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Factors Associated with Shifting Cultivation in Meghalaya: Policy Perspective Probit Approach

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ABSTRACT

In the state of Meghalaya, shifting cultivation is still prevalent in the hilly regions. Although, several policies were framed to wean farmers from the practice to adopt sedentary agricultural practices, the transition was slow. Based on data obtained from 250 farmers, the paper examines the structural base of cultivators and the factors associated with the continuing practice of shifting cultivation. Probit regression model was employed to analyse the effect of different factors that influence farmers' decision to continue slash and burn agriculture Overall, the paper concludes that there were slight differences in the socio-economic characteristics between the two groups of farmers. Notwithstanding the category of households, majority of the respondents were engaged in agriculture and were dependent on this sector to make their ends meet. The results of the probit estimation showed that age and lack of alternative livelihood had significant positive influence on continuation of shifting cultivation while family size, annual per capita income, Government incentives and access to market had negative significant influence. Hence, it reaffirms the role of Government in weaning-off the farmers from shifting cultivation. Agroforestry, forest gardens and home gardens could be considered as promising ventures accompanied with capacity building and development of skills regarding better farming practices and value addition among the community. However, to stand the test of time, policy makers need to make arrangements for survival of the dual economy consisting of traditional *jhum* farming with settled agriculture in the short term while allowing the transition between the systems organically over time providing the space to jhum cultivation under natural farming will prove a better option.

Keywords: Shifting cultivation, factors, probit model, *jhum*, slash, natural farming.

JEL codes: Q15, Q16, Q23

I

INTRODUCTION

Shifting cultivation is a common practice among millions of people in upland areas of South and Southeast Asia in order to meet their demands for livelihood, nutrition, and food security. The area under shifting cultivation varies year to year as the plot size per household is dependent on the size of the family based on the principle of "mouths to feed" (Government of India, 2018; ICIMOD, 2021). Moreover, few studies suggest that the mere adoption of a form of settled agriculture by upland farmers in the *jhum* areas of the NE region does not mean that the same farmers have given up shifting cultivation, as a shifting cultivator may continue the traditional agricultural practice whilst adopting and accommodating multiple settled cultivation practices (Choudhury, 2013; ICIMOD, 2021; Government of India, 2018). This makes the documentation of the area and population dependent on shifting cultivation a daunting task. However, several attempts have been made to collect and estimate the population and the acreage of shifting cultivation. In Asia alone, an estimated 200 million people

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practiced *jhum* in 110 million hectares of land (Karki, 2017, Heinimann *et al.*, 2017). In 2010, the area under shifting cultivation in NE region accounted to be of 8771.62 sq. km which constituted 85 per cent of the total of shifting cultivation area in India (Government of India, 2014).

Shifting cultivation was considered a primitive and economically inefficient system of agricultural practice. Therefore, several policies were formed to wean farmers from the practice and encourage shifting cultivators to adopt cash crops whilst transforming fallows into plantations. Since the 1970s, plantation crops such as rubber, palm trees, coffee, cashew and tea have been encouraged in the *jhum* fallows of South East Asia (Fox *et al*. 2009; Choudhury, 2013; ICIMOD, 2021). In the North East Hill Region (NEHR), the cash crop alternatives include broom grass cultivation in Khasi hills of Meghalaya; floriculture in Mizoram; and passion fruit cultivation in Nagaland, Manipur and Mizoram and cashew nut plantation in the Garo Hills of Meghalaya (Government of India, 2018 and Choudhary, 2012). These transformations were supported by creation of fundamentals such as access to landholdings and markets by the Government as well as the assurance of higher economic returns and assured income.

The people of Meghalaya are mostly agriculturists with more than 80 per cent of the population dependent on it (Government of Meghalaya, 2022). Both settled and shifting agriculture have been practiced by the population (Deb *et al.*, 2013). According to an estimate, about 8400 sq. km. area was under shifting cultivation in North-east India during 2010-11, out of which Meghalaya had a share of 448.99 sq. km., *i.e*., 4.36 per cent of the total geographical area of the state (Government of India, 2018). The total area was again estimated at 237.87 sq. km current *jhum* and 422.68 sq. km abandoned *jhum* in 2015-16 (Government of India, 2019). This depicted the persistence of the practice in the state.

Jhum is mostly practiced in the common lands and the forests. All the forests areas except the reserved forest, protected forests, sacred groves (*Law Kyntang)*, restricted forests *(Law Adong)* and private forests, are mostly subjected to shifting agriculture (Deb *et al.*, 2013). All the tribal communities of Meghalaya are engaged in shifting cultivation at varying levels. The term used for shifting cultivation by the *Lyngngam* sub tribe of *Khasis* is *Rep Lyngkha* and for *Garos* is *A.ba so.a*.

The transition from shifting to settled agricultural system influences the socio-economic as well as the existing agricultural patterns (Erni, 2015). One of the most important socio-economic variables is the level of education and there has been no distinct conclusion as to whether a settled household has higher level of education compared to settled agricultural households. Some studies showed that the most *jhumias* had completed primary schooling however the proportion of graduates in shifting cultivation households was low (Deb *et al.*, 2013; Mathur and Bhattacharya, 2022); whereas Punitha *et al.* (2016) reported a higher proportion of graduates in Manipur. Furthermore, Zaitinvawra and Kanagaraj (2008) concluded in their study that

there was no major difference in the educational status between the *jhumias* and non-*jhumias*.

Though studies on shifting cultivation have been expanding since past few decades in NEHR and other tribal parts of India, these have mainly concentrated on the aspects of biodiversity, ecological sustainability and the impact on livelihood based on secondary sources. Particularly in Meghalaya, few researches have been conducted based on field survey to study the existing proportion of shifting and settled farming systems in the households, the impact on the socio-economic status of native people (Patel *et al*., 2013) and the empirical analysis of the determinants of adoption and continuation of *jhum*.

Furthermore, most jhum farmers have been attached to shifting cultivation due to their desire to increase social bonding and continue to practice the ways of their ancestors (Rasul *et al*., 2004; Pandey *et al*., 2020). As jhum agriculture was extensively practiced, this created more space for a farmer to adopt slash and burn as farmers who diversified into settled agricultural systems did not discontinue shifting cultivation but rather took up additional livelihood activities like growing of horticultural crops, rearing of livestock and other non-agricultural activities. With a multi-cereal resource base made up primarily of upland rice, maize, millet, and other coarse grains, the *jhum* farmers rely heavily on their own production to support their basic needs. However, they have not been able to produce enough in recent years to satisfy their needs all year round (ICIMOD, 2021). Hence, it becomes imperative to shift from subsistence farming system such as *jhum* cultivation to settled systems that are economically more viable and environmentally suitable. Keeping in view the above aspects, this study was conducted with the objectives to understand the socio-economic characteristics of shifting and settled agricultural households and the factors associated with the continuation of shifting cultivation.

II

METHODOLOGY

Data

This study is based on primary data collected through intensive household (HH) surveys, focused group discussions and field observations. Multi-stage sampling technique was adopted to select the study area. In the first stage, a total of 10 villages from four Community and Rural Development (C&RD) blocks covering two districts of Meghalaya were selected. Three villages viz., Maweit, Nongpathar, Lamjew from Nongstoin C&RD block; Langshonthiang, Nongrongdu and Riangju from Mawshynrut C&RD block of West Khasi Hills and two villages each *viz*. Sadolpara, Mangdugre,Chidaogre and Boldamgre from Dadenggiri and Rongram C&RD blocks of West Garo Hills were purposively selected based on the regions with predominant shifting cultivators which were undergoing transitions in regard to land-use practices on prior discussions with the District Agricultural officers (DAO), Block Development Officers (BDOs) and Gram Sevaks. The predominant land use practices in the study

area included *jhum*, settled paddy, plantation crops such as are arecanut, cashew nut, black pepper, broomstick and annual cash crops such as ginger, cotton, chilli, pumpkin, taro and yam.

After the selection of the villages, respondents were selected randomly from the same area ensuring that both the categories of farmers faced similar economic, social, geographical and cultural environments. Data were collected from two types of cultivators to assess the changing agricultural livelihood patterns, one category of farmers who were depending only on *jhum* agriculture and the other who had adopted some form of settled cultivation. Out of the total 250 respondents, 122 households (48.80 per cent) did not diversify into settled activities and were considered in the former category the *jhum* farmers or the shifting cultivators whereas; 128 households (51.20 per cent) belonged to the latter category of settled agriculturists (Mbaga-Semgalawe and Folmer, 2000; Goswami *et al*., 2012; Shehu and Sidique, 2014).

Analytical Technique

Descriptive Analysis

Descriptive statistical tools such as averages and percentages were employed to draw inferences from the data classified into two categories of farmers.

Empirical Analysis and Variables

The analytical model presented in this paper is based on the literature on adoption of a particular agricultural practice. Since, the response dependent variable is a binary one, both logit and probit regression models which accommodate two categories in the dependent variable are suitable. However, for the purpose of this study, probit regression model has been employed to analyse the effect of different factors that influence farmers' decision to continue slash and burn agriculture because it has ability to resolve the problem of heteroscedasticity and it satisfies the assumption of cumulative normal probability distribution (Gujarati, 2004; Kehinde and Adeyemo, 2017). Here, the dependent variable (Y_i) is binary in nature, taking value 1, if a farmer practices *slash and burn* agriculture and 0, if he does not. The probit model can be specified as shown below:

$$Y_i = F(X_i\beta) + \varepsilon_i,\ \varepsilon \sim N(0,1)$$

$$Y_i = \begin{cases} 1, if\ adopted \\ 0, if\ otherwise \end{cases}$$

Where,

ε =error term
β = coefficients of the variables

X_i = vector of explanatory variables

The probability P_i of a farmer practicing *slash and burn* agriculture over not practicing it can be expressed as

$$P_i = \text{prob}[Y_i = 1 \mid X] = \phi\,(X\beta) = \int_{-\infty}^{\beta X} (2\pi)^{-1/2} \exp\left(-z^2/2\right) dz$$

Where,

ϕ=cumulative distribution of a standard normal random variable

Since estimates of the probit model provide only direction of effects, the marginal effects are usually calculated to interpret the actual change in probability of independent variables. The relationship between a specific variable and the outcome of the probability is interpreted by means of the marginal effect, which account for the partial change in the probability. The marginal effect associated with an explanatory variable on the probability P (Y_i = 1 | X), holding the other variables constant, can be derived as follows:

$$\frac{\partial P_i}{\partial X_i} = \varphi(X_i'\beta)\beta_k$$

Where,

φ = Standard normal probability density function

The marginal effect on dummy variables is to be estimated differently from continuous variables. Discrete changes in the predicted probabilities constitute an alternative to the marginal effect when evaluating the influence of a dummy variable. Such an effect can be derived from the following equation (Greene, 2003).

$$\Delta = \phi\,(X\beta, d = 1) - \phi\,(X\beta, d = 0)$$

A number of variables were hypothesised to determine the farmer's decision to continue shifting cultivating. These variables were classified into two categories namely; internal and external factors. The null hypothesis of the study was that the continuation of shifting cultivation was not influenced by the internal factors such as age, education, household size, primary occupation, farming experience, annual per capita income and perception and external factors of access to credit, extension service, government incentive, distance from road, access to market and lack of alternative livelihoods. The units of measurement, descriptive statistics of these variables and the expected outcomes had been summarized in Table 1. The analysis of data was carried out in software STATA 17.

TABLE 1: DESCRIPTIVE STATISTICS OF VARIABLES USED IN PROBIT MODEL

Variables	Unit of measurement	Average			Expected outcome
		Adopter	Non-adopters	Adopter+ Non adopters	
(1)	(2)	(3)	(4)	(5)	(6)
Internal					
Age	Year	44.96 (12.92)	43.24 (10.64)	44.11 (11.84)	±
Education	Year spent in school	1.52 (0.59)	1.66 (0.78)	1.59 (0.69)	-
Household size	Number	5.69 (1.77)	5.76 (2.02)	5.73 (1.89)	±
Primary occupation	Dummy, 1 for cultivator, 0 for other	0.81 (0.39)	0.78 (0.41)	0.80 (0.40)	±
Farming experience	Year	23.58 (9.67)	22.87 (9.07)	23.23 (9.36)	+
Annual per capita income	'000 rupees	37.52 (17.72)	40.55 (23.52)	39.02 (20.78)	-
Perception	Dummy, 1 for favourable, 0 for otherwise	0.62 (0.49)	0.33 (0.47)	0.48 (0.50)	±
External					
Access to credit	Dummy, 1 for yes, 0 for no	0.32 (0.47)	0.32 (0.47)	0.32 (0.47)	-
Extension service	Dummy, 1 for yes, 0 for no	0.27 (0.45)	0.56 (0.50)	0.41 (0.49)	-
Government incentive	Dummy, 1 for yes, 0 for no	0.31 (0.46)	0.47 (0.50)	0.39 (0.49)	-
Distance from road	Kilometre (km)	4.96 (1.68)	4.65 (1.25)	4.81 (1.49)	+
Access to market	Dummy, 1 for yes, 0 for no	0.47 (0.50)	0.77 (0.42)	0.62 (0.49)	±
Lack of alternative livelihoods	Dummy, 1 for yes, 0 for no	0.65 (0.48)	0.19 (0.39)	0.43 (0.50)	+

Source: Field survey, 2021-22.
Note: Figures in parentheses represent standard deviation.

III

RESULTS AND DISCUSSION

The present study attempts to understand the characteristics of the farmers pertaining to the socio-economic and asset profile and the reasons which contribute to the prevalence of shifting cultivation in the state of Meghalaya. The findings and interpretations have been divided into two sections apropos of structural base of cultivators and the factors associated with the continuation of shifting cultivation.

1. Structural Base of cultivators

The study area comprised of two categories of farmers, one which followed the traditional *jhum* system and the other which adopted forms of settled cultivation. The former group was the shifting cultivators and the latter formed the settled cultivators. The structural base of the farmers pertains to the demographic profile of the

respondents, socio-economic characteristics and the asset structure of shifting and settled agricultural households

1.1. *Comparative Demographic Characteristics of Respondents*

The demographic characteristics of sampled respondents that might influence the decision- making process and consequently the adoption of diversified farming practices were studied. The characteristics that were discussed included gender, age group, level of education, primary occupation and farming experience (Table 2). In both shifting (85.23 per cent) and settled (72.66 per cent) agricultural systems, majority of the respondents were males. Age is an important variable in the Indian society where social and cultural bonds were strong, the elderly is revered and their counsel is given high significance, and Meghalaya is no exception. Among the three age groups. youth (less than 35 years), middle aged (35-60 years), and old age (above 60 years), more than two-thirds of the respondents belonged to the middle-aged category in shifting

TABLE 2: DEMOGRAPHIC CHARACTERISTICaS OF RESPONDENTS

Sl.No. (1)	Particulars (2)	Shifting (n=122) (3)	Settled (n=128) (4)	Overall (n=250) (5)
I	*Gender*			
	Male	93	104	197
		(85.25)	(72.66)	(78.80)
	Female	35	18	53
		(14.75)	(27.34)	(21.20)
II	*Age group*			
	Youth (<35)	35	27	62
		(27.34)	(22.13)	(24.80)
	Middle (35-60)	84	92	176
		(65.63)	(75.41)	(70.40)
	Old (>60)	9	3	12
		(7.03)	(2.46)	(4.80)
III	*Level of education*			
	No schooling	3	7	10
		(2.47)	(5.13)	(3.77)
	Primary	58	45	103
		(45.68)	(37.18)	(41.51)
	Middle	63	53	116
		(49.38)	(43.59)	(46.54)
	High school and above	3	17	20
		(2.47)	(14.10)	(8.18)
IV	*Primary occupation*			
	Farming	99	102	201
		(81.48)	(79.49)	(80.46)
	Service	2	11	13
		(1.23)	(8.97)	(5.20)
	Petty business	21	15	36
		(17.28)	(11.54)	(14.34)
V	*Farming experience (years)*	23.58	22.83	23.21

Source: Field survey, 2021-22.
Note: Figures in parentheses are per cent to total.

(65.63 per cent) as well as settled (75.41 per cent) agricultural systems. This result was found to be in tandem with the findings in the region where a typical *jhum* farmer was found to be middle-aged in Manipur (Punitha *et al.,* 2016), Mizoram (Zaitinvawra and Kanagaraj, 2008 and Lalrinsangpuii *et al.,* 2016).

The level of education indicated only a slight difference between the two categories of farmers with the majority of the respondents in shifting (49.38 per cent) and settled (43.59 per cent) cultivation completing middle school level education. From Table 2, it is also evident that there exists a small portion of the shifting (2.47 per cent) and settled (5.13 per cent) farmers who had no schooling. However, the settled farmers had a higher share of farmers (14.10 per cent) who completed high school as compared to shifting cultivators (2.47 per cent).

Farming (80.46 per cent) as the primary occupation was predominant among the respondents in the study area, followed by petty business (14.34 per cent) and service (5.20 per cent). More than four-fifth of the shifting cultivators (81.48 per cent) and three-fourth of the settled cultivators (79.49 per cent) were engaged in farming as their primary occupation. The average farming experience of 23.21 years revealed that farmers in both the categories were proficient in their occupation, with a slight margin between the shifting cultivators (23.58 years) and the settled cultivators (22.83 years).

1.2. *Comparative Socio-Economic Characteristics of Households*

The socio-economic characteristics of the surveyed households have been provided in Table 3. The total sample consisted of 1434 respondents, out of which 694 belonged to shifting cultivation households and 740 belonged to the settled cultivation households. The settled cultivation households had higher number of both adult males and females *i.e*., 2.32 and 2.23 per household while shifting cultivation households had 1.88 adult males and 2.04 females per family. However, the number of children was observed to be more in shifting agricultural households. Interestingly, the percentage of adult females was more than the adult males and children in both agricultural system households. The average family size was similar with 5.69 in shifting and 5.78 in settled agricultural households and the labour availability was found to be higher in settled (4.55) than in shifting (3.89) households.

The number of earners and non-earners has a significant impact on the family's income level while the dependency ratio indicates the household's economic security. On an average, there were 39.05 per cent earners in shifting households and 35.78 per cent in settled households indicated that two-thirds of the household were dependent on the one-third to make their ends meet. The average dependency ratio implied that a single person was bearing the burden of 1.56 persons in shifting households and 1.80 in settled households.

Education is an important demographic variable and the Table 3 clearly depicts that the majority of the population had been to schools. One thirds of the shifting cultivation households (35.51 per cent) had completed their primary level of education

TABLE 3: SOCIO-ECONOMIC CHARACTERISTICS OF SHIFTING AND SETTLED AGRICULTURAL HOUSEHOLDS

(No.)

Sl.no	Particulars	Shifting (n=694)	Settled (n=740)
I	*Family structure*		
	Adult male (above 14 years old)	1.88	2.32
		(32.97)	(21.29)
	Adult female (above 14 years old)	2.04	2.23
		(35.36)	(40.13)
	Children (below 14 years old)	1.80	1.23
		(31.67)	(38.58)
	Family size	5.69	5.78
		(100.00)	(100.00)
	Labour availability (number of adults equivalents)	3.89	4.55
	Earners	2.22	2.06
		(39.05)	(35.78)
	Non-earners	3.47	3.71
		(60.95)	(64.22)
	Dependency ratio	1.56	1.80
II	Education level of households		
	Illiterate	0.01	0.06
		(0.24)	(1.24)
	Children <3 years	0.4	0.17
		(7.19)	(3.12)
	Up to primary (1-4)	1.95	1.24
		(38.26)	(24.01)
	Middle (5-7)	1.58	1.13
		(30.99)	(21.78)
	Secondary	1.27	2.05
		(24.94)	(39.60)
	Higher Secondary and above	0.28	0.69
		(5.57)	(13.37)
III	*Education level of family head*		
	Literate (per cent)	97.53	94.87
	Illiterate (per cent)	2.47	5.13
IV	*Gender wise literacy rate*		
	Male literates (per cent)	46.85	45.36
	Female literates (per cent)	53.15	54.64
V	Primary occupation		
	Farming (per cent)	83.53	81.10
	Service (per cent)	0.40	4.27
	Petty business (per cent)	16.06	14.63

Source: Field survey, 2021-22.
Note: Figures in parentheses are per cent to total.

with an average of 1.95 individuals per family whereas; more than one-thirds of the settled cultivation households (38.37 per cent) had completed secondary schooling with an average of 2.05 individuals per family. A negligible proportion of the population in both categories (0.22 per cent in shifting households and 1.24 per cent in settled households) were illiterate and a small portion (7.19 per cent in shifting households and 3.12 per cent in settled households) comprising of children below 3 years were yet to attend schools. The settled households had more share (12.95 per cent) of individuals i.e., 0.69 pursuing higher secondary level of education and above as compared to shifting households (5.57 per cent). A lion's share of the head of the households were literate in both categories of households (97.53 per cent in shifting

households and 94.87 per cent in settled households) It was interesting to note that share of female literates was higher than male literates in both categories of households with the highest in settled households (54.64 per cent) when compared to shifting households (53.15 per cent).

As regards of the occupation, out of the total working population in the study area, more than four-fifths of the shifting cultivators (83.53 per cent) and settled agriculturists (81.10 per cent) were predominantly engaged in farming followed by petty business which include shop keeping, artisans, carpentry and a small portion were working in the service sector.

1.3. *Asset Structure of the Shifting and Settled Agricultural Households*

The structure of assets pertaining to the housing structure, livestock, SHG membership and owned land of the shifting and settled agricultural households in the study area have been depicted in Table 4. All the households in the study area were living in their own houses. One third of shifting cultivators (35.80 per cent) and less than one fifths of the settled agriculturists (16.67 per cent) had kutcha dwelling. Semi-

TABLE 4: ASSET STRUCTURE OF THE SHIFTING AND SETTLED AGRICULTURAL HOUSEHOLDS

Sl.No.	Particulars	Shifting (n=122)	Settled (n=128)
(1)	(2)	(3)	(4)
1.	*Housing structure*		
	Kutcha	44	21
		(35.80)	(16.67)
	Semi-pucca	78	72
		(64.20)	(56.41)
	Pucca	0	34
			(26.92)
2.	*Livestock*		
	Cattle	9	13
		(7.41)	(10.26)
	Piggery	29	20
		(23.46)	(15.38)
	Poultry	114	112
		(93.83)	(87.18)
	Sericulture	24	21
		(19.75)	(16.67)
	Fishery	5	11
		(3.70)	(8.97)
3.	Member of SHG (per cent)	36	62
		(29.51)	(48.72)
4.	Owned land (ha)	0.09	1.01
		(7.46)	(59.53)

Source: Field survey, 2021-22.
Note: Figures in parentheses are per cent to total.

pucca houses were most common in both shifting households (64.20 per cent) and settled households (56.41 per cent) whereas pucca houses were only found among the settled agriculturists (26.92 per cent). The livestock assets found in the study area included cattle, pigs, poultry, sericulture and fishery. Out of these, poultry was widely reared in both shifting cultivation (93.83 per cent) and settled agricultural households

(87.18 per cent) followed by piggery (23.46 per cent) and sericulture (19.75 per cent) in shifting households. Moreover, the rearing of pigs was a significant practice in the *Garo* households while sericulture was predominant among the *Khasi* households. The share of cattle and fishery was found to be slightly higher in the settled households. From the Table 4, it can be clearly noted that the about half of the settled households (48.72 per cent) had membership in SHG whereas it was less than one third in the shifting cultivator households (29.51 per cent). This shed light on the constraints of financial security as well as accessibility to improved technology on the traditional shifting cultivators, in the context that SHG participation improved the income level and the overall standard of living of the household. A huge difference was observed in the land owned by shifting households and settled households. A *jhumia* owned only 7.46 per cent where as a settled farmer owned 59.53 per cent of total cultivated land. This implied that the willingness of the farmers to invest in settled agricultural systems was tied in with their legal rights over land.

Factors Associated with the Continuation of Shifting Cultivation

Table 5 presents the estimated results of the probit model regarding the factors associated with the continuation of shifting cultivation. The overall fit of the model was evaluated using two separate goodness of fit measures i.e., the likelihood ratio test and the Pseudo R^2. The likelihood ratio test was significant: $\chi 2\ (13) = 76.95$; $\rho = 0.000$ and the estimated value of Pseudo R^2 at 0.349 indicated that the explanatory variables explain a sizeable portion of the variations in the factors determining the farmers' continuation of shifting cultivation.

TABLE 5: PROBIT ESTIMATES FOR CONTINUATION OF SHIFTING CULTIVATION MODEL

Variable	Coefficient	Std. error	Z statistic	Marginal effects
(1)	(2)	(3)	(4)	(5)
Constant	0.855	1.040	1.42	
Internal				
Age	0.940*	0.348	-0.02	0.005
Education	0.071	0.217	-0.33	-0.018
Household size	-0.198***	0.071	-2.81	-0.050
Primary occupation	0.284	0.314	0.91	0.072
Farming experience	0.014	0.029	-0.47	-0.003
Annual per capita income	-0.000***	0.000	-4.13	0.000
Perception	0.141	0.305	0.46	0.036
External				
Access to credit	0.358	0.283	1.27	0.090
Extension service	0.115	0.294	-0.39	-0.030
Government incentive	-0.554*	0.299	1.85	-0.132
Distance from road	0.000	0.090	0	0.000
Access to market	-0.768**	0.297	-2.49	-0.187
Lack of alternative livelihoods	1.424***	0.315	4.52	0.360
LR chi^2	76.95			
Prob > chi2	0.000			
Log-likelihood	-71.706			
Pseudo R^2	0.349			

Source: Field survey, 2021-22.

Note: LR stands for likelihood ratio, ***p<0.01, **p<0.05, *p<0.10.

The null hypothesis was formulated to check whether the factors were associated with continuation of shifting cultivation. Since, the calculated value of f statistic was greater than the critical value, the null hypothesis was rejected. Therefore, it could be stated that the variables incorporated in the model had some influence on the decision of a farmer to continue *jhuming*.

The estimated coefficients and standard errors reveal which are the factors associated with continuation of shifting cultivation. A statistically significant coefficient suggests that the likelihood of continuation of practice increase/decrease as the response of the explanatory variable increases/decreases. The internal factors of age, household size and annual per capita income and the external factors of Government incentive, access to market and lack of alternative livelihood were found to be significant.

The positive significant influence of age on shifting cultivation implied that older farmers are likely to continue *jhum* by 0.5 per cent. This could be due to the reason that as the farmers advance in age, they become more risk averse and prefer to continue a common practice to maintain the current level of food security and economic stability- with a deterioration in physical energy added into the bargain (Kwadzo and Quayson, 2021).

Family size significantly influenced the continuation of shifting cultivation as it affected the labour availability for the practice (Teegalapalli and Datta, 2016). According to Dolisca *et al*. (2007), household size played an important role as it affected land clearing for *jhumming*. The household size is an ambiguous factor, however, in the present study, its negative effect indicated that large family size was likely to diversify into other agricultural practices thereby reducing shifting cultivation by overcoming the labour constraints. It was estimated that for every unit increase in family size, the shifting cultivation decreased by 5 per cent.

The effect of annual per capita income was found to be negative and significant, suggesting that farmers were more likely to discontinue shifting cultivation as the income increases. However, the study indicated a marginal decrease of 0.001 per cent in *jhum* cultivation as a result of per unit increase in income. This could be due to availability of resources to afford additional expenditure for opting alternative cultivation methods (Mbaga-Semgalawe and Folmer, 2000; Goswami *et al.*, 2012). Previous studies showed that the adoption of settled cultivation was determined by the economic status of a household (Teegalapalli and Datta, 2016) and poor *jhum* farmers chose to clear more land for extensive cultivation by utilising the family labour as they lack credit to adopt sedentary agricultural practices (Pascual and Barbier, 2006). According to Linquist *et al*. (2007), farmers with better food security and higher income were willing to grow more cash crops in addition to the traditional crops.

The probability of the farmers continuing shifting cultivation decreased by 18.7 per cent with improved access to markets. The negative influence on the practice of *jhum* was suggestive of the tendency of the farmers in the study area to diversify their cultivation practices beyond the traditional crops, in order to take advantage of the

opportunities generated by the linkage of markets. Similar findings were reported from shifting cultivators of Nagaland and Chittagong Hill tracts of Bangladesh where the agricultural systems transitioned from subsistence crops to market-oriented products (Rasul et al., 2004; IWGIA, 2014).

Incentives produced by Government policies have been one of the major driving forces in determining the utilisation and modification of land use patterns (Balsdon, 2007). Angelsen (1999) highlighted that the policies directed towards off-farm sector were more successful in reducing the farmers from clearing the forests as compared to agricultural intensification and price policy reforms. As expected, the results of the study show that farmers benefitted by Government incentives in the form of off-farm labour such as MGNREGA were less likely to continue shifting cultivation with a marginal effect of 13.2 per cent.

The lack of alternative livelihoods had been cited as one of the main factors that positively influence farmers to continue shifting cultivation. This study shows that as more and more alternative livelihoods were introduced, the probability of continuation of shifting cultivation decreased by 36 per cent. It was also cited as the second most significant reasons for attachment to shifting cultivation in the Eastern Himalayas (Pandey *et al*., 2020). This revealed that the provision of alternative employment and income opportunities reduced willingness of the farmers to continue shifting cultivation and consequently the pressure at the forest frontier. However, the mere availability of these options may not be effective in making farmers successfully adopt settled agricultural systems. The farmers need assurance of a fair return for their risks and investments which could be achieved by building strong market linkages and including intervention in product differentiation through processing the raw produce to either semi-processed goods or finished products. Hence, the economic potential of alternative livelihoods is key to changeover from shifting to permanent farming.

IV

CONCLUSION AND POLICY IMPLICATIONS

The socio-economic study of the region revealed that the settled households had comparatively larger family size with more adults, however the earners were more in shifting households as greater number of members in settled households pursued higher education. There was little difference in the percentage of educated household members between the two household categories, however, settled households had more members with a higher level of education. Notwithstanding the category of households, majority of respondents were engaged in agriculture and were dependent on this sector to make their ends meet. The probit estimation showed that age and lack of alternative livelihood had a significant positive influence on the continuation of shifting cultivation while family size, annual per capita income, Govt. incentive and access to market had a negative significant influence. Education, primary occupation, farming

experience, perception, access to credit, extension service and distance from the road had no significant influence on farmers' decision to continue shifting cultivation

The results of the study have strong implications in that it reaffirms the role of Government incentives in weaning off the farmers from shifting cultivation. To make transitions more effective, the farmers should be encouraged to organise into groups and work in collaboration with other farmer groups, NGOs, Government departments and other stakeholders. Market accessibility is another major concern wherein there is a need to increase market penetration, however the choice of crop must be based on needs of the community and culturally acceptable. This will facilitate the adoption rate requiring little support from the Government which will help in the formation of a resilient and self-reliant community. Additionally, necessary policies are needed to provide alternative livelihood opportunities, putting emphasis on secondary agriculture and allied activities such as piggery, sericulture and commercial crops catered to the hilly regions where the intensity of *jhum* cultivation is higher. A shift from shifting to settled farming is inevitable in the coming years, however this transition must be cognizant of the economic viability of the alternative opportunities, nutritional security of the communities, inclusivity of all sections of the society and the resilience of the introduced agricultural system. Agroforestry, forest gardens and home gardens could be considered as promising ventures for communities seeking change and achieve the twin benefits of a regular income while paving way to settled agricultural system. Such interventions should also be accompanied with capacity building and development of skills regarding better farming practices and value addition among the community. Overall, to stand the test of time, policy makers need to make arrangements for survival of the dual economy consisting of traditional *jhum* farming with settled agriculture in the short term while allowing the transition between the systems organically over time. Further natural farming which is one of the emerging opportunities may be considered a better policy option in the shifting cultivation dominant areas of the state in specific and North Eastern Hill Region in general.

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