, ginger, turmeric, and dragon fruit has opened new avenues for market expansion, rural employment, and value addition. This transformation aligns with Bangladesh's broader development goals, including poverty reduction, export growth, and environmental conservation.

However, the potential of agricultural diversification in the CHT is not yet fully realized due to a combination of socioeconomic, infrastructural, and environmental challenges. Limited access to technology, inadequate transportation networks, market inefficiencies, and the persistence of traditional practices have constrained productivity and profitability. Moreover, environmental degradation resulting from monocropping, tobacco cultivation, and deforestation threatens the long-term viability of agriculture in the region. Understanding how crop and fruit diversification influences yield, income, and sustainability is therefore essential for designing effective agricultural and environmental policies.

This study aims to examine the relationship between agricultural diversification and economic resilience in Baghaichari Upazila of Rangamati district. Specifically, it evaluates how variations in crop and fruit cultivation affect productivity, profitability, and environmental health. Using both descriptive and econometric analyses, including regression modeling based on primary data from 102 households, the research identifies key factors influencing production decisions—such as farm size, income, farming experience, access to machinery, and proximity to markets. The study further explores how diversification can serve as an adaptive response to climatic variability and market uncertainty.

The significance of this research extends beyond local economic implications. It contributes to the national discourse on sustainable agriculture and rural transformation by offering evidence-based insights into the CHT's evolving agricultural landscape. Furthermore, it aligns with Bangladesh's commitments to the United Nations Sustainable Development Goals (SDGs), particularly those related to poverty alleviation, sustainable resource management, and climate resilience.

In essence, this study seeks to bridge the gap between environmental conservation and economic development. By analyzing the dynamics of agricultural diversification, it aims to provide a framework for sustainable farming that ensures livelihood security, promotes ecological balance, and enhances the long-term resilience of rural communities in the Chattogram Hill Tracts.

A lot of research has been done on crop diversity; studies have looked at how it affects agricultural growth, income, and overall productivity (Lubna & Saha, 2024; Saha, 2022;

Rahman, 2009) Explains the benefits of crop diversity as a growth strategy for agriculture and highlights possible economic ramifications (Rahman, 2009). Moreover, Clements, Hagggar, Quezada, and Torres have emphasized the link between crop diversification and the substitution of high-value commodities, especially fruits and vegetables for the export market, for low-value commodities (Feliciano, 2019). This shows that crop diversity can significantly increase the market value of agricultural products. Additionally, Coelli & Fleming (2004) emphasize how factor productivity and crop production efficiency are impacted by diversification into commercial agriculture, especially in smallholder farming settings Coelli & Fleming (2004). The impact of crop diversification on farmers' decisions and income has also been a subject of investigation (Alam et al., 2020; Devi & Sharma, 2022). found that small farmers were more inclined to grow fruits, oilseeds, and fibers in areas where it was difficult to set up irrigation infrastructure in order to meet their financial needs. This suggests that crop diversity may have positive economic effects for farmers (Saha, 2025; Devi & Sharma, 2022; Saha & Jeong, 2019). Additionally, the financial effect of crop diversity on revenue among households has been demonstrated in the context of North-East India, indicating its potential contribution to economic growth (Priscilla, Sharma, and Kar, 2021; Dey & Saha, 2025; Saha, 2013). Furthermore, the potential of crop diversification to promote economic growth and reduce economic volatility has been highlighted in the context of low-income countries and small states (Lee & Zhang, 2019; Lubna & Saha, 2024; Biswas et al., 2025). To sum up, this article offers strong evidence of how crop diversity affects the economy, covering areas like household income, agricultural growth, and economic growth. These results demonstrate the importance of crop diversity as a tactic with a wide range of economic implications.

## 2. Literature Review

The Chattogram Hill Tracts (CHT) in Bangladesh present unique agricultural challenges and opportunities. Shifting cultivation (jhum) is traditional but unsustainable due to shortened fallow periods and technological constraints, necessitating modern cultivation methods for long-term viability (Rahman et al., 2021). Agroforestry and crop diversification emerge as practical strategies for soil conservation and enhancing land productivity, thereby promoting socioeconomic growth (Saha, 2024; Rahman et al., 2021).

Hossain et al. (2020) identify various modern farming systems in the CHT, including multi-storey fruit gardens (MSFG) and multi-strata agroforestry systems (MAFS). These methods are increasingly adopted by both indigenous and Bengali farmers, demonstrating higher rice yields in valleys compared to traditional shifting agriculture.

Alam and Alam (2020) emphasize the significance of traditional underutilized food plants and suggest

strategies for sustainable hill farming, integrating jhum, plough cultivation, and mixed fruit gardening, which remains vital for indigenous livelihoods.

Crop diversification is crucial for agricultural growth and economic benefits. Studies indicate that it enhances productivity, stabilizes income, and reduces environmental impacts (Akter et al., 2024; Dessie et al., 2019; Hufnagel et al., 2020). However, mixed results exist regarding its impact on household income and food security, with some studies showing significant benefits and others indicating minimal effects (Akhi et al., 2024; Oh et al., 2022; Aheibam et al., 2023).

Economic analyses reveal diversification's potential in reducing income risks and promoting sustainable agricultural practices (Venkatesh et al., 2021; Asante et al., 2019; Poly et al., 2025). The importance of diversification in achieving Sustainable Development Goals, such as "No Poverty," is also highlighted, noting its broader effects on nutrition, food security, gender equity, and climate change resilience (Feliciano, 2019; Shoron et al., 2025).

The topic is important because agricultural diversification in the Chattogram Hill Tracts (CHT) plays a vital role in enhancing economic resilience, food security, and environmental sustainability. The region's dependence on traditional shifting cultivation has led to soil erosion, declining productivity, and ecological degradation. By exploring diversified crop and fruit production, this study addresses how sustainable agricultural practices can improve farmers' income, reduce poverty, and mitigate environmental challenges. Understanding these dynamics is essential for formulating effective rural development policies, promoting sustainable livelihoods, and achieving national and global goals such as poverty reduction and climate resilience (Saha & Hasan, 2013).

The Chattogram Hill Tracts (CHT) region of Bangladesh occupies a unique position in the nation's agricultural and ecological landscape due to its distinctive topography, climatic diversity, and sociocultural composition. This study holds significant value as it systematically explores how agricultural diversification contributes to both economic resilience and environmental sustainability in one of the most ecologically sensitive and economically marginalized regions of the country. Historically, the CHT has relied heavily on traditional shifting cultivation (Jhum), a practice that, while culturally rooted, has led to soil erosion, biodiversity loss, and declining agricultural productivity. The present research provides empirical evidence on how transitioning from monocropping and jhum-based agriculture to diversified crop and fruit cultivation can enhance productivity, stabilize income, and promote long-term ecological balance.

From an economic perspective, the study is crucial in highlighting diversification as a strategy to reduce income volatility and enhance rural livelihoods. By examining the profitability of high-value crops such as paddy, litchi, and mango, the research identifies viable options for

smallholder farmers to increase income and improve food security. The results also underline the importance of key determinants—such as farm size, household income, farming experience, and access to machinery—in shaping farmers' production decisions. These insights provide valuable guidance for policymakers, agricultural extension officers, and development practitioners seeking to design targeted interventions that foster inclusive rural development.

Environmentally, the study's findings stress the urgency of adopting sustainable land management practices in the hilly regions. By comparing the ecological consequences of different cultivation systems, it offers a roadmap for balancing economic growth with environmental conservation. Promoting crop diversity and modern agroforestry practices can help mitigate soil degradation, conserve biodiversity, and support climate resilience, directly aligning with Bangladesh's commitments to the Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

In essence, this research bridges the gap between economic aspirations and environmental imperatives in the CHT. Its significance lies in its ability to inform sustainable agricultural policies, empower local farming communities, and contribute to the broader discourse on rural transformation and ecological stewardship in developing economies.

### **3. Diverse Production of Crops and Fruits in CHT Bangladesh**

The Chattogram Hill Tracts (CHT) feature hills and valleys, where valley farmers grow paddy, vegetables, and fruits, and hill farmers practice jhum and fruit horticulture. While some hill farmers continue jhum, most have shifted to forestry and horticulture. Traditionally reliant on subsistence farming, primarily rice, the CHT economy has benefited from crop diversification. Introducing various fruits and crops, including tangerine, mango, litchi, pineapple, banana, citrus, ginger, turmeric, paddy, mustard oil, betel nuts, tobacco, and vegetables, has boosted agricultural productivity and the regional economy. The hilly areas hold significant potential for cultivating high-value crops like fruits, vegetables, aromatic, and medicinal plants through agroforestry.

#### **3.1 Chattogram Hill Tracts is the new fruit hub**

The Chattogram Hill Tracts (CHT), which include the Bandarban, Khagrachhari, and Rangamati districts, cover one-tenth of Bangladesh's area and are critical to agricultural development.

The region, with its abundant natural resources and rising population, presents food and nutrition security issues. Horticulture dominates hill agriculture, and the CHT has recently emerged as a major fruit hub, producing 44 different fruit varieties and accounting for approximately 15% of the nation's total fruit production. In 2017,

approximately 92,000 hectares produced 1.559 million tons of fruits, a 15% increase in four years to 1.8 million tons. The fruit market is worth around Tk 8,500 crores, with 99,669 hectares under cultivation. Eighteen fruits, including mango, jackfruit, banana, papaya, pineapple, and orange, account for 81% of production, with 14,67,594 tons produced. In addition, 38 other fruits are grown, including dragon fruit, cashew nuts, coffee, and olives. According to the Department of Agricultural Extension (2022), 99,67.5 hectares produced 16,85,529 tons of fruits in 2020-21, worth more than Tk 1,807.42 crore. Mango production alone spanned 14,538 hectares, producing 1,64,804 tons worth Tk 164.6 crore. Jackfruit, lychee, banana, and guava are also major contributors. Jhum cultivation includes crops like paddy, pumpkin, cotton, beans, and maize, while valley lands grow high-value crops like paddy and vegetables.

The region is also seeing a rise in coffee and cashew nut cultivation, with 2,027 hectares planted in 2020-21, reflecting a significant increase in cashew nut production and imports. Encouraging profitable crops can reduce tobacco farming and support sustainable agricultural development. Rasul and Tripura (2016) note that cultivating turmeric and ginger on hill slopes has significantly improved the standard of living for tribes in the Chattogram Hill Tracts (CHT), stabilizing their economies. Hossain et al. (2020) add that turmeric is particularly profitable, prompting almost all traditional farmers to grow it. In the CHT, 8,000 hectares yield nearly 50,000 metric tons of fresh ginger and turmeric annually. Tobacco, a major cash crop, has been cultivated intensively since around 1990 with support from regional and international businesses. Currently, eight international companies incentivize tobacco farming, engaging at least 7,000 farmers (Ullah and Shamsuddoha, 2014). In 2017-18, 3,918 hectares in the CHT and Cox's Bazar districts produced 6,326 metric tons of tobacco, with 2,660 hectares in Bandarban alone (BBS, 2019). Tobacco is planted from October to November and harvested from April to May.

#### 4. Methodology and Research Design

The research was done in the Rangamati region of Chattogram Hill Tracts (CHT), located in southeastern Bangladesh. The Chakmas are the dominant group in the Rangamati district among 12 distinct sociolinguistic groups. The region differs geographically from the lowlands in that it is made up of highly steep, rocky, hilly terrain and dense bamboo rainforest. The rugged terrain, isolation of settlements, and numerous unsolved challenges have hampered the economic growth of the region. Households in the Chattogram Hill Tracts (CHT) are highly dependent on agriculture, where 50-75% rely on crops, livestock, fisheries, etc. as their primary source of income.

##### 4.1 Data collection method

The research is grounded in primary as well as secondary

data. Based on the patterns of the crops, this study uses both qualitative and quantitative methodologies in its descriptive analytical investigation of the effect of crop and fruit diversification on the overall agricultural output in terms of yield, productivity, and production volume, the sustainable model for the hilly area, and to evaluate the environmental impact, including factors like soil health and biodiversity conservation, arising from crop diversification practices. Secondary data are gathered from secondary sources, such as secondary journal research and papers. A structured questionnaire is used to collect primary data from 102 families from Baghaichari Upazila in the Rangamati district. The questionnaire is meant to collect information using stratified random sampling.

A structured questionnaire is used to collect primary data from 102 families from Baghaichari Upazila in the Rangamati district. The questionnaire is meant to collect information using stratified random sampling. Microsoft Excel has been used to hold the data from many kind of analysis, as well as the graphs, diagrams, and tables that come from primary and secondary sources.

#### 5. Results Analysis and Discussion

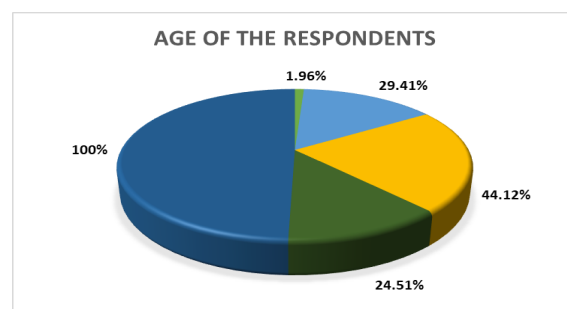
Based on the brief survey, descriptive analysis discussed in the below through the some table and figure.



Figure 2: Map of Rangamati District

##### Age of the respondents

The figure indicates that out of 102 respondents, 1.96% are up to 20 years old, 29.41% are (31-40), 44.12% are (41-50), and 24.51% are over 50.



### Gender of the respondents

The percentage of male and female respondents is given in the following pie chart. From the figure, it is seen that, of the the total 102 respondents, 89% are male respondents and 11% are female. We can see that most of the respondents are male because Bangladesh is a patriarchal country, and the respondents are Chakma, who are also patriarchal.

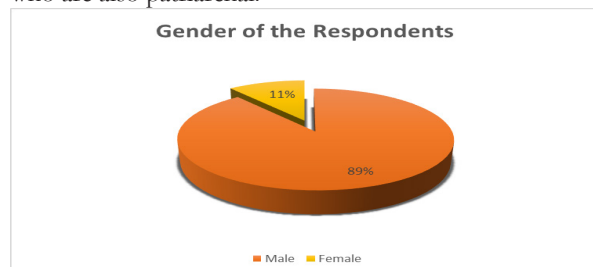


Figure 4: Gender of the respondents

### The education level of the respondents

Based on the research of 102 respondents, the educational backgrounds are categorized into: no education, primary, secondary, SSC, HSC, and undergraduate and above. The frequencies are 0, 15, 38, 33, and 16, with percentages shown in Table. Notably, the average literacy rate is 72.9% in Bangladesh and 73% among the Chakma, with no respondents found for any education level.

Education Level	Frequency	Percentage (%)
No education	0	0
Primary	15	14.71
Secondary to SSC	38	37.25
HSC	33	32.35
Undergraduate and above	16	15.69
<b>Total</b>	<b>102</b>	<b>100</b>

Table 1: Education of the respondents

Here is a pie chart representing the educational status of respondents: This pie chart also described the education level of the 102 respondents

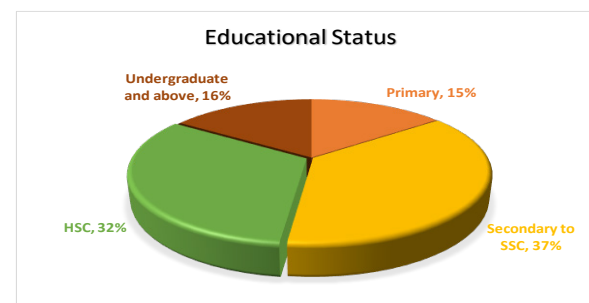


Figure 5: Educational status of the respondents

### Family size of the respondents

The respondents' household size is displayed in the following table. This table shows the percentage of the respondents

Family size (members)	Frequency	Percentage (%)
2-4	76	74.50
5-7	26	25.5
>7	0	0
<b>Total</b>	<b>102</b>	<b>100</b>

Table 2: Family size

### Source: Survey Data (2023)

The table shows that 74.50% of respondents (76 family members) are at (2-4), 25.5% of (respondents 26 family members) are at (5-7), and >7 at this level is zero.

### Income of the respondents

Family income (monthly)	Frequency	Percentage (%)
0-5000	3	2.94
5000-10000	28	27.45
10000-20000	32	31.37
20000-above	39	38.24
<b>Total</b>	<b>102</b>	<b>100</b>

Table 3: Income of the respondents

### Source: Survey Data (2023)

The income ratio of the 102 respondents as a whole is displayed in the following table. This table shows the monthly family income of the respondents. From the table, 2.94% at (0-5000), 27.45% at (5000-10000), 31.37% at (10000-20000), and 38.24% at (20000-above) are the results that we can observe.

### Occupation of the respondents

Occupation	Frequency	Percentage (%)
Govt	22	21.57
Non-Govt	13	12.75
Farmer	56	54.90
Others	11	10.78
<b>Total</b>	<b>102</b>	<b>100</b>

Source: Survey Data (2023)

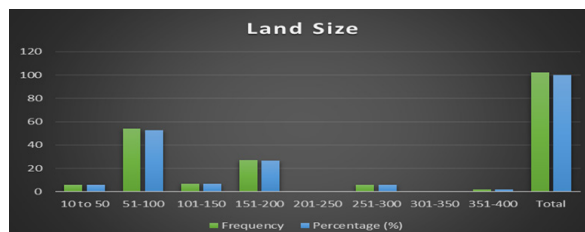


Figure 6: Land size

### Land Size of the respondents

The following bar diagram shows the respondents' land ratio:

According to the diagram, six families have decimals for land size ranging from (10-50), 54 families have decimals ranging from (51-100), 7 families have decimals ranging from (101-150), 27 families have decimals ranging from (151-200), 6 families have decimals ranging from (251-300), and 2 families have decimals ranging from (351-400). Here we can see that most of the families have a frequency at (51-100).

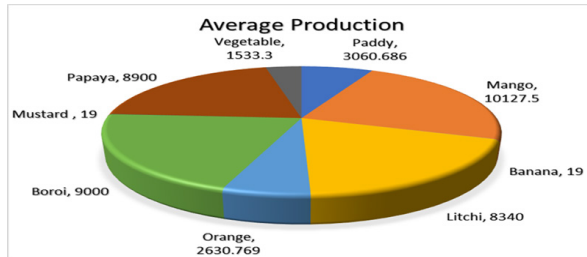


Figure 7: Average Production

#### Cultivation Ratio

This table shows the various crops grown on jhum land during the year or season. Paddy, maize, bananas, papaya, litchi, mango, and vegetables are among the most often-grown crops. Most farmers here grow bananas, paddy, mangos, and vegetables. From the respondents, we found the crops and fruits in the below table. In table 5, we estimate the average area and the average production of the crops and fruits. In Baghaichari Upazila mostly produces mango, whose average production is 10127.5 kg. Following that, the following are the production figures: 9000 kg for boroi, 8900 kg for papaya, 8340 kg for litchi, 3060.686 kg for paddy, 2630.769 kg for oranges, 1533.3 kg for vegetables, 19 tons for bananas, and 19 tons for mustard. It showed that only a small portion of the research area's land was used for crop cultivation. Here is the table representing the cultivation status of respondents:

The research area's crop cultivation used less land than anticipated. Crop cultivation in the research area took up less land than expected. The mountainous terrain at the research location may contribute to this phenomenon. The mountainous terrain at the research location may contribute to this phenomenon. Respondents found it challenging to cultivate additional agricultural crops. The study suggests that participants should focus on cultivating more diverse horticultural crops to increase production volume.

Crops (kg)	Average Area (decimal)	Average Production (kg)
Paddy	129.49	3060.686
Mango	33.605	10127.5
Banana (ton)	54	19 (ton)
Litchi	29.58	8340
Orange	20.71	2630.769
Boroi	26	9000

Mustard (maund)	154	19 (maund)
Papaya	45	8900
Vegetable	73.33	1533.3

Table 5: Cultivation Ratio

Source: Survey Data (2023)

#### Farming experience and Farm to market distance

In the survey, the respondent's farming experience was also measured. Here in the following table 6, we can see that most of the respondents' farming experience is (5-10) years 31.37%, (10-20) years 42.2%, (20-30) years 14.71%, (30-40) years 7.84%, and the last (40-50) years 3.92%.

5-10	32	31.37
10-20	43	42.2
20-30	15	14.71
30-40	8	7.84
40-50	4	3.92
Total	102	100

Table 6: Farming experience

Source: Survey Data (2023)

In the table 7 that follows, respondents farm to market distance also estimated:

Respondents farm to market distance is from 1 to 9 kilometers only. The distance is not so great. That's why the respondents don't have to think about the transportation system. Basically, the majority of the outputs are sold whole on the local market. The respondents of the survey transport their goods easily by boat, mini-truck or auto. Therefore, because of the short distance, the transportation cost is not costly.

Farm to market distance (km)	Frequency	Percentage (%)
0-1	4	3.92
2-3	34	33.33
4-5	48	47.06
6-7	9	8.82
8-9	7	6.86
Total	102	100

Table 7: Farm to market distance

Source: Survey Data (2023)

#### Impact of Hill Agriculture on Environment

Due to deforestation and burning, shifting cultivation and plough agriculture on sloping lands cause land degradation, forest degradation, and biodiversity loss in hilly regions. The environment is disturbed as a result. In hilly areas, plow cultivation and tobacco growing are the methods that pose the greatest danger to the environment, forests, and agricultural practices. Growing

tobacco depletes the fertility of the soil and makes it challenging to grow other crops on the same plot of land. Because it reduces the options available to farmers for crop production, this threatens agro-biodiversity. Chakma and Nahar (2012) highlighted the harm that jhum farming causes to the environment. are as follows:

- Loss of forest area (deforestation)
- Increase landslide
- Loss of animal biodiversity
- Loss of plant biodiversity
- Increase temperature
- Decrease environmental balance
- Decrease biomass and soil carbon storage
- Source of forest fire
- Decrease soil productivity
- Loss of the top-soil

Extensive farming activities, intensive spading, burning, earthing up, slush, and crop cultivation down the slope all caused soil erosion on the hillside. The monoculture of rubber plants, aroids, ginger, pineapple, turmeric, and other crops has made soil erosion and runoff worse by depleting vital nutrients and biodiversity (Erni, Khisa, and Mohiuddin, 2015).

During the monsoon season, excessive rainfall promotes soil erosion on sloping terrain cleared for Jhum, leaving it naked or partially covered with seedlings. In CHTs, annual cultivation of crops without mulching resulted in the highest soil loss (99.15 t ha<sup>-1</sup> yr.<sup>-1</sup>), followed by shifting cultivation (41.23 t ha<sup>-1</sup> yr.<sup>-1</sup>), while agroforestry and orcharding had the lowest soil loss (10 t ha<sup>-1</sup> yr.<sup>-1</sup>). According to (Hossain et al., 2020), factors like rainfall, slope length, land management techniques, and plant cover density affect soil loss.

Land use		Average soil Loss (t ha <sup>-1</sup> yr. <sup>-1</sup> )	Natural rate of soil formation (t ha <sup>-1</sup> yr. <sup>-1</sup> )	Net soil Loss (t ha <sup>-1</sup> yr. <sup>-1</sup> )
<b>Annual crops: mainly root crops such as Ginger, Turmeric, Mukhikachu</b>	Conventional tillage: hoeing without mulch	99.15	15	-84.15
	Conventional tillage: hoeing with mulch	35.16	15	-20.16
<b>Pineapple</b>		18.05	15	-3.05
<b>Pineapple</b>		18.05	15	-3.05
<b>Shifting Cultivation</b>		41.23	15	-26.23

Table 8: Soil erosion under different agricultural land use system in CHTs

Source: Khan and Alam, 2015; Rasul., 2009.(Hossain et al., 2020)

The contribution of the selected characteristics of the respondents to their perceptions towards the diversification of crops and fruit production

Out of the 17 variables that could be used, three (paddy, mango, and litchi production) were chosen as dependent

variables and six (individual full-model regression analysis) as independent variables. This was done to find out what factors affect farmers' views on crop and fruit production diversification. Family income and the size of the respondents' farms were found to have a substantial influence on paddy production in the first study. (Table 9).

The R-square seems to indicate that the model has good fitness. The coefficient of multiple

SL. No.	Variable	Coefficient (β)	Standard Error	t-value	p
01.	Farm to market distance (km)	0.025	0.049	0.50	0.617
02.	Farming experience	0.041	0.038	1.08	0.284
03.	Machinery owned	0.066	0.041	1.59	0.114
04.	Family income	0.101*	0.051	1.97	0.052
05.	Farm size (decimal)	0.209**	0.024	8.83	0.000
06.	Educational status	-0.053	0.049	-1.07	0.285

Table 9: Contribution of selected characteristics of the respondents to their perceptions towards paddy production

R2=0.5469

Adjusted R2=0.5173

F=18.51

Prob > F = 0.0000

determination,  $R^2$ , is 0.5469 for the model. This means that explanatory variables in the model explained about 54.69% of the variation in respondents' attitudes. The adjusted  $R^2$  (which is the measure of goodness of fit of the estimated regression model) value of 0.5173 indicated a good fit of the model. In regression analysis, family income showed a borderline significant and positive influence on respondents' perceptions towards paddy production (Table 9). The value of regression coefficient (0.101) was significant at the 0.05 level. The regression coefficient of 0.101 implied that for every unit increase in family income, there was a corresponding 0.101-unit increase in the overall attitude of the respondents towards paddy production. The farm size of the respondents exhibited a very low p-value (0.000), indicating a highly statistically significant and positive influence on respondents' perceptions towards paddy production. The value of the regression coefficient of (0.209) was significant at the 0.05 level. The regression coefficient 0.209 implied that for every unit increase in farm size, there was a corresponding 0.209-unit increase

in the overall attitude of the respondents towards paddy production. So we see that the model has an F-statistic of 18.51 with a p-value of 0.0000, indicating that the overall model is statistically significant.

In this second analysis for mango production, it was also found that the paddy production family income and farm size of the respondents were found to have significant influence (Table 10). The model has an F-statistic of 2.01 with a p-value of 0.0903, indicating that the overall model is not statistically significant at the conventional 0.05 significance level. However, it is close to the threshold, and some researchers might consider it significant at a higher significance level. The coefficient of multiple determination,  $R^2$ , is 0.2565 for the model. This means that the explanatory variables in the model explained about 25.65% of the variation in respondents' attitudes. The adjusted  $R^2$  value of 0.1290 indicated a good fit for the model. In regression analysis, family income showed a coefficient of 0.590, and the p-value is 0.015. It is statistically significant at the

SL. No.	Variable	Coefficient ( $\beta$ )	Standard Error	t-value	p
01.	Farm to market distance (km)	0.081	0.177	0.46	0.649
02.	Farming experience	-0.026	0.126	-0.21	0.835
03.	Machinery owned	-0.080	0.201	-0.40	0.692
04.	Family income	0.590**	0.229	2.57	0.015
05.	Farm size (decimal)	0.193*	0.087	2.23	0.032
06.	Educational status	-0.199	0.183	-1.08	0.286

Table 10: Contribution of selected characteristics of the respondents on their perception towards mango production

**$R^2=0.2565$  Adjusted  $R^2=0.1290$  F=2.01**  
 .05 significance level. The regression coefficient of 0.590 implied that for every unit increase in family income, there was a corresponding 0.590-unit increase in the overall attitude of the respondents towards mango production. The p-value is 0.032, and the coefficient for farm size is 0.193, suggesting statistical significance at the 0.05 level. The regression coefficient of 0.193 implied that for every unit increase in farm size, there was a corresponding 0.193-unit increase in the overall attitude of the respondents towards mango production. The overall model is not statistically significant at the 0.05 level, but it is close to being significant at the 0.10 significance level. The individual variables family income and farm size decimal are statistically significant predictors of mango at the 0.05 significance level. Other variables do not show statistically significant relationships with the dependent variable in this model. In the last analysis for litchi production, it was found that among the individual variables, farming experience and machinery owned are statistically significant predictors at the 0.05 level.

**Prob > F = 0.0903**

Farm to market distance and farm size show marginal significance (Table 9). The model has an F-statistic of 3.55 with a p-value of 0.0239, indicating that the overall model is statistically significant at the conventional 0.05 significance level. The R-square seems to indicate that the model has good fitness. The coefficient of multiple determination,  $R^2$ , is 0.6032 for the model. This means that the explanatory variables in the model explained about 60.32% of the variation in respondents' attitudes. The adjusted  $R^2$  value of 0.4332 indicated a good fit for the model.

In regression analysis, farming experience showed a coefficient of -0.164, and the p-value is 0.041. It is statistically significant at the 0.05 significance level and has a negative influence on respondents' perceptions towards litchi production. The regression coefficient of -0.164 implied that for every unit decrease in farming experience, there was a corresponding -0.164-unit decrease in the overall attitude of the respondents towards

litchi production. Machinery owned by the respondents exhibited a very low p-value (0.001), indicating a highly statistically significant and positive influence on respondents' perceptions towards litchi production. The

coefficient is 0.376, and the p-value is 0.001, indicating statistical significance at the 0.05 level. The regression coefficient of 0.376 implied that for every unit increase in machinery owned, there was a

SL. No.	Variable	Coefficient ( $\beta$ )	Standard Error	t-value	p
01.	Farm to market distance (km)	0.153*	0.096	1.60	0.132
02.	Farming experience	-0.164**	0.073	-2.25	0.041
03.	Machinery owned	0.376**	0.089	4.20	0.001
04.	Family income	-0.154	0.135	-1.14	0.273
05.	Farm size (decimal)	0.922*	0.051	1.81	0.092
06.	Educational status	0.061	0.093	0.65	0.527

Table 5.12 Contribution of selected characteristics of the respondents to their perceptions towards litchi production

R<sup>2</sup>=0.6032      Adjusted R<sup>2</sup>=0.4332      F=3.55      Prob > F = 0.0239

Corresponding 0.376-unit increase in the overall attitude of the respondents towards litchi production. The farm to market distance of the respondents showed a coefficient of 0.153, and the p-value is 0.132, suggesting that this variable is not statistically significant at the conventional significance level (0.05). And the farm size of the respondents exhibited a coefficient of 0.092, and the p-value is 0.092, indicating marginal significance (0.05 < p < 0.10).

**Conclusion and Policy Recommendations**

The study reveals the wide variety of fruits and crops grown in the Chattogram Hill Tracts (CHT), particularly in Baghaichari Upazila, Rangamati district. The data highlights how agricultural diversification has a favorable economic impact, especially when it comes to yield, productivity, and production volume. It also draws attention to the negative environmental effects of shifting agriculture and monocropping, which significantly destroy soil. This study is being carried out to try and gain a better understanding of how the production of crops and fruits influences material services in Baghaichari Upazila. The study discovered that a number of factors, including easy access to technology, market information, machinery ownership, access to irrigation, proper education, transportation, and water supply, have a significant impact on the production of various crops and fruits. The farm plot owners in the designated survey region do not take out any agricultural loans. The findings indicate the potential for additional improvement and crop choice optimization, even though paddy and litchi farming show promise of profitability and mango cultivation may not be statistically significant. Numerous fruits and vegetables, including citrus fruits, ginger, turmeric, dragon fruit, and others, provide significant contributions to the region's agricultural productivity and economic health. The CHT's natural capacity to sustain a range of crops is credited with the shift from

monoculture to diversified agriculture in the area. But the report also highlights worries about the detrimental effects of tobacco growing on regional ecosystems and the environmental consequences, including soil erosion, that result from antiquated farming methods like slash-and-burn.

**Policy Recommendations:**

**Promotion of Sustainable Farming Practices:**

Encourage farmers to implement sustainable farming methods that prioritize biodiversity preservation and soil health in order to lessen the negative effects of agriculture on the environment. Encourage practices that improve long-term soil fertility and lessen soil erosion.

**Crop Optimization:**

Further research and extension services should be conducted to explore optimal crop choices based on economic viability and environmental sustainability. This could involve promoting crops like paddy and litchi that have shown considerable profitability. **Modernization of Agriculture:** Encourage the adoption of modern farming techniques and technologies to maximize agricultural output while minimizing environmental impact. This could include the use of efficient irrigation systems, organic farming methods, and precision agriculture.

**Community Awareness:**

Raise awareness among the local community about the negative consequences of slash-and-burn farming and tobacco cultivation. Promote alternative practices that are both economically viable and environmentally friendly.

**Government Support:**

Advocate for government policies that support sustainable agriculture and provide incentives for farmers to adopt environmentally friendly practices. This could include subsidies for eco-friendly farming methods and financial support for transitioning to more sustainable crop choices.

In summary, the Chattogram Hill Tracts are rich in

potential for diversified and economically productive agriculture; yet, the long-term viability of the area depends on striking a balance between environmental sustainability and production. A more resilient and ecologically aware agriculture sector in the CHT can result from putting the recommendations mentioned above into practice.

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