SANDEE

Working Paper No. 117–17

Are All Shifting Cultivators Poor? Evidence from Sri Lanka's Dry Zones

Prabath Nishantha Edirisinghe
H.M.B.S. Hearath

ECONOMICS & THE ENVIRONMENT

South Asian Network for Development and Environmental Economics (SANDEE) PO Box 8975,
EPC 1056, Kathmandu, Nepal.
Tel: 977-1-5003222 Fax: 977-1-5003299

Prabath Nishantha Edirisinghe, H.M.B.S. Hearath

Are All Shifting Cultivators Poor? Evidence from Sri Lanka's Dry Zones

Keywords
Shifting cultivation
Sri Lanka
Slash and burn agriculture
Deforestation

SANDEE Working Paper No. 117–17

Are All Shifting Cultivators Poor? Evidence from Sri Lanka's Dry Zones

Prabath Nishantha Edirisinghe

Forest Department

Battaramulla, Sri Lanka

H.M.B.S. Hearath

University of Sri Jayawardenepura

Gangodawila, Sri Lanka

March 2017

South Asian Network for Development and Environmental Economics (SANDEE)
PO Box 8975, EPC 1056, Kathmandu, Nepal

SANDEE Working Paper No. 117–17

The South Asian Network for Development and Environmental Economics

The South Asian Network for Development and Environmental Economics (SANDEE) is a regional network that brings together analysts from different countries in South Asia to address environment-development problems. SANDEE's activities include research support, training, and information dissemination. Please see www.sandeeonline.org for further information about SANDEE.

SANDEE is financially supported by the International Development Research Center (IDRC), The Swedish International Development Cooperation Agency (SIDA), the World Bank and the Norwegian Agency for Development Cooperation (NORAD). The opinions expressed in this paper are the author's and do not necessarily represent those of SANDEE's donors.

This Working Paper series of electronic preprints based on research funded by SANDEE and supported with technical assistance from network members, SANDEE staff and advisors.

Faculty Advisor
Jean Marie Baland

Staff Advisor
Heman Das Lohano

Comments should be sent to

Prabath Nishantha Edirisinghe
Email: edirisingh17027@alumni.itc.nl

Contents

Abstract

1. Introduction **1**

2. The Policy Climate in Sri Lanka **2**

3. Study Area and Data **3**

4. Shifting Cultivation in Monaragala District **5**

4.1 Some comparative indicators 5

4.2 The practice of shifting cultivation 8

4.3 Fallow period 8

5. Examining the Determinants of Shifting Cultivation **9**

6. Results and Discussion **10**

6.1 Regression results 10

6.2 Alternatives to shifting cultivation 11

7. Conclusions and Policy Recommendations **13**

Acknowledgements **13**

References **14**

Tables

Table 1. Sampling structure 5

Table 2. Summary statistics and mean comparison of shifting cultivators and non-shifting cultivators 6

Table 3. Comparison of input use for private lands and shifting cultivation lands 8

Table 4. Regression results 10

Figures

Figure 1. Shifting cultivation intensity and deforestation rate in different districts of Sri Lanka, 1992–2010 2

Figure 2. Forest cover and Divisional Secretariat divisions of Monaragala district 3

Figure 3. Shifting cultivation land in the study area (five Divisional Secretariat divisions) 4

Figure 4. Private land ownership of the sample households 7

Figure 5. Distribution of shifting cultivation area of households and private land use size 7

Figure 6. Household willingness to give up shifting cultivation 12

Figure 7. Preferred alternatives to shifting cultivation 12

Appendices

Appendix A: Questionnaires 16

Appendix B: Tables with Detailed Information 27

Abstract

Shifting cultivation is one of the main causes of deforestation and forest degradation in Sri Lanka. This study uses household data and satellite images to investigate the determinants of shifting cultivation and the potential to control the intensity of this practice. Some 50% of households studied in Monaragala district of Sri Lanka practiced shifting cultivation during the 2011/2012 cultivation season. This practice is largely characterized by a short fallow period, mono cropping and high input use and repeated annual use of the same plot of land. Households practicing shifting cultivation, on average, use less than 1 hectare every year for this activity. Some 59% of shifting cultivation farmers indicated that they had cultivated the same piece of land every year during the 2006–2011 period. The practice is not restricted to poor landless farmers. Regression results show that households that possess more private land and other assets tend to cultivate larger areas of land. Therefore, the contribution of relatively wealthy households to shifting cultivation is more than that of poor households. Furthermore, households with more adult family members in a family tend to cultivate larger areas of shifting cultivation lands. Full-time non-farm occupations are a deterrent to this practice. To reduce the area of shifting cultivation, the study recommends an integrated plan with alternate income generation options for people who may have to give up existing swidden lands.

Keywords

Shifting cultivation, Sri Lanka, Slash and burn agriculture, Deforestation.

Are All Shifting Cultivators Poor? Evidence from Sri Lanka's Dry Zones

1. Introduction

Shifting cultivation, locally referred to as *chena* cultivation, is a traditional agricultural system practiced in many parts of the world, including the dry zones of Sri Lanka. In this system, farmers clear and burn forested land in order to cultivate annual crops. The farmer then shifts to different forest locations, leaving the previously cultivated land fallow (Agalawatte and Abyegunawardena, 1993). Traditionally, this form of cultivation is characterized by a mixture of crops (Agalawtte and Abeygunawardena, 1993), a long fallow period and minimal use of agro-chemicals. During the fallow period soil fertility improves and the land once again becomes suitable for growing crops (Jochim and Kandiah, 1948). However, it takes about 10–15 years for the fallow lands to restore the fertility of the soil (Weerakoon and Seneviratne, 1982; Erni, 2015). This traditional practice of swidden agriculture has been a means of livelihood for many farmers worldwide.

Shifting cultivation is generally a suitable agricultural practice as long as fallow periods are long enough to increase soil fertility (Erni, 2015). However, due limited forested land and high population pressure, the fallow period historically maintained by farmers has reduced over time (Weerakoon and Seneviratne, 1982; Rahman ***et al***., 2012). For instance, Fujisaka and Escobar (1997), reviewing 103 publications on 136 cases of slash and burn agricultural systems in different countries, found that long fallow periods of over eight years were maintained in two cases, while no fallow period was observed in 45 cases. Thus, shifting cultivation has become increasingly unproductive in many parts of the world (Agalawatte and Abyegunawardena, 1993).

It is estimated that the deforestation from 1992–2010 was 8.7% of the total forest area of 1992 (Legg and Jewell, 1995; Edirisinghe ***et al***., 2012). The Government of Sri Lanka has set a target to increase forest cover from 29% to 32% of land area by 2030 to meet the Nationally Determined Contribution (NDC) under Paris Agreement of UNFCCC (Ministry of Mahaweli Development and Environment, 2016). In order to achieve this target, deforested and degraded forests need to be restored and existing natural forests must be conserved. This is important because forest loss has many environmental consequences such as climate change, loss of biodiversity and animal habitats, soil erosion etc.[1] In this context, there is interest in reducing deforestation due to shifting cultivation and restoring some of this land to forests.

Agronomists, foresters and development workers recognize that shifting cultivation as a form of agroforestry has provided secure and sustainable livelihoods to millions of people for centuries. Therefore, replacing shifting cultivation by other land uses can affect food production and the livelihood of many farmers (Erni, 2015). Given the prevalence of multiple trade-offs between shifting cultivation and forest conservation, this paper seeks to identify solutions to this complex challenge. It seeks to understand who is mainly responsible for shifting cultivation in Sri

[1] Fernando (2006) studied the implications of shifting cultivation system for elephant habitats. Traditional shifting cultivation with long fallow periods provides good habitats for elephants. Elephants are considered as "edge loving species" who prefer the ecotone between forest and disturbed habitats. Asian elephants prefer to feed on pioneer vegetation which is common in secondary forests. Traditional shifting cultivation leads to mosaic of succession stages that is ideal for elephants. Since protected areas do not consist of such vegetation two third of the elephant habitats are outside the protected areas in Sri Lanka. However, permanent high intensive agricultural methods using high inputs such as irrigation, mechanized plowing, fertilizers and herbicides create bare lands that elephants cannot use (Fernando, 2006).

Lanka, the extent of the fallow period, the socio-economic determinants of this practice and what options may satisfy the need for livelihoods and forest conservation.

2. The Policy Climate in Sri Lanka

Figure 1 shows shifting cultivation intensity and deforestation rate in different districts of Sri Lanka during 1992–2010. The color represents the intensity of shifting cultivation while deforestation percentage is shown in a Box for each district. As evident in Figure 1, shifting cultivation is most commonly practiced in Sri Lanka's dry zone. While there is no good estimate of the numbers of farmers practicing shifting cultivation, it is clearly practiced on a large scale on government owned forest or shrub land.

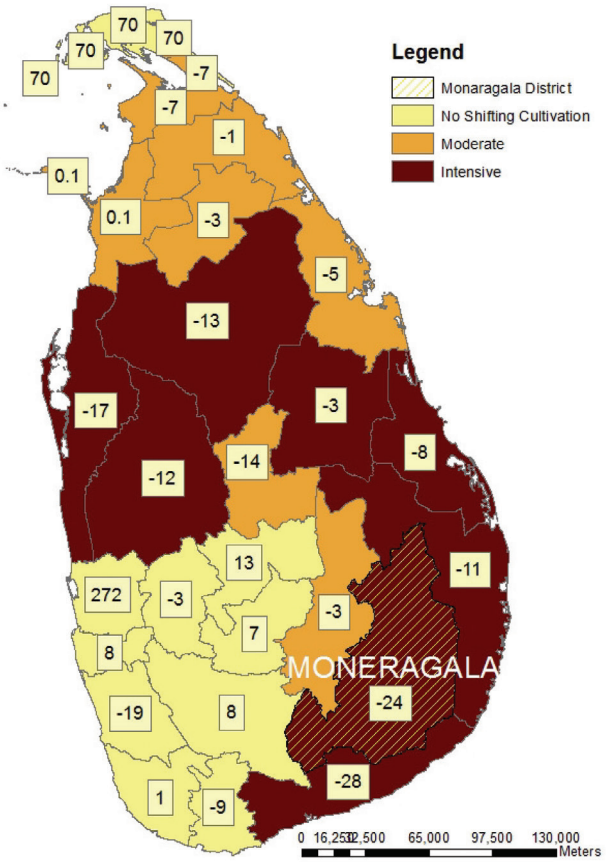


Figure 1. Shifting cultivation intensity and deforestation rate in different districts of Sri Lanka, 1992–2010

Source: Developed by authors based on discussion with experts and satellite images

Note: The color represents the intensity of shifting cultivation while deforestation percentage is shown in a Box for each district, where a minus sign (-) represents deforestation and a positive sign (+) represents forest gain.

While cultivation on government land without permission is currently prohibited (Forest Conservation Act of Sri Lanka, 2008), swidden agriculture continues as a well-established traditional practice. Forest Department records show that the average fine for shifting cultivation is around Rs. 10,000 and the maximum fine is Rs. 200,000. However, few legal actions are taken, partly because there is an understanding that poor landless farmers have few alternative options. Further, attempts to control shifting cultivation have created social and political problems.[2] Occasionally, the courts have sympathized with farmers.

[2] Local politicians support shifting cultivators in order to avoid social unrest.

Since law enforcement alone is not sufficient to control shifting cultivation, in 1993, the government of Sri Lanka commenced a program to establish timber-based agroforestry system on swidden lands with the participation of farmers in Sri Lanka. Under this program, the government gives free seedlings (mainly teak) to farmers and provides monetary incentives to establish and maintain these trees. Farmers cultivate annual crops between trees and have the right to harvest the timber 25 years after planting. However, because the teak canopy shades the land, farmers lose their annual income after three years. Because the scheme does not support the day-to-day lives of farmers (Kumarasiri *et al*., 2000), farmers who undertake agro-forestry continue shifting cultivation on other forest-lands.

In 2009, complementing the agroforestry scheme, the Government of Sri Lanka issued annual permits for shifting cultivation on a limited amount of land. But farmers continued to practice without legal permits. Thus, in 2014, a policy decision was taken by H.E. the President of Sri Lanka to provide permits to farmers to cultivate a maximum of 0.8 ha (2 acres) of shifting cultivation land in an attempt to solve the problems of shifting cultivation.[3]

Given the trade-offs between farming and forest conservation and the inability of the government to change the way farmers cultivate forest lands, this study was launched to get a better understanding of the socio-economic determinants of the practice. The study is based on evidence from Monaragala district in Sri Lanka's dry zone, where shifting cultivation takes place on a significant scale.

3. Study Area and Data

Monaragala district is rich in forests and ranks high in poverty indicators. Approximately 40% of the district is forested (Edirisinghe *et al*. 2012). Even though its population density is low,[4] population growth rate during 2001–

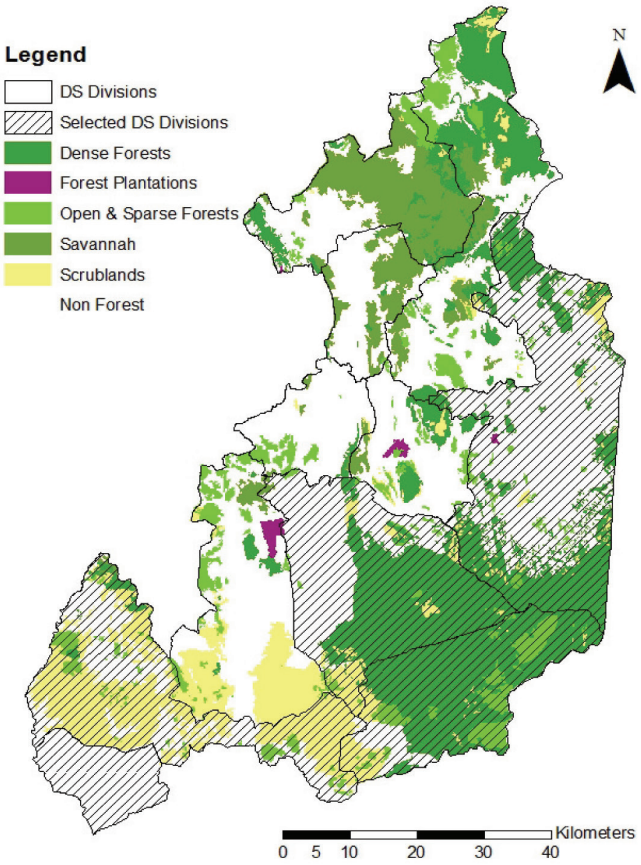


Figure 2. Forest cover and divisional secretariat divisions of Monaragala district

Source: Developed by authors using satellite images

[3] In order to obtain a permit farmers need to apply to the Forest Department through farmer organizations.

[4] The population density at 81 persons per square kilometer is well below the national average (323 persons per square kilometer in 2012).

2012, at 1.15 p.a., was above the national average of 0.71 (Department of Census and Statistics, 2012). The estimated deforestation rate of 24% (between 1992 and 2010) was also higher than the 9% national average; as was the Poverty Head Count Index (33%), relative to the national average (15%) (Department of Census and Statistics 2009).[5]

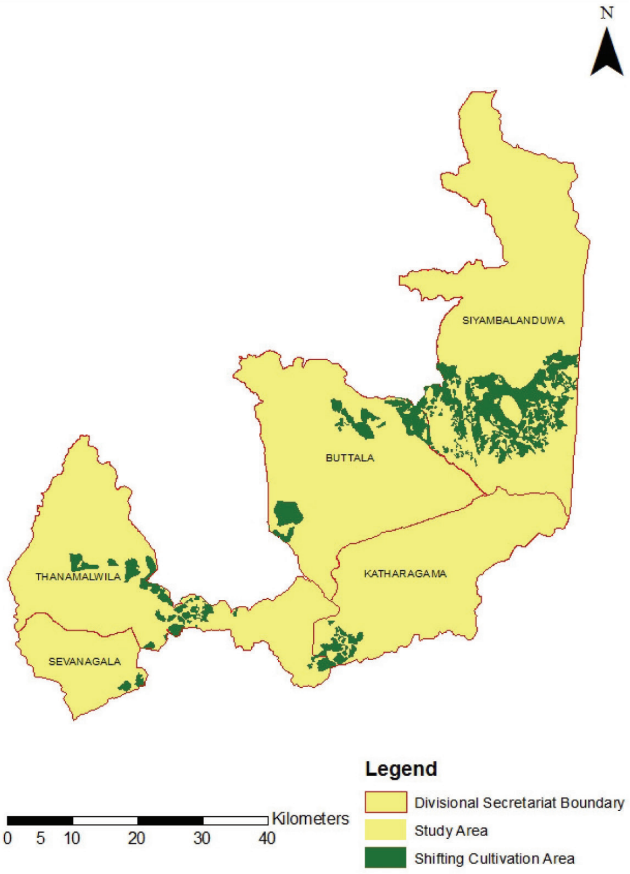


Figure 3. Shifting cultivation land in the study area (five divisional secretariat divisions)

Source: Developed by authors using satellite images

To identify our study area, we first selected five Divisional Secretariat (DS) divisions where shifting cultivation is practiced (out of the 11DS divisions) in Monaragala district. Figure 2 shows the forest cover of the district and indicates that the selected DS divisions are located in forested areas in the south-east. The terrain in the selected divisions is flat, making it suitable for agriculture; while the terrain in the other divisions is undulating. Figure 3 shows the shifting cultivation land in the five DS divisions studied.

There are 110 *Grama Niladhari* (Village Officer) divisions within the selected DS divisions. Out of these, we identified 25 G*rama Niladhari* divisions where shifting cultivation takes place, based on discussions with key informants such as forest officers, *Grama Niladharies* and local villagers, as well as field observations. We randomly selected 50 out of 102 villages in these 25 divisions for further examination. Twelve households were randomly identified from each selected village using the household list held by the *Grama Niladhari*. We identified 600 households (5%) in the 50 villages for our final survey (Table 1).

[5] The Department of Census and Statistics (2004) report that 68% of the employed labor force in Monaragala district is engaged in the agricultural sector, whereas this percentage is 34% for the rest of Sri Lanka.

Table 1: Sampling structure

Divisional Secretariat Division	No. of GN Divisions selected	No. of Households in selected GN divisions	No. of villages	No. of villages selected	No. of households selected	No. of households surveyed
Siyambalanduwa	5	1450	22	10	120	120
Thanamalwila	8	3114	29	18	216	216
Buttala	6	2407	27	12	144	140
Katharagama	4	3234	17	8	96	90
Sewanagala	2	1890	7	2	24	24
Total	25	12095	102	50	600	590

We undertook a household survey of 590 households (ten were unavailable) and 50 villages during January–June 2012 using pretested questionnaires (Appendix A). From these surveys, we obtained information on demographic characteristics, assets, employment and farm income of households. Information on the area, input use, crops, income and fallow periods linked to shifting cultivation was recorded for the 2011/2012 cultivation season (September–February). The village questionnaire collected information on village history, demographic, price and infrastructure information by interviewing merchants, government officers and farmers.

Lands at images of 2011, obtained from Global Visualization Viewer (GLOVIS)[6] and Google images were used to prepare a map of forest cover in the entire district and of shifting cultivation areas of five selected Divisional Secretariat Divisions, which cover 3194 square kilometers. Other spatial data, such as district and divisional secretariat boundaries, were obtained from topographic maps of the Survey Department of Sri Lanka. The preparation of maps and spatial data analysis was conducted using QGIS and ArcGIS.

4. Shifting Cultivation in Monaragala District

Shifting cultivation is popular in Monaragala district, with some fifty percent of households in the sample practicing shifting cultivation in the 2011/2012 season.[7] The average shifting cultivation area among the practicing households is 0.85 ha per household.

4.1 Some comparative indicators

Table 2 presents descriptive statistics for all households and shifting cultivation and non-shifting cultivation households. Simple tests of means between both types of households are included in the last column to examine whether the households who practice shifting cultivation are significantly different from non-practicing farmers.

The main occupation of the head of the household in our sample is farming, but 11% of total households have nonfarm

full-time occupations (Table 2).[8] The mean comparison test suggests that non-shifting cultivation households have more non-farm full-time occupations compared to shifting cultivators (Table 2). As far as demographic variables are concerned, shifting cultivation households have more adult family members relative to non-practicing households. The number of years of schooling of the household head is significantly lower among shifting cultivation households.

This study estimated the average labor wage income of the household head in the sample to be Sri Lankan Rupees 26,206 per year (Table 2). The average labor wage income is significantly higher among non-shifting cultivators than

[6] GLOVIS provides facilities to download Lands at images.

[7] This percentage varies among DS Divisions (see Table B.1, Appendix B).

[8] Table B.2 in Appendix B provides details of main occupation of household heads. Non-farm full-time employment includes government employment, private sector employment, foreign employment and self-employment.

shifting cultivators, demonstrating that household heads who do not practice shifting cultivation earn more income in the form of daily labor wages. Normally poor households depend much more on an income from daily labor wages, so it is an important indicator of poverty.

Overall, summary data suggests that the average shifting cultivation farmer has more private land, more household labor, less annual income from daily wages, less education, lives further away from roads and is less likely to have non-farm employment relative to the head of a household that does not practice shifting cultivation.

Table 2. Summary statistics and mean comparison of shifting cultivators and non-shifting cultivators

Variable	All households	Shifting cultivation households	Non-shifting cultivation households-	t-test for mean comparison
	Mean (standard deviation in parenthesis)	Mean (standard deviation in parenthesis)	Mean (standard deviation in parenthesis)	t-stat (probability value in parenthesis)
Area of shifting cultivation land of a household (ha)	0.43 (0.64)	0.85 (0.68)	0	-
Wealth variables				
Private land (ha)	1.16 (1.02)	1.35 (0.065)	0.98 (0.051)	4.50 (0.000)***
Asset index	0.00 (0.01	0.04 (1.44)	-0.04 (0.88)	0.80 (0.42)
Livestock ownership (1 if household owns livestock, 0 otherwise)	0.06 (0.24)	0.05 (0.22)	0.07 (0.26)	0.05 (0.29)
Demographic variables				
Number of adult members in a household	3.22 (1.35)	3.40 (1.32)	3.05 (1.35)	3.18 (0.00)***
Age of the household head (years)	48.41 (13.07)	48.32 (11.39)	48.50 (14.59)	0.17 (0.87)
Schooling years of the household head	6.52 (3.53)	6.17 (3.53)	6.87 (3.50)	2.41 (0.02)**
Population density in village (persons per square kilometer)	57.50 (45.34)	53.92 (28.67)	61.09 (57.27)	1.95 (0.05)*
Economic variable				
Availability of full-time non-farm occupations (1 = Yes, 0 = No)	0.11 (0.31)	0.06 (0.25)	0.15 (0.36)	3.50 (0.00)***
Unskilled labor income of a household (Sri Lankan Rs./Year)	26,206 (55,660)	24,435 (49,916)	30,003 (60,748)	1.654 (0.097)*
Accessibility variable				
Distance to a tar road (km)	0.98 (1.50)	1.13 (1.74)	0.82 (1.18)	2.45 (0.01)**

*** p<0.01, ** p<0.05, * p<0.1

The mean comparison test results show that shifting cultivation households have more private land than non-shifting cultivation households. The average private land holding for shifting cultivation households is 1.35 ha, which is 38% higher than that for non-shifting cultivation households (0.98 ha). Total private land belonging to households varies from 0 to 10 ha in the study area. Around 49% of the households possess less than 1 ha of private land and 16% of the households have more than 2 ha of private land (Figure 4). The average shifting cultivation area of a household that owns less than 1 ha of private land is 0.71 ha, while it is 1.18 ha among households who own more than 2 ha of private land. Figure 5 shows that the area of shifting cultivation land increases as the private land area increases.

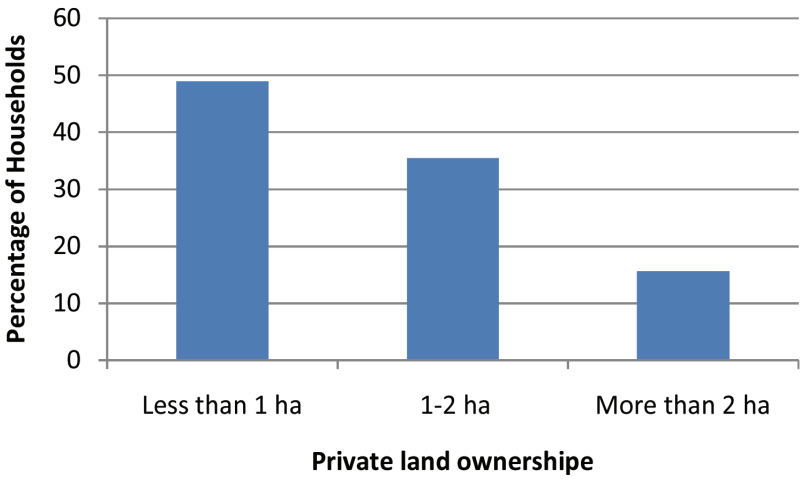


Figure 4. Private land ownership of the sample households

Source: Household survey data

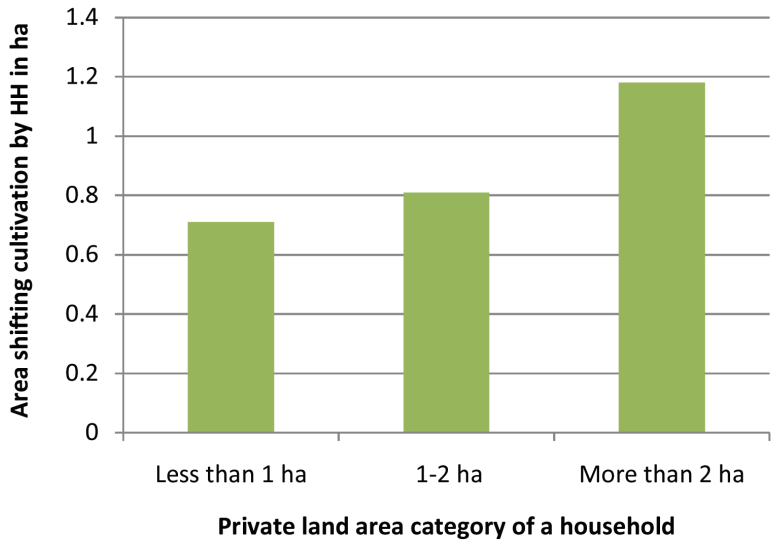


Figure 5. Distribution of shifting cultivation area of households and private land use size

Source: Household survey data

4.2 The practice of shifting cultivation

Ninety-eight percent of households practice shifting cultivation on government-owned land, while 2% of farmers cultivate on *devala* land (temple-owned land). The majority of households (94%) practice swidden agriculture on one parcel. During the *Maha* season, farmers start land preparation in August, cultivate crops in September and October and harvest between December and February.[9]

A majority (56%) of the sampled shifting cultivators cultivate maize as a mono crop, especially in the Buttala and Siyambalanduwa DS divisions. Farmers in other DS divisions grow a mix of crops comprising groundnuts, cowpea, *kurakkan*, and vegetables. Diverse crops stabilize income, reducing uncertainties due to weather, and provide income over a longer period of time because harvest times vary. In addition, a mixture of crops conserves genetic and species diversity (Gunasena and Pushpakumara, 2015). However, a majority of farmers grow maize because there is a well-established commercial market for maize. Farmers who grow mixed crops consume a large fraction of the harvest.

Swidden farmers in the study area use a variety of modern inputs. Around 63%, 56% and 54% of households use fertilizers, other agrochemicals and tractors on their shifting cultivation plots. Table 3 shows that farmers use more inputs in swidden agriculture than private lands. This suggests that subsistence farmers are compensating for poor quality swidden lands by using more agricultural inputs. While farmers mainly use family labor for shifting cultivation, they also use hire labor, especially during land preparation and harvesting. Some farmers, who practice shifting cultivation away from villages, stay in forest farms during the cultivation season.

Table 3. Comparison of input use for private lands and shifting cultivation lands

Input	Private lands (Mean Cost Rs. per ha)	Swidden Land (Mean Cost Rs.per ha)
Labour	2606	8392
Fertilizer	1673	5931
Pesticide	1432	2447
Weedicide	1201	261
Tractor (Land preparation)	3884	4857

4.3 Fallow period

Shifting cultivation in Monaragala district is a static system. Some 59% of shifting cultivation farmers had cultivated the same piece of land every year during 2006–2011, while 41% of farmers kept the land uncultivated for at least one year during this period. For farmers cultivating the same land every year, the fallow period is around six months, which is the period between two cultivation seasons. This fallow period is much shorter than the six years reported by Weerakoon and Seneviratne (1982) over 30 years ago. Now, farmers burn vegetation after about six months and then return to growing crops. From the focus group discussion with farmers, it was reported that a large number of elephant population feed on these shifting cultivation lands during the short fallow period. Since 94% of households do not have another plot to move to, there is little possibility of an increase in the fallow period. The farmers who kept the land uncultivated for at least one year during 2006–2011, did so for reasons including terrorism, personal and legal problems and the need to let land lie fallow.

[9] The Yala season (April to July) does not see much shifting cultivation.

5. Examining the Determinants of Shifting Cultivation

Following Adhikari *et al*. (2004) and Rahman *et al*. (2012), we analyze the socio-economic determinants of shifting cultivation using two models: (i) linear model to investigate the determinants of the area under shifting cultivation by a household and (ii) logit model to examine the probability of practicing shifting cultivation.

Equation(1)specifies that the area of shifting cultivation is a function of socio-economic variables. Hence,

$$A = X\alpha + \varepsilon \qquad (1)$$

where A denotes the area of shifting cultivation land of a household in hain the 2011/2012 cultivation season, X is a vector of explanatory variables, αa vector of unknown parameters and ε is the error term. The area of shifting cultivation land can be zero or positive ($A \geq 0$). Since no shifting cultivation reflects the behavior of households, we included the zero value (households with no shifting cultivation) in the analysis. We estimated equation 1 as an ordinary least squares regression.

A Logit model is used to analyze why farm households practice shifting cultivation. The survey shows that around 50% of the households practice shifting cultivation ($A > 0$). We define a binary dependent variable which measures whether a household has practiced shifting cultivation or not. The logit model is specified as follows:

$$\text{Prob}\,(Y = 1 \mid X) = \frac{e^{x\beta}}{1 + e^{x\beta}} \qquad (2)$$

where Y = 1 if the household practices shifting cultivation (shifting cultivation household), and 0 otherwise (non-shifting cultivation household). The explanatory variables in X are the same as defined above. The logit model is estimated using the maximum likelihood estimation method.

The explanatory variables in Equations (1) and (2) include wealth variables, demographic variables, economic variables, accessibility variables and village controls. *Wealth* can increase or decrease shifting cultivation, depending on the nature of the assets and other factors such as availability of labor. Therefore, we include three wealth variables: area of private land owned by household, an asset index and a dummy variable for owning livestock. The private land owned by a household includes combines area under home garden, uplands and paddy land.[10] Principle Component Analysis was done to calculate the asset index using the asset variables of number of tractors, threshers, trucks and cars that belong to a household and the number of rooms in the home. Some households rear livestock such as cattle, poultry, goats and pigs. We used a dummy variable that equals 1 if the household has livestock and 0 otherwise.

Demographic variables include the number of adult members of the family, the age of the household head, the number of years of schooling the household head has received and population density in the village. A family member above 15 years of age is counted as an adult and the number of adults in a household reflects the labor availability of the family and the size of the family. The number of years of schooling the household head has received reflects the education level of the household head. We hypothesize that larger households and less educated households contribute to more shifting agriculture.

Economic variables reflect household head's non-farm occupations. Government jobs, private sector jobs, overseas employment and self-employment were considered full-time non-farm occupations. We used a dummy variable equal to 1 if the household head had a full-time non-farm occupation and 0 otherwise. We hypothesize that full time job may lead to a reduction in shifting agriculture practice.

Accessibility reflects the remoteness of the village and access to markets and public services. We measure this as distance to a tar road from a village. *Village variables* include 49 village dummy variables for 50 villages used in the model in order to control village level heterogeneity.

[10] A home garden is defined as any land area around the house; uplands are defined as any land located away from the house. Paddy land is also located away from the house.

6. Results and Discussion

6.1 Regression results

Table 4 presents the regression results of the linear model of area in shifting cultivation and logit model of the factors that influence the probability that a household undertakes shifting cultivation. The R^2 is 34% for the linear model and 21% for the logit model.

Table 4. Regression results

Variable	Linear Model		Logit Model	
Dependent variable	Area of Shifting cultivation land of a household (ha)		Binary variable = 1 if shifting cultivator, 0 otherwise	
	Coefficient estimate	p-value	Coefficient estimate	p-value
Constant	-0.035	0.926	1.916	0.565
	(0.377)		(3.328)	
Wealth variables Source: Household survey data			Source: Household survey data	
Private land (ha)	0.124***	0.000	0.269*	0.062
	(0.030)		(0.144)	
Asset index	0.040*	0.066	0.061	0.554
	(0.022)		(0.103)	
Livestock ownership	-0.030	0.772	-0.529	0.219
	(0.102)		(0.430)	
Demographic variables				
Number of adult members in a household	0.038*	0.071	0.182**	0.046
	(0.021)		(0.091)	
Age of the household head	0.020	0.109	0.139**	0.012
	(0.013)		(0.056)	
Age square of household head	-0.0003**	0.030	-0.002***	0.001
	(0.0001)		(0.0005)	
Number of years of schooling of household head	-0.013	0.105	-0.094***	0.008
	(0.008)		(0.035)	
Population density in village	-0.001	0.424	-0.044	0.334
	(0.001)		(0.045)	
Economic variable				
Availability of full time non-farm occupation	-0.156*	0.060	-1.044**	0.004
	(0.083)		(0.361)	
Accessibility variable				
Distance to a tar road (km)	0.012	0.667	-0.089	0.599
	(0.028)		(0.169)	
Village effects				
Village fixed effects	Yes		Yes	
Observations	590		566	
F-statistics	4.76***		-	
Chi-square statistics	-		166.02***	
Probability value	0.000		0.000	
R-squared	0.338		0.211	

*** p<0.01, ** p<0.05, * p<0.1

Note: Standard errors are given in parentheses. Age and Age squared of household head are jointly significant at 1% level in each model.

The results show that households who possess more private land are more likely to undertake shifting cultivation and also cultivate a larger area of land under shifting cultivation. The private land is statistically significant at the

1% level in the linear model and 10% level in logit model. The linear model results show that as private landholding increases by one ha, the area of shifting cultivation increases by 0.124 ha. Another wealth indicator is the household ownership of assets. The asset index is statistically significant at 10% level in linear model, and has a positive impact on the area of shifting cultivation – i.e., households that have more wealth cultivate a larger area of shifting cultivation.

The number of adult family members in a household positively and significantly influences the area of shifting cultivation worked by a household and the probability of shifting cultivation (Table 4). Shifting cultivation needs labor for land preparation, planting, weed control, the application of fertilizers, pest control, harvesting and to protect crops from wild animals. Farmers use family labor to perform these activities as much as possible. If a family is large, the family has to also earn more to meet its own expenses. Therefore, households with a greater number of adult family members cultivate more shifting cultivation land. This finding is similar to Adhikari *et al*. (2004), who found that labor allocation is positively related to fuel wood, leaf litter and grass collection from forests in Nepal.

The age of the household head and the age square are jointly statistically significant at the 1% level in both models (Table 4). The results of linear model show that the relationship between age and the area of shifting cultivation is parabolic. The area of shifting cultivation of a household increases with the age of the household head and decreases after a certain age. This behavior shows the middle-aged household heads cultivate more land area of shifting cultivation as compared to relatively young or very old ones. Similarly, the results of logit model show that the middle-aged household heads are more likely to engage in shifting cultivation than relatively young or very old ones. These results make sense as often younger heads of household move away from farming and engage in other income-generating activities, while older heads cannot physically cultivate a large area of shifting cultivation

The number of years of schooling is statistically significant at the 1% level only in the logit model. The result show that the probability of practicing shifting cultivation decreases with years of education of household head. Availability of full-time non-farm work is negatively and significantly related to the area of shifting cultivation and probability of practicing shifting cultivation (Table 4). This is expected since household heads who engage in full-time non-farm occupations have a higher opportunity cost of labor.

6.2 Alternatives to shifting cultivation

Survey data shows that some 80% of shifting cultivators would give up this practice if a viable alternative was provided (Figure 6). In the survey, farmers were asked to rank five alternatives to shifting cultivation: (i) improved upland farming with cash crops (ii) irrigated agriculture (iii) timber farming (iv) rubber cultivation (v) other employment opportunities. Out of these alternatives, 67% of farmers ranked irrigated agriculture as their most preferred alternative. Around 29% of farmers ranked improved upland farming as their most preferred alternative. Only 2% of farmers ranked timber farming and rubber cultivation as their most preferred alternative, and 2% of farmers ranked other employment opportunities as their most preferred alternative (Figure 7).

It is also interesting to note that farmers did not find timber farming and rubber cultivation attractive alternatives to shifting cultivation. This is because it takes a long time before the benefits to accrue and because of the risks associated with potential damage caused by elephants.

While irrigated agriculture is the most attractive alternative to shifting cultivation, providing irrigation facilities in the study area would be expensive. Therefore, other ways to improve the productivity of private lands, alongside adequate water conservation measures need to be considered. For instance, Agalawtte and Abeygunawardena (1993) found that conservation farming is more profitable in the long run relative to shifting cultivation.

Eco-tourism by increasing elephant habitat could also be considered. A forest enhancement program could be established in Monaragala with people's participation. For instance, elephant feeding grounds can accommodate traditional shifting cultivation with relatively long fallow periods. Sparse panting of trees can also be done on such land. The people who are affected due to reduction of shifting cultivation land area can participate in such a program, if it includes options for ecotourism.

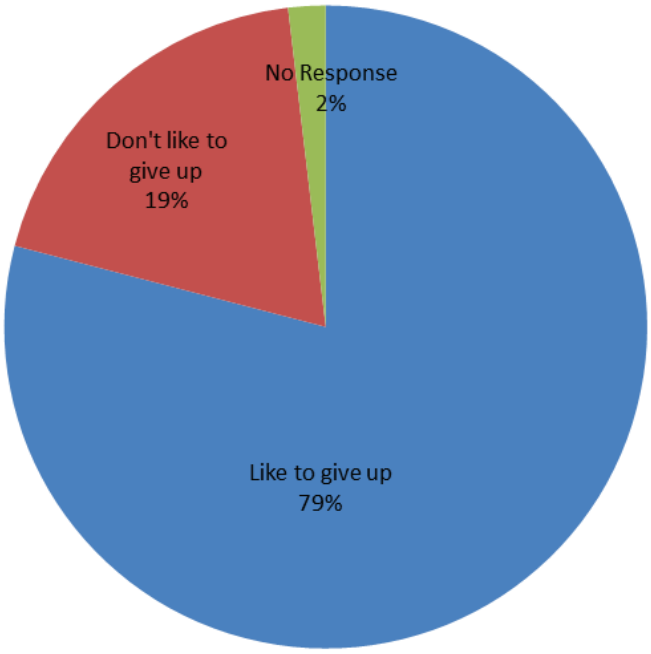


Figure 6. Household willingness to give up shifting cultivation

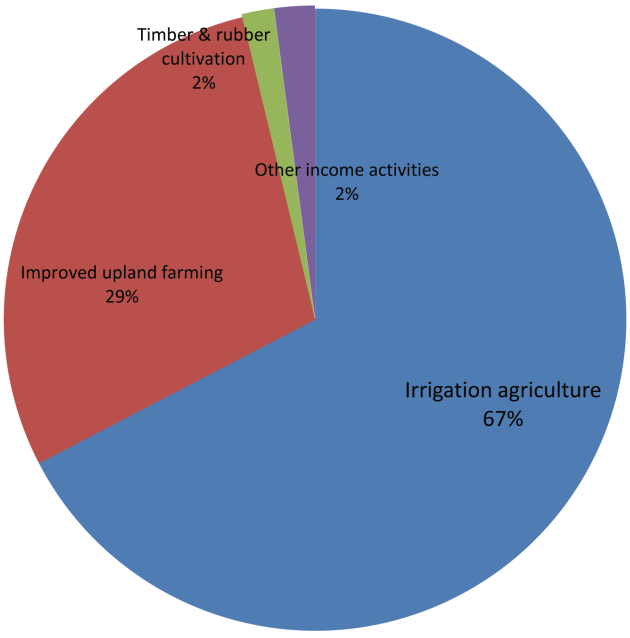


Figure 7. Preferred alternatives to shifting cultivation

7. Conclusions and Policy Recommendations

The present shifting cultivation system disrupts the natural regeneration process of forests and the formation of secondary forests due to continuous cultivation. Since farmers also clear some forest land for cultivation, shifting cultivation contributes to deforestation as well. Further, good habitat for wild elephants is reduced since shifting cultivators cultivate the same land every year and destroy pioneer vegetation. However, shifting cultivation also supports the livelihoods of around 50% of the households in the study area. Therefore, it is necessary to identify strategies to reduce shifting cultivation that do not hurt people's livelihoods, especially the poor.

Our study indicates that shifting cultivation is not a practice restricted to poor landless farmers. Statistical analyses suggest that households that possess more private land and other assets tend to cultivate larger area under shifting cultivation. Since shifting cultivation requires inputs and is associated with risk, households who have the capacity to invest and take risks tend to cultivate a bigger area of shifting cultivation. Shifting cultivation households use both family labor and hired labor. When there are more adult family members in a family, they can participate in more shifting cultivation. The age of the head of a household and shifting cultivation have a parabolic relationship. Very young and very old households cultivate a smaller shifting cultivation area and middle-aged household heads cultivate more land. Household heads who have full-time non-farm occupations, as expected, cultivate a smaller area of shifting cultivation.

In order to achieve current forest enhancement targets by 2030, some portion of shifting cultivation land may have to be allocated for forest restoration and elephant habitat conservation. We recommend that poor and needy households continue to use the land they are currently using for shifting cultivation. Our findings also suggest that around 80% of shifting cultivators are willing to give up this practice if a viable alternative was provided. Thus, to implement a plan for reducing shifting cultivation area, households will need assistance to improve agricultural productivity on private lands or will need alternative income generating opportunities, possibly through ecotourism. The study recommends an integrated plan with alternate income generations options for people who may have to give up existing swidden lands.

Acknowledgements

We wish to record our gratitude to Jean Marie Baland, Priya Shyamsundar, Mani Nepal, Heman Lohano, A.K. Enamul Haque, Celine Nauges, Pranab Mukhopadhayay, Jeff Vincent, E. Somanathan and Subhrendu Pattanayak for their invaluable suggestions, cooperation and encouragement, all of which have made this project possible. The authors would also like to thank Bishnu Sharma for his help in creating the CSPro format for entering data and his guidance in handling data in CSPro. We wish to acknowledge the financial and logistical support of SANDEE, especially that of Anuradha, Bhawana Malvika and Krisha. We would like to extend our sincere thanks to the Integrated Development Association, Kundasale, Sri Lanka for providing the logistic support to carry out the study. We also appreciate the support of many others, both individuals and institutions, during the course of this study and we regret that we do not have the space to acknowledge them all individually.

References

Adhikari, B., S.D. Falco and J.C. Lovette (2004), 'Household characteristics and common property forest use: Evidence from common property forest management in Nepal', *Ecological Economics* 48: 245–257.

Agalawtte, M.B. and P. Abeygunawardena (1993), 'Conservation farming as an alternative to shifting cultivation in Sri Lanka: an economic evaluation', *Journal of Sustainable Agriculture* 4(2): 65–79.

Department of Census and Statistics, Sri Lanka (2004), 'District and Provincial Table of the Sri Lanka Labour Force Survey 2004', [Available at] http://www.statistics.gov.lk/samplesurvey/bullet2004.PDF

Department of Census and Statistics (2009), 'Poverty in Sri Lanka', [Available at] http://www.statistics.gov.lk/poverty/reportnew-Final.pdf

Department of Census and Statistics (2012), 'Population of Sri Lanka by District, Preliminary Report (Provisional)', [Available at] http://www.statistics.gov.lk/PopHouSat/CPH2011/Pages/sm/CPH%202011_R1.pdf

Edirisinghe, E.A.P.N., K.P. Ariyadasa and R.P.D.S Chandani (2012), 'Forest Cover Assessment in Sri Lanka', *The Sri Lankan Forester* 34(new series): 1–12.

Erni, C. (2015), 'Shifting cultivation, livelihood and food security: New and old challenges for indigenous peoples in Asia', Food and Agricultural Organization of United Nations, International Work Group for Indigenous Affairs and Asia Indigenous Peoples Pact.

Fernando, P. (2006), 'Elephant conservation in Sri Lanka: Integrating scientific information to guide policy', Principles of Conservation Biology. Sinauer Associates, Sunderland, MA, USA. Pp 649-652.

Fujisaka, S. and G. Escobar (1997), 'Towards a Practical Classification of Slash-and-Burn Agricultural Systems', Rural Development Forestry Network, Network Paper 21c.

Gunasena. H.P.M. and D.K.N.G. Pushpakumara (2015), 'Chena Cultivation in Sri Lanka, in M.F Cairns (ed.) Prospectus for Agroforestry Interventions' Environmental Change Indigenous People, Agriculture and Forest Conservation.

Intergovernmental Panel on Climate Change (2007), 'IPCC Fourth Assessment Report: Climate Change 2007', [Available at] http://www.ipcc.ch/publications_and_data/ar4/syr/en/spms2.html

Jochim, A.W.R and S. Kandiah (1948), 'The Effect of Shifting (chena) Cultivationand Subsequent Regeneration of Vegetation in Soil Composition and Structure', *Tropical Agriculturist* 104**(**1): 3–11.

Khan, S. R. and S. R. Khan (2009), 'Assessing poverty-deforestation links: Evidence from Swat, Pakistan', *Ecological Economics* 68(10): 2607–2618.

Kumarasiri, D.H.S, E.A.P.N. Edirisinghe and H.K.D. Chandrasinghe (2000), 'Comparative Analysis of Socioeconomic Benefits and Sustainability of Participatory Forestry Project in three Ecological Zones of Sri Lanka with spatial reference to Farmers' Woodlots', report submitted for partial fulfillment of a Post Graduate Diploma in Forestry Management, Indian Institute of Forest Management, Bhopal.

Legg, C. and N. Jewell (1995), 'A 1:50,000-scale forest map of Sri Lanka: the basis for a National Forest Geographic Information System', The Sri Lanka Forester Special Issue – Remote Sensing: 25–36.

Limon, J.A.G., L. Riesgo and M. Arriaza (2002), 'Agricultural risk aversion revisited: A multicriteria decision-making approach', paper prepared for presentation at the Xth EAAE Congress 'Exploring Diversity in the European Agri-Food System', Zaragoza (Spain), 28–31 August 2002.

Ministry of Mahaweli Development and Environment (2016), 'Nationally Determined Contributions', [Available at] http://www4.unfccc.int/ndcregistry/PublishedDocuments/Sri%20Lanka%20First/NDCs%20of%20Sri%20Lanka.pdf

Rahman, S.A., M.F. Rahman and T. Sunderland (2012), 'Causes and consequences of shifting cultivation and its alternative in the hill tracts of eastern Bangladesh', *Agroforestry Systems*, 84(2):141-155.

Sapkota, I.P. and P.C. Oden (2008), 'Household characteristics and dependency on community forests in terai of Nepal', *International Journal of Social Forestry* 1(2):123–144.

StataCorp. (2011), Stata: Release 12. Statistical Software. College Station, TX: StataCorp LP.

Survey Department Sri Lanka (2007), The National Atlas of Sri Lanka, Second Edition.

United Nations Sustainable Development (1992), United Nations Conference on Environment and Development, Rio de Janerio, Brazil, 3–14 June 1992 AGENDA 21. [Available at] www/http://sustainabledevelopment.un.org/content/documents/Agenda21.pdf

Weerakoon, L. and A.M. Seneviratne (1982), 'Managing a Sustainable Farming System in the Highlands of Sri Lanka', Proceedings 1982, British Crop Protection Conference-Weeds.

Appendices

Appendix A: Questionnaires

Household Questionnaire

Name of the village:

Name of the Grama Niladhari Division:

D.S Division:

Name of the Head household:

Date of interview:

Name of the enumerator :

SECTION 1: HOUSEHOLD INFORMATION

Please read out and fill the following household information.

ID Code	Name (not full name)	Relation to head household* (Coded)	Age	Sex	Highest Education Qualification	Occupation*

Relation to head household

Head household-1	Wife-2	Son-3	Daughter-4	Son in law-5
Daughter in law-6	Grandson- 7	Granddaughter-8	Father-9	Mother-10
Other specify .....-11				

Sex

Male -1	Female-2

Occupation code

Farmer- 1	Agricultural laborer -2	Non agricultural labourer-3	Security Force/Police -4
Garment worker -5	Teacher-6	Other Government occupation-7	Other private sector occupation-8
Working abroad -9	Self employment (specify)-10	Retired government worker – 11	No employment-12

SECTION 2: HOUSING AND ASSETS

What type of dwelling does your household occupy? ☐

Single-family-1 Sharing with other family-2

Number of rooms in the house (Excluding the living room and kitchen) ☐

How long do you live in this village?

If more than 5 years leave month blank. If 'forever' or 'always', etc. Write 99

Years: ☐ Months: ☐

Main construction material of outside walls: ☐

Baked bricks/cemented bricks plastered -1 Baked bricks/stones not plastered -2

Cement Bricks not plastered – 3 Unbaked Bricks not plastered -4, Wood –5 Mud- 6, No outside wall-7

Main material roof is made of: ☐

Tiles-1 Cajan – 2 Galvanized iron – 3 Asbestos -4 Straw-5 Other (specify)..... -6

Do you have an own drinking water source? Yes- 1, No- 2 ☐

What type of toilet is used by your household? Water sealed-1 Pit type-2 No toilet-3 ☐

Do you have electricity in your dwelling unit? Yes 1 / No 2 ☐

How much did you pay for your last electricity bill?

Rupees Time Unit Months

a. What are the farm machinery and vehicles the household own

Item	How many
Four wheel tractor	
Two wheel tractor	
Harvester	
Plough	
Water pump	
Thresher	
Truck	
Car	
Motor cycle	
Three wheeler	
Bicycle	
TV	
Radio	

Land own by you

Land	Area Acres
Homestead	
Upland	
Paddy	

Canopy cover of the home garden: ☐

High so cash crops cannot be grown

Moderate so cash crops can be grown in open areas

Low So cash crops can be grown

SECTION 3. VOCATIONAL/TECHNICAL TRAINING AND APPRENTICESHIP

(FOR ALL PERSONS 5 YEARS AND OLDER)

Id Code	1.Have you ever received technical or vocational training, or worked as an apprentice? Include both formal and informal training*. 2. What is the programme.		3-Duration of the training in months.	4. Are you presently working in a job where you use the training you received***.
	1 (Code)			

Answers for Q1

Yes training on going-1 Yes training completed-2 Drop out of training-3 No-4

Answer for Q4

1- Yes 2- No, working in other occupation 3- No, but plan in the future to work in occupation where training could be used

SECTION 4. FARMING AND LIVESTOCK

Description of plots on which you cultivated last year

Location* Coded	Holding status	Irrigated Yes-1/ No -2	Production in Maha				Production in yala			
			Crop	Area (Ac)	Yield	Unit	Crop	Area (Ac)	Yield	Unit

Location:–

Homestead-1 Paddy land-2 Other upland-3 Other – Specify.....-4

Holding status:

Own (having selling right)-1 User (Having user right-2 Rented in (cash)-3 Rented in (share)-4, Any other.....-5

Crop code:

Paddy -1	Maize-2	Cowpea – 3	Mung bean- 4	Kurakkan-5	Gingerly-6
Brnjal – 7	Ground nut-8	Melon- 9	Pumpking-10	Chille-11	Other .....,. - 12

How much did you sell out of these crops

Crop	Quantity	Unit

How much is the rent paid last year for rented in lands?.

Cash: (6 digits)

Production quantity

Product	Quantity	Unit

How much lands have you rented out last year in acres: ☐

How much you received as ☐

Cash

Products

Product	Quantity	Unit

Cost of inputs

Season	Hired labour cost Rs	Cost of fertilizer Rs.	Cost of pesticide Rs.	Cost of weedicide Rs	Cost for sprayer Rs	Cost for tractor Rs	Cost for water pump. Rs	Cost for harvester. Rs	Cost for thresher Rs	Other Rs
Yala										
Maha										

Livestock holding

	Cow	Buffalo	Goat	Poultry	Other
How many of these you presently have (adult)					
How much you earned by selling livestock /its products last year					
Egg					
Milk					
Animal					

Income from other employments of members of the household (except overseas employments)

Membr ID No	Occupation (Coded)	Payment (Coded)	How many peak months	No of days work in peak months	No: of off peak months	No days work in off peak months	If daily paid what is the rate	If monthly paid what is the salary

Occupation code:

Agricultural laborer -2	Non agricultural labourer-3	Security Force/Police -4	Garment worker -5
Teacher-6	Other Government occupation-7	Other private sector occupation-8	Pension – 11

Payment code: Daily paid -1 Monthly Paid-2 [ ]

Is your family member work abroad in ? Yes-1/No-2

How much did he/she send home over the past 12 month? Rs..... [ ]

Did anybody receive pension or social security payment? Yes 1/ No 2 [ ]

How much they receive per month [ ]

Is your family members engaging in self employment? Yes-1/No-2 [ ]

If yes

Family member	Self employment (Pre coded)	Income per month

Hiring a three wheeler-1, Run a Shop -2, Run a vehicle repairer center-3, Run a rice mill-4, Other (specify) -.....- 5

SECTION 5. ASSISTANCE AND CREDIT

Did you receive the service from agriculture extension officers during the last 12 months? [ ]

Yes 1 No 2

Was the information provided by the agent helpful [ ]

Yes very helpful 1 Yes fairly helpful 2 No not helpful 3

Did you receive the service from a credit officer from any lending institution over the past 12 months? [ ]

Yes 1 No 2

How much did you borrow [ ]

For what purpose did you invest the money [ ]

Farming or livestock – 1, Self employment- 2, Housing-3, Other ..... -4

Do you receive Samadhi benefits? Yes-1 No-2 [ ]

SECTION 6 SLASH AND BURN CULTIVATION SYSTEM

SECTION 6 PART A.

LANDHOLDING AND TENURE

Does your household currently operate slash and burn cultivation? Yes-1/No-2 ☐

Do you operate land jointly with other persons outside your households?Yes-1/No2 ☐

If operate jointly what percent of output from the farm is retained by your household?
Percent ..... ☐

Does your household own any land in the village for slash and burn cultivation? ☐
Yes-1/No-2

How many parcels of slash and burn land does your household own? ☐
One 1 Two 2 Three 3 Four 4

Use and description of land parcels?

	Plot1	Plot2	Plot3	Plot4
What is the extend of the land? (Acers)				
What is the distance from your home in km				
Who owns the land Government-1 Temple/Devala - 2 Private-3				
Did you cultivate these lands during this year Yes 1 No 2				
If yes what is the extend in acres				
Is this land cultivated in 2010 Yes 1 No 2				
Is this land cultivated in 2009 Yes 1 No 2				
Is this land cultivated in 2008 Yes 1 No 2				
Is this land cultivated in 2007 Yes 1 No 2				
Is this land cultivated in 2006 Yes 1 No 2				
Year cultivated last				

17. If you do not cultivate lands continuously what is the reason ☐

To keep the land more fertile -1, I was sick- 2, My family members were sick- 3, I do not have money to spend-4, Other (.....)-5

Rent out lands

	Plot1-Ac	Plot2-Ac	Plot3-Ac	Plot_4
Did you rent out or share crop out any of the above land parcels over the past 12 months? Yes 1 No 2				
How much land did you rent out for fixed rent in the last 12 months?				
How much total cash rent did you receive last year?				
How much land did you rent out for sharecropping in the last 12 months				
What was the total cost of inputs provided by your household to the share cropper (s)				
What was the value of share of production did you receive from the share cropper				

Rent in of slash and burn lands

	Plot 1-Ac	Plot2-Ac	Plot3-Ac	Total
Did your household rent in or sharecrops in any other land over the past 12 months? Yes 1 No 2				
How much land did you rent in for fixed rent in the last 12 months? acres				
How much total cash did you pay the land ? acres				
How much land did you rent in for sharecropping arrangement? acres				
What is the value of harvest did you pay %				

SECTION 6. PART B: MAHA CROP PRODUCTION

1.In the past maha what are the crops you grow	2.How much land did you cultivate under each crop		3.Yield		4.How much of the total harvest did you sell?		5.How much were you paid for the crop you sold (Rs)
the crops you grow							crop you sold (Rs)
	Qty	Unit	Qty	Unit	Qty	Unit	

Expenditure for maha crop production

Item	Amount	Rate
Hired Labour	Days	Wage/day:
Fertilizer 1	Kg	Rs/Kg
Fertilizer 2	Kg	Rs/Kg
Pesticide 1	Bottles	Rs/Bottle
Weedicide 1	Bottles	Rs/Bottle
Weedicide 1	Bottles	Rs/Bottle
Sprayer	Total rent paid	Rs.
Water pump	Total rent paid	Rs.
Tractor	Total rent paid	Rs.
Harvester	Total rent paid	Rs.
Thresher	Total rent paid	Rs.
Other(Specify).....	Total rent paid	Rs.
Other(Specify).....	Total rent paid	Rs.
Other(Specify).....	Total rent paid	Rs.
Other(Specify).....	Total rent paid	Rs.

SECTION 6. PART C: YALA CROP PRODUCTION

1.In the past yala what are the crops you grow	2.How much land did you cultivate under each crop		3.How much total crop did you harvest		4.How much of the total harvest did you sell?		5.How much were you paid for the crop you sold (Rs)
	Qty	Unit	Qty	Unit	Qty	Unit	

Expenditure for Yala crop production

Item	Amount	Rate
Hired Labour	Days	Wage/day:
Fertilizer1	Kg	Rs/Kg
Fertilizer 2	Kg	Rs/Kg
Pesticide1	Bottles	Rs/Bottle
Weedicide 1	Bottles	Rs/Bottle
Weedicide 1	Bottles	Rs/Bottle
Sprayer	Total rent paid	Rs:
Water pump	Total rent paid	Rs:
Tractor	Total rent paid	Rs:
Harvester	Total rent paid	Rs:
Thresher	Total rent paid	Rs:
Other(Specify).....	Total rent paid	Rs:
Other(Specify).....	Total rent paid	Rs:
Other(Specify).....	Total rent paid	Rs:
Other(Specify).....	Total rent paid	Rs:

SECTION 6. PART D. FARMERS BEHAVIOUR

1 If you do not practice slash and burn agriculture what is the Reason? ☐

I have other lands to cultivate-1, I do not have money to spend-2, I do not have people to go there-3, I am sick-4, My income is enough-5 Legal Problems-6 Wild Elephant damages-7

Not profitable- 8 Other - 9

What is the current vegetation in your slash and burn lands

Land	Vegetation (Code)
Land 1	
Land 2	
Land 3	

10 year old forest-1, 5 to 10 year old forest-2, Shrub Grass-3

What is the fallow period you maintain?..... ha

Do you live in the slash and burn land during the cultivation period? Yes-1 No-2

If yes who accompany you (Write Id Codes of family members)

Who stay at home (Write Id Codes of family members)

Do you like to give up slash and burn cultivation if an alternative is provided

Yes 1 .No 2

Rank following alternatives base on your preference

Alternative	Rank
Upland farming with cash crops	
Irrigation lands	
Lands Timber cultivation	
Lands for rubber cultivation	
Other Employment opportunity	
Other specify.....	

Were you fined or charged for slash and burn cultivation? Yes 1 No 2

If yes in which years and how?

Year	Fine or Punishment

Do you think soil fertility is reducing in your lands now? Yes 1 No 2

If yes why? .....
.....
.....

Does elephant damage your chena lands? Yes 1 No 2

If yes in which years and income loss

Year	Loss

Have you obtain a legal permission for slash and burn cultivation Yes -1 No -2

What is the extent..... ha

When did you obtain the permission ..... year

If you do not obtain a permit what is the reason .....

Village questionnaire

Village characteristics

Name of the village

Is this a traditional village or settled village

If settled village answer question number 3 – 6 . Otherwise go to part B

When the village was settled?

Number of families settled…….

Population at the time of settlement……..

Land allocation at the time of settlement (AC)

Paddy……..

Upland…….

Homestead…….

Population Characteristics

Total persons residing in the village.

Number of household residing in the village

Total land area of the village

Number of "Samurdhi Recipients" of the village?……

The distance from village to chena cultivation area (km)……..

C Access to Facilities

Is there a service in the village	Yes	No	How far the closest service in Km
Shop			
Co-op shop			
Fertlizer Stores			
Agro chemical stores			
Tractor rental			
Weekly Market			
Main Bazar			
Police Station			
Post Office			
Bus stop			
School			
Tar road			
Concrete road			

Farming Practices

Land use of the village

	Area (Ac)
Paddy	
Upland	
Homesteads	

What percentage of household are landless laborers (neither own nor operate land).....

How many tube wells are there in the village?
a. Privately owned .....
b. Publically owned .....

Is there a village tank in the village? Yes 1 No 2

Does the village receive irrigation water from other irrigation scheme?

If yes what is the scheme?.....

What is the area under irrigation?.. (Ac).....

What is the rent for tractor use in the village?

What is the price did farmer receive for following crops and products (Last season)

Crop	Unit	Price Maha	Price Yala
Rice (samba)			
Rice (Nadu)			
Maize			
Mungbean			
Cowpea			
Brinjal			
Groundnuts			
Pumpkin			
Melon			
Chili			
Egg			
Chicken			
Milk			
Goat			

Main buyers of agricultural products of the village

Buyer	Does the buyer come to village to purcase	If no what is the distance from village to the buyer

What price did farmer pay for fertilizer?

Name of the fertilizer	Unit	Cost

Has the village visited by a field and agricultural extension officers during past six months?

Yes 1 No 2

Distance from village to forest area.....

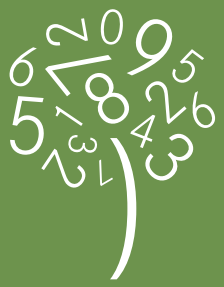
Appendix B: Tables with Detailed Information

Table B.1. Shifting cultivation in Divisional Secretariat Divisions

Slash and burn cultivation	Buttala	Kataragama	Sewanagala	Siyambalanduwa	Thanamalwila	Total
Number of households that use this practice generally	86	35	5	86	108	320
Percentage	61.4	38.9	20.8	71.7	50	54.2
Number of households that do not use this practice generally	54	55	19	34	108	270
Percentage	38.6	61.1	79.2	28.3	50	45.8
Number of households that practiced this in Maha, 2011	83	28	4	86	95	296
Percentage	59.3	31.1	16.7	71.7	44.0	50.2
Number of households that did not practice this in Maha, 2011	57	62	20	34	121	294
Percentage	40.7	68.9	83.3	28.3	56.0	49.8
Total	**140**	**90**	**24**	**120**	**216**	**590**

Table B.2 Main occupation of household heads

Occupation	Number	Percentage
Farmer	464	78.64
Self-employed	29	4.92
Government employment	47	7.95
No employment	18	3.05
Private sector employment	17	2.88
Laborer	7	1.19
Retired	7	1.19
Foreign employment	1	0.17
Total	**590**	**100.00**



SANDEE

P.O. Box 8975, E.P.C 1056, Lalitpur, Nepal

Street address: c/o ICIMOD, Khumaltar, Lalitpur, Nepal

Tel: 977 1 5003222**, Fax:** 977 1 5003299**, Email:** info@sandeeonline.org, **Web:** www.sandeeonline.org

SANDEE Sponsors

ICIMOD IDRC CRDI Norad SWEDEN