

Forest Income as an Insurance Diversification Strategy among Rural Farmers in South Nandi, Kenya

Sumukwo Joel

Department of Applied Environmental Social Sciences,
University of Eldoret, P.O. Box 1125, 30100 Eldoret, Kenya
E-mail address: sumukwoj@gmail.com

Abstract

Limited income opportunities and lack of formal insurance schemes among farmers in sub-Saharan Africa have impeded rural economic development. This paper examines the insurance diversification function of forest income among households in South Nandi of Kenya. Using survey data of 224 households located within a 4 km radius of South Nandi forest, income diversification strategies and insurance role of forest products are examined. Results show that forest incomes contribute significantly (24%) to total household income. Diversification model indicates that farm income has an inverse effect on level of diversification. That is, increased farm income reduces income diversification strategies among the households. The residents consider improved farm income stream promotes financial security and stability. But the off-farm income is not associated with reduced diversification of household income sources among residents of South Nandi. Results show that forest income has a positive and significant effect on the index of diversification forest income. Hence forest income is an important natural insurance diversification strategy to rural households as it assumes an option value to over half of the residents. This study suggests that to reduce consumption and income shocks, programs that coevally enhance agricultural efficiency and reliability of forest income should be adopted. In conclusion, the stated insurance premium value above (40%) maximum willingness to pay would guarantee the continued flow of forest services in the future irrespective of whether there is current consumption or not. Further, the benefits from forest income diversification in risk management should be integrated in forest conservation policies.

Key words: Forest incomes, diversification strategy, Natural insurance, Non-timber forest products, Kenya

INTRODUCTION

Limited income opportunities and the absence of formal insurance programs, that serve to absorb frequent income shocks, have impeded rural economic development in low-income countries. However, empirical evidence and literature reveal that rural farmers in sub-Saharan Africa use forest commodities to meet various livelihood needs. These studies have shown that non-timber forest products (NTFPs) contribute to total household income that range from about 20% to over 50% (Cavendish, 2000; Shackleton *et al.*, 2007; Kamanga *et al.*, 2009; Illukpitiya *et al.*, 2010; Mutenje *et al.*, 2011). Households adjacent to these forests often have used these resource products to construct diversification programs whose goals range from risk reduction, reaction to crisis, improve domestic income to wealth accumulation (Valdivia *et al.*, 1996; Ellis, 1998; Paumgarten *et al.*, 2009; Mutenje *et al.*, 2011). This also includes to stabilize or smoothen, or both, the income variability over time. To the rural farmer more income diversification sources help cope with unpredictable changes in different income activities so that shortages from a single income source become easier to cope with (Heubach *et al.*, 2011). Some of the main diversification behavioural activities that have been identified and determined are farm income, off-farm and non-farm incomes. Generally, households that depend on forest resources have agriculture, off-farm or/and forest products as primary income sources (Illukpitiya *et al.*, 2010).

Forest income often acts as natural insurance in periods of unpredictable economic shocks (Babulo *et al.*, 2009) which includes unexpected income shortfalls or cash needs (Vedeld *et al.*, 2007). The insurance role of forest goods mainly occurs with a shock or sudden changes in the economic, social or climatic environments in which households exist and function (Shackleton *et al.*, 2007; Kamanga *et al.*, 2009). The rural poor rely on local commons not only for self-insurance but also for mutual insurance (Baland *et al.*, 2005). Contingent valuation techniques have been used to assess option and existence values of natural resources (for example, Turpie *et al.*, 2003; Amirnejad *et al.*, 2006).

The majority of the households in South Nandi are smallholder subsistence farmers who depend on one to less than a hectare farm plots for food production and income generation (Republic of Kenya, 2010). Hence, income diversification is an important instrument for sustaining livelihoods with poverty rates of over 46% (Republic of Kenya, 2011). There exist, therefore, substantial gaps in our understanding about the diversification functioning of non-timber forest products as natural insurance premium. Information from this study will enhance our knowledge on the actual functioning of rural economies in rural Kenya. Therefore, the objective of this paper is to examine the effects of forest income diversification as a natural insurance strategy among rural households in South Nandi, Kenya. The study tests: the economic contribution of forest income to total household income and the natural insurance diversification function of forest incomes to rural households.

MATERIALS AND METHODS

Empirical Model

Theoretical and empirical findings show that households maintain diversified livelihood strategies (or income sources) due to insufficient income from any single strategy and also to reduce consumption risks (Sunderlin *et al.*, 2005; Vedeld *et al.*, 2007; Tesfaye *et al.*, 2011). Diversification theory suggests that any decreases in total production may be outweighed by the decrease in risk associated with producing a variety of goods (Shone *et al.*, 2006). The natural insurance valuation involved obtaining the monetary option value of NTFPs as the households' extra willingness to pay for the improved provision of forest products to guarantee continued availability of the resources in the future (Mcsweeney, 2005; Völker *et al.*, 2010). Contingent valuation method is also based on random utility method.

The demand for income diversification can be shown in a simple utility function;

$$U = u(Y_{ij}, F_n, C) \quad (1)$$

Where U is the utility as expressed in the demand for the commodity

Y_{ij} refer to incomes from activities i to j

F_n is the n^{th} forest income goods such as livestock pasture, firewood, forest honey, vegetables, mushrooms, herbal medicines.

C is the costs of income diversification

In describing the effective income sources used in diversification by households an inverse Simpson index of diversity variable was constructed in which an OLS regression model is constructed from income values derived in a random utility model. Hence, diversification of household income can be expressed mathematically as:

$$Y_{ij} = \beta_0 + \beta_1(X_{1i}) + \beta_2(X_{2i}) + \beta_3(X_{3i}) + \varepsilon_i \quad (2)$$

Where:

Y_{ij} is total household income in Kenya Shillings, (X_{1i}) is farm income, (X_{2i}) is off-farm income, (X_{3i}) is forest income, β_{is} are unknown coefficients to be estimated and ε_i is the stochastic term.

The Study Area

The study was conducted among rural households living adjacent to South Nandi Forest Reserve. South Nandi forest, located about 320 km west of Nairobi, is among Kenya's few remaining tropical forests (Fig. 1) and is an extension of both North Nandi and Kakamega forests.

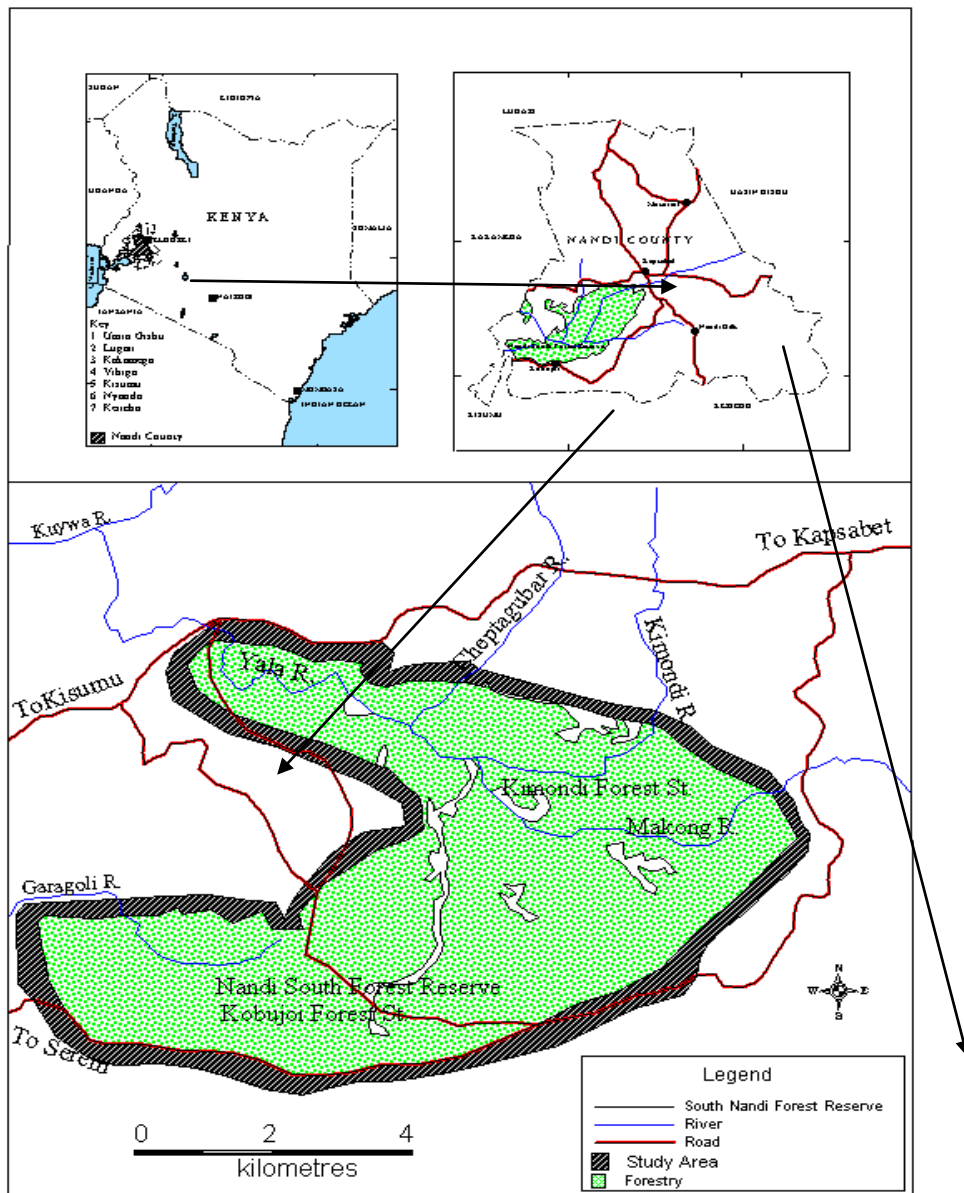


Figure 1: Map of County showing South Nandi Forest Reserve

Source: Author

Methods of Data Collection, Empirical Design and Sampling Method

Questionnaire survey was the main instrument for the collection of household data in this study. The identification information of the residential area was sought and date of the interview noted. The study required various methods of data collection from both

secondary and primary sources. The primary data was gathered through interviews, key informants and focus group discussions for the purpose of exploring various viewpoints and to provide relevant information on management of forest products and services. An original survey design was constructed to solicit participants' responses on socio-economic characteristics, household income diversification strategies, forest resource use and random utility valuation of forest incomes. In the last section of the questionnaire design contingent valuation survey was used in assessing the natural insurance provision of forest products continued supply. This study used the continuous CVM to elicit the willingness to pay values. In this procedure the respondents were free to answer the open-ended questions by indicating the maximum amount they were willing to pay.

A pre-testing of the survey instrument was conducted among 40 randomly selected households prior to implementation of the survey and then the questions were adjusted accordingly. A structured questionnaire survey was used in twenty-four forest fringe villages. The selection of the villages was based on their proximity to the forest from information provided by chiefs of the six locations on the periphery of the forest. The villages are, on average, within four-kilometre radius of the forest edge.

In order to get samples representative of the population, the 2009 national census survey data was used to list all households in the study area in which a total of 224 households was chosen representing 16% of the household population of the selected villages in South Nandi. The formula below was used in selecting the number of respondents as the representative sample size,

$$n = \frac{NC^2}{C^2 + (N-1)e^2} \quad (3)$$

Where n = Sample Size, N is Population Size, C is Coefficient of Variation (30%), e is Standard error of 2%.

In order to provide every household within the research area equal chance of being interviewed, sampling was done at two levels: multi-stage stratified sampling and systematic random sampling. The survey was done between January and April 2015. Secondary data was extracted from various published materials. Individual household heads were interviewed on local forest resource management.

Measuring Index of Diversification

In this study, a diversity variable, for diversification levels of income, was constructed from all households' sources of income, namely; off-farm income, farm income, and forest income (in RUM estimates). The diversification index is affected both by the income sources and the distribution of income between the different sources (Valdivia *et al.*, 1996). The inverse index helps to understand the effective income sources used in diversification in which the squared term allows for non-linearity. Therefore, an inverse Simpson index of diversity was used (Hill, 1973) as applied in Valdivia *et al.*, (1996), Illukpitiya *et al.*, (2010) and Heubach *et al.*, (2011):

$$\text{Index of Diversity} = \frac{1}{\sum_{i=1}^N P_i^2},$$

$$\text{Where } \sum_{i=1}^N P_i^2 = \left(\frac{Y_1}{Y_T}\right)^2 + \left(\frac{Y_2}{Y_T}\right)^2 + \left(\frac{Y_3}{Y_T}\right)^2 \quad (4)$$

N represents the number of household income sources

P_i is the proportion of household income from activity i

The income source (Y_1) is off-farm income, Y_2 represents on-farm income, Y_3 is income from non-timber forest products and Y_T is the total household income from all the sources. A diversity index of 1 means there is no diversification at all. A diversity index close to the number of income sources (3) indicates a more uniformly distributed income from each of the sources.

Techniques of Analysis

All the completed questionnaires were collected before being subjected to analysis. Descriptive statistics were computed in order to explain the mean, median, standard deviation, ranges of the data, frequency distributions. The analyzed data was presented in form of tables, graphs, and other appropriate presentation techniques. Some selected variables were used in the multivariate analysis where the relationship between the dependent variable, willingness to pay, and the explanatory variables were examined. An Ordinary Least Squares (OLS) regression was used for estimating the parameters in the multiple regression model.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

Table1 summarizes the descriptive statistics of the main socio-economic characteristics of the households. The age ranged between 25 and above 56 years. All the respondents were farmers and most (68%) of them had primary education and below. Household education level has a positive effect on income, causing the need to diversify income portfolio of activities to meet livelihood demands. This means that a forest income is an attractive income both and an insurance diversification strategy.

Table 1: Descriptive statistics of socio-economic characteristics of the households

Variable		Percent
Gender:	Female	63
	Male	37
Age:	25 Years and below	6
	26-40	30
	41-55	37
	56 and above	28
Occupation:	Formal employment	6
	Business man/woman	24
	Farmer	100
	Casual Work	16
Education:	No formal schooling	18
	Primary school	50
	Secondary school	23
	College and above	9
Size of household:	<u>Age 0 – 16:</u>	49
	Males	(51)
	Females	(49)
	<u>Age 17 and above:</u>	51
	Males	(52)
	Females	(48)
Land size distribution (in acres):		
	0.1 – 2.4	(46)
	2.5 – 9	(48)
	10 and above	(6)

The average land size among the households sampled was 3.9 acres (equivalent to 1.6 hectares) and supported 94% of residents. With an average family size of 7 persons, households basically depended on small-scale rain-fed farming for subsistence and often were faced with idiosyncratic and covariate shocks in which coping mechanisms must be devised to protect income and consumption requirements.

Farm and Off-Farm Household Economic Activities

Households in South Nandi were typically farmers who obtained income mostly from crop growing and livestock production. Farm and off-farm income sources were mostly tea (51% of farm income) and salaried employment (52% of off-farm income) respectively. These two sources of income combined contributed 51% to the total regular household income (that is all household income that did not include forest incomes). Tea farmers (62%) each received on average Sh. 82,416 per annum. About 54% of the tea farmers earned below this average amount. The huge income inequalities among households provided incentives for people to resort to extraction of forest goods as an income diversification strategy.

Most of the households (98%) depended on maize production as a source of income with an average yearly earning of Sh. 20,589. Income from maize production was

statistically the same, as income from milk and livestock sells, in a paired t-test at 5% level of significance (Table 2). High fluctuations of maize prices implied that farmers had to increase investments in milk production and livestock sells to stabilize domestic incomes. This led to increased demand for forest resources as a major fallback revenue source in times of financial stress during depressed farm output and increased commodity prices.

Household Income Diversification

Diversification Regression Model

Households generally construct variety of income portfolio of activities to cope with consumption shocks and to devise risk management strategies. In order to understand the effective income sources used in diversification by households an inverse Simpson index of diversity variable was constructed. The three main sources that were considered as determining diversification were off-farm, farm and forest incomes. Off-farm income consists of income from business, wages and other incomes not included in forest incomes. Farm income refers to income from crop and livestock production. Forest income was the income that emanated from non-timber forest products. Results (t-values in the parenthesis) of the effects of the three main household diversifications strategies in OLS regression were:

$$\text{DIVERSIFICATION} = 1.845 + 0.218 \text{ OFF-FARM} - 0.405 \text{ FARM} + 0.308 \text{ FOREST INCOME}$$

(6.258) (39.014) (3.470) (-6.362)

F value = 22.163, $R^2 = 0.687$, adj. $R^2 = 0.622$, and $n = 224$.

Off-farm income had a positive and significant effect on index of income diversification. Thus evidence indicates that off-farm income was not associated with reduced diversification of household income sources among residents of South Nandi. Instead, as off-farm income had a strong significant ($p < 0.05$) effect on diversification, it meant that it contributed to household diversification strategies for improved income. It also indicated that households with off-farm income sources considered these sources unstable and unreliable economic activities to be depended on as the only domestic source of income. In the regression model above farm income had an inverse effect on level of diversification indicating that people were not likely to construct other income portfolios if these activities provided financial security throughout the year.

The results also show that forest incomes had a positive and significant effect on the index of diversification. This means that the higher the income from forest sources the more likely was the household to diversify income. This also indicates that people used forest income to diversify to other streams of income mainly as a risk management strategy. In other words, the returns from forest sources were likely to be greater than off-farm incomes.

Diversification and natural insurance demand

Recent empirical studies (for example, Cavendish, 2000; Vedeld *et al.*, 2007; Paumgarten *et al.*, 2009; Babulo *et al.*, 2009) have described insurance role of non-timber forest products, but most do not relate with income diversification. In this study majority (81%) of the households had diversified their income sources as a coping strategy in the face of unpredictable consumer prices, weather variability and anticipated future domestic needs. Majority (89%) of these rural households made use of combinations of various non-timber forest products as natural insurance cover during the period of income or consumption risk/and uncertainty such as times of economic stress like drought, financial difficulties or depressed agricultural output prices economic survival in periods of uncertainty. These people combined the main forest product of consumption with extraction of medical plants, wild fruits and water.

The Insurance Value of Forest Incomes

To test the natural insurance demand for forest incomes, a demand for continued flow of forest products, this research used contingent valuation method. Most (84%) of the respondents were willing to pay (WTP) some amount of money in the contingent market for improved provision of forest products and 56% of them were willing to contribute extra money, above the normal maximum WTP amounts for improved forest products management, as guarantee for future availability of forest products.

Table 2: Option Values Amounts

Maximum Monetary Contribution	Bid (Sh.)	No. of Respondents	Total Value (Sh.)
Extra Amount (KSh.):			
	100	2	200
	200	3	600
	500	20	10,000
	1,000	21	21,000
	1,200	1	1,200
	1,500	2	3,000
	2,000	19	38,000
	3,000	4	12,000
	3,200	1	3,200
	4,000	4	16,000
	5,000	13	65,000
	6,000	2	12,000
	7,000	3	21,000
	8,000	5	40,000
	10,000	2	20,000
	12,000	1	12,000
	15,000	2	30,000
Total		105	305,200

Among those who stated a non-zero positive WTP for insurance provision of forest resources, 37% bided amounts higher than their normal maximum WTP amounts indicating that they valued more future availability of non-timber forest products than

their current flows. In other words, unexpected future income shortfalls or cash needs cause households to value more the future benefits of the resource. On average the option value of forest products is Sh. 2,907 per annum indicating the residents' option demand, which was their natural insurance premium (see Table 2).

The lowest extra contribution was Sh. 200 and the highest was Sh. 15,000. The total extra contribution was 40% above the maximum WTP amount. This means that the Nandi South forest assume an option value to the residents which should be included in sustainable management strategies.

CONCLUSIONS AND POLICY IMPLICATIONS

Due to limited income opportunities and lack of formal insurance programs in rural areas, this paper sought to investigate effectiveness of forest incomes in natural insurance provision for economic development in South Nandi, Kenya. The results show that forest incomes contributed on average 24% of household income, which was the second largest share of total household income after farm income (54%) sources. Non-timber forest product income, concomitantly with off-farm income sources, was used by forest-margin households to construct income diversification strategies for improved domestic income and natural insurance programs. Further, the finding reveal that majority (81%) of the households diversified their income sources as an income and consumption risk coping strategy.

To reduce consumption and income shocks, programs that coevally enhance agricultural efficiency and reliability of forest income should be adopted. Pro-poor approaches, like enhancement of entrepreneurial skills, which focus on increased off-farm incomes could be implemented to improve income security in order to reduce the number of people that depend on forest resources during difficult financial times. Hence, for improved household welfare and general economic growth the role of forest incomes in coping and risk insurance provision to the vulnerable households must be appreciated. It is recommended that the benefits from forest income diversification in risk management should be integrated in forest conservation policies.

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