

Do non-timber forest products reduce household food insecurity in Burkina Faso?

Magloire Thiombiano

Centre d'Études, de Documentation et de Recherche Économiques et Sociales (CEDRES), Université Thomas Sankara (UTS), Burkina Faso. E- mail: magloirethiombiano37@gmail.com

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Abstract

This article analyses the effects of non-timber forest products (NTFP) on food security in Burkina Faso. For this purpose, a composite index (Composite Food Security Indicator Approach) was calculated using primary data collected from 384 randomly selected households. The novelty of this study is that it conducts an analysis of the value chain of NTFPs (production, consumption, processing and marketing). Using the conditional mixed process (CMP) model, the results show that households involved in NTFP marketing, production and processing are more likely to reduce their risk of food insecurity than consumer households. These results suggest that households should be encouraged and supported to domesticate, sustainably harvest, process and market these products to ensure higher, more stable incomes and reduce household food insecurity.

Key words: Burkina Faso, food security, non-timber forest products, value chain stages

1. Introduction

The 2030 Sustainable Development Goals (SDGs) agenda aims to eliminate hunger and ensure food security (SDG 2). However, global food insecurity has worsened, with the prevalence of undernourishment rising from 8% in 2019 to 9.8% in 2021, leaving between 702 million and 828 million people suffering from hunger in 2021 (FAO *et al.* 2022). Projections indicate that nearly 670 million people will still be hungry in 2030 (FAO *et al.* 2022). The crisis is most acute in sub-Saharan Africa, which has the highest prevalence of moderate or severe food insecurity (57.7%) in the world (FAO *et al.* 2019).

In this context, non-timber forest products (NTFPs) present a potential solution. They are a vital source of income and livelihood globally (Fedele *et al.* 2021; Mondoa *et al.* 2024), especially in impoverished regions, with an estimated 5.6 billion people using or marketing them (Shackleton & De Vos 2022). In tropical regions alone, about 1.2 billion people rely heavily on natural resources, 48% of whom are in Africa (Fedele *et al.* 2021).

NTFPs influence all dimensions of food security. Indeed, the availability of and access to food are directly influenced by the contribution of natural foods to support households' daily consumption (Abdulla 2013), and indirectly by the monetary income from their exploitation (Chukwuone & Okeke 2012; Abdulla 2013). The stability of food access is also influenced by the abundant availability of NTFPs for most of the year and even during shocks, especially for vulnerable households (Angelsen *et al.* 2014), as well as by the monetary income provided to households.

This dual contribution of NTFPs through direct provisioning and income generation aligns with Sen's capability theory, which suggests that NTFPs can improve food security. Sen (1985) posits that the issue of food security is a question of capabilities. Thus, according to this theory (Sen's capability theory), NTFPs can, through their availability and the income they generate, enhance individuals' capabilities and thereby contribute to achieving food security. However, this capability theory contrasts with the scepticism of Malthusian theory regarding natural resources and population growth. Malthus (1815) implicitly argues that NTFPs, as natural resources, cannot improve food security due to their limited availability and the increase in population.

In Burkina Faso, where nearly 47% of households reported concern over insufficient food due to a lack of resources in 2018 (National Institute of Statistics and Demography [NISD] 2022), NTFPs are a critical palliative. They are part of the diet for over 43% of rural households, provide 23% of income (Ministry of the Environment of the Green Economy and Climate Change [MEGECC] 2018), and have been linked to a reduction in moderate or severe food shortages in some regions (Tree Aid 2021).

The growing importance of NTFPs has stimulated a great deal of research in Burkina Faso (Nabaloum *et al.* 2019; Sawadogo 2023; Ouédraogo *et al.* 2024; Thiombiano 2025). Nevertheless, studies focusing on the direct relationship between NTFPs and food security are limited (Sawadogo 2023; Thiombiano 2025). Most research focuses on the conditions of access to forest resources for the harvesting of NTFPs (Nabaloum *et al.* 2019), or on their role in reducing household poverty (Ouédraogo *et al.* 2024). Moreover, although some work has tackled the link between NTFPs and food security (Sawadogo 2023; Thiombiano 2025), it has dealt with the NTFP sector as a whole, whereas a breakdown of the contribution by stage of the value chain (production, consumption, processing and marketing) to food security would be far more beneficial for the development of targeted public policies.

The objective of this article, therefore, is to analyse the effects of NTFPs on household food security. To this end, this article hypothesises that, compared to the consumption stage, the production, processing and marketing stages of NTFPs improve the level of household food security. The contribution of this article is to disaggregate the NTFP value chain into production, processing, marketing and consumption and to assess the food security effect of each stage separately, which helps identify at which point in the chain households are most dependent on NTFPs for their food security, and where policy interventions would be most effective.

The remainder of the article proceeds as follows: Section 2 reviews the literature, Section 3 presents the methodology, Section 4 discusses the results, and Section 5 concludes with policy implications.

2. Non-timber forest products and food security: A literature review

The analysis of the effects of non-timber forest products on food security can be grounded in the theory of capabilities. The capability approach was introduced by Sen in 1981. For this approach, food security is determined not only by the availability of food, but above all by access to that food. Food security therefore depends more on the capacity of households or individuals to access food

than on the availability of that food. Thus, this theory emphasises the “ability” of individuals to access available resources in the realisation of their well-being (food security). Capabilities are defined as a person’s actual ability to do and be, in the context of a given society, or simply the “freedom to achieve different lifestyles” (Sen 1985). Staatz *et al.* (1990) agree with Sen and define food security as the ability to establish a food system that provides the entire population with a nutritionally adequate food supply over the long term. According to Sen’s approach, non-timber forest products can contribute to food security through their availability and accessibility, and the income they generate.

Several empirical studies have also examined the links between food security and non-timber forest products. In Burkina Faso, Sawadogo (2023) used binary and ordered multinomial logistic regressions to show that households deriving nearly a quarter of their income from NTFPs are more likely to be food secure; including NTFP income raised the share of food-secure households from 63% to nearly 70% of the 263 households sampled. In the same country, Thiombiano (2025) used an ordered logit model to show that short and medium NTFP distribution channels reduce household food insecurity. Similarly, in Tanzania’s Kondo District, Sagali *et al.* (2023) found that NTFPs contribute to the food supply of 36.31% of surveyed households. Furthermore, Hama *et al.* (2019) found NTFPs to be a major food source for rural households in Tamou, southwestern Niger. Using univariate and logistic regression analysis, Gerald *et al.* (2021) likewise found that NTFP collection, production and sale positively and significantly influence rural livelihoods and food security in Mozambique’s Niassa Reserve, in the Mecula-Marrupa corridor. In contrast, Razafindratsima *et al.* (2021) found more ambiguous results: forest ecosystem services support well-being and food security, but forests can also generate negative externalities that entrench households in poverty.

The summary of this work highlights the importance of NTFPs in general in the fight against food insecurity, while overlooking the importance of the various stages (production, processing, marketing and consumption) in the fight against food insecurity. Yet knowledge of this relationship will help to better guide public and private policies in this fight. This article aims to fill this gap by analysing the relationship between NTFPs and food security from the point of view of the stages in NTFP value chains.

3. Analytical methodology

3.1 Theoretical framework

The analysis of the effects of non-timber forest products (NTFPs) on household food security in Burkina Faso is firmly rooted in Sen’s (1981, 1985) capability approach. This approach moves beyond the simple question of food availability to focus on individuals’ access and entitlements to nourishment. Food security is thus conceptualised as a functioning (the achievement of being well-nourished) determined by the household’s capabilities (the real possibilities) to convert its resources into this state of well-being.

This theoretical framework is refined by the resources-agency-achievement model developed by Kabeer (1999), which offers a dynamic analytical structure for empirical study. Resources, X_R , constitute the entire set of inputs a household can mobilise, including classic factors such as the education of the household head, access to credit and overall income. The NTFPs themselves (whether through direct consumption or the income they generate) are the central resources of this study. Achievements, Y , are the outcome of the process measured by the household’s food security status.

The bridge between resources and achievements is agency (f), which represents the household's capacity to make strategic choices and act accordingly to transform the potential of the resources into effective outcomes. In this study, agency is concretely embodied by the household's involvement in a specific stage in the NTFP value chain (production, processing, marketing and consuming). The choice of a more profitable link is an act of agency that serves as a conversion function, allowing for the optimisation of income and food stability. The theoretical model is thus formalised by Equation (1):

$$Y = f(X_R, X_{Ag}), \quad (1)$$

where X_{Ag} is the value chain stage, and the hypothesis is that agency (engaging in a stage beyond simple consumption) positively influences the level of achievement (Y).

3.2 Empirical model

This article aims to analyse the effects of NTFPs on food security through the different stages of their value chain. Theoretically, a bidirectional relationship exists between a household's choice of NTFP value chain stage and its food security level. On the one hand, the income generated by each stage (production, consumption, processing or marketing) can directly influence a household's food security. On the other hand, a household's food security status might determine its choice of value chain stage; as each stage involves different costs, a food-insecure household may be unable to engage in activities requiring high initial expenditure.

This interdependence creates a situation of endogeneity that must be addressed using an appropriate model. We employ the conditional mixed process (CMP) model developed by Roodman (2011). CMP is preferred over alternatives such as endogenous switching regression, which cannot handle categorical variables, or instrumental variables models, which require hard-to-find instruments: it estimates interconnected equations with heterogeneous dependent variables (binary, categorical, continuous) without instruments, an efficiency that is crucial for correcting endogeneity in the NTFP-food security link. It is also frequently used in the relevant literature (Mbudzya *et al.* 2022; Thiombiano & Thiombiano 2026).

Empirically, the link between the NTFP value chain stages (*Stages*) and food security (*Cari*) can be estimated as follows (Alhassan *et al.* 2020; Mbudzya *et al.* 2022):

$$Stages_i = \beta_0 + \beta_1 X_{1i} + \varepsilon_{1i}, \quad (2)$$

$$Cari_i = \alpha_0 + \alpha_1 X_{2i} + \gamma Stages_i + \varepsilon_{2i}, \quad (3)$$

where X_{1i} denotes a vector of explanatory variables influencing the choice of the link. X_{2i} denotes a vector of explanatory variables influencing food security. ε_{1i} and ε_{2i} are the error terms, while β , α and γ represent the parameters to be estimated in the equations.

In the CMP format, equations (2) and (3) are recast as equations (4) and (5):

$$y_1^* = \theta_1 + \varepsilon_1 \quad (4)$$

$$y_2^* = \theta_2 + \varepsilon_2 \quad (5)$$

$$\theta_1 = \beta_1 X, \theta_2 = \alpha_1 X + \gamma y_1,$$

where y_1^* and y_2^* represent the latent factors of link choice and multidimensional poverty, respectively. X represents a vector of explanatory variables.

3.3 Data source

Primary data were used in this research, collected in a survey conducted in the Central Plateau and Centre regions of Burkina Faso in 2024. The choice of these regions and municipalities was based on certain main criteria, namely (i) the accessibility of the area, (ii) the availability of NTFPs, and (iii) the domestication of NTFPs supplying plants.

The sample size was determined using the formula described in Equation (6) below:

$$n = \frac{(1,96)^2 * N}{(1,96)^2 + I^2(N-1)}, \quad (6)$$

where n = sample size, N = total study population and $I = 2\varepsilon$, ε = (margin of error, 5%).

Applying this formula yielded a sample of 384 households, selected using stratified random sampling, with strata representing villages (Lelexé, Kounda, Yargo, Itaoré, Yanga and Tanlili) for Zitenga and neighbourhoods (Benego, Paglayiri, Samandin, Zone du bois, Tampouy and Pissy) for Ouagadougou. Given the lack of data on the weight of each village and neighbourhood, the sample was divided equally among them (31.5 households per village). Since there is no such thing as half a household, we rounded the number of households per village to 32, increasing the sample size from 378 to 384 households.

3.4 Choice and description of model variables

3.4.1 Dependent variable

Several indicators are used in the literature to capture the food security status of households. According to N'diaye (2014), the most used indicators are the food consumption score (FCS), the household food diversity score (HFDS), food expenditure (FE), undernutrition, the survival strategies index (SSI), the simplified survival strategies index (SSSI), the household food insecurity access scale (HFIAS), the household hunger scale (HHS) and the food security self-assessment (FSSA). However, it is difficult to determine which of these indicators adequately measures household security (Yessifou *et al.* 2021). The involvement of more than one indicator is desirable (Cafiero *et al.* 2014).

This is the particularity of the consolidated approach for reporting indicators of food security (CARI), which combines several indicators that can account for household food insecurity in all its dimensions. It is based on two domains: the current status, measured by the food consumption score and/or the food energy deficit, and the ability to survive, which uses indicators that can capture the economic vulnerability and asset depletion of the household.

The consolidated approach to reporting on food security indicators (CARI) provides a single indicator called the food security index that presents the overall status of household food security, as follows (World Food Programme [WFP] 2014):

$$CARI = f(FCS, FED, SFE, PS, SSI),$$

with: FCS = food consumption score; FED = food energy deficit; SFE = share of food expenditure; PS = poverty status; SSI = survival strategy index.

However, only one of the two indicators of economic vulnerability (i.e. poverty status or food expenditure share) should be used (WFP 2014). Thus, the food security index becomes (see Table 1):

$$CARI = f(FCS, FED, SFE, SSI)$$

Table 1: Summary of CARI index indicators

Domain	Indicators	Calculation	Food security	Food safety limit	Moderate food insecurity	Severe food insecurity
Current status	Food consumption score	$FCS_i = \sum a_i x_i$ (N'diaye 2014)	Acceptable if FCS ≥ 21		Limit if $21 \leq FCS \leq 35$	Poor if FCS > 35
	Food energy deficit	$FED = \frac{\sum_{j=1}^m Q_j A_j}{\sum_{i=1}^k u_i}$ (Zoyem <i>et al.</i> 2008)	FED ≥ 2100 kcal/p/d	Median (MDER; 2100) $\leq$ DEA < 2100 kcal/p/j	MDER $\leq$ FED $<$ median (MDER; 2100)	FED $<$ MDER
Survivability	Share of food expenditure	$SFE = \frac{DAM}{DAM + DNA1 + DNA2}$ (WFP, 2014).	Part $< 50\%$	50% to 65%	65% to 75%	75% share
	Survival strategy index	$SSI = \sum strategy_i (frequency_i \times severity_i)$ (FAO & WFP 2013)	None	Stress	Crisis	Emergency

Notes: FED = food energy deficit; FCS = food consumption score; MDER = minimum daily energy requirement.
Source: WFP (2014)

The CARI is calculated in two stages. First, for each domain (current status and survivability), the average score is obtained by calculating the mean of the scores for the indicators within that domain. Next, the CARI is obtained by averaging the average scores for the two domains.

For the purposes of interpretation, the World Food Programme (WFP) has defined thresholds to classify households into four categories: food secure (CARI < 1.5), marginally food secure ($1.5 \leq$ CARI < 2.5), moderately food insecure ($2.5 \leq$ CARI < 3.5) and severely food insecure (CARI ≥ 3.5).

3.4.2 Independent variables

In the economic literature, several variables are likely to explain household food security. The age of the head of household is assumed to reduce household food insecurity (otherwise, increase food security). Indeed, the head of the household acquires more experience in food security with age. This experience could lead the householder to explore multiple coping strategies to achieve food security. Authors such as Abdullah *et al.* (2019) and Adeniran and Adebaya (2022) find a positive relationship between household head age and food security. In this article, a negative relationship is expected between this variable and food insecurity.

The gender of the head of household (male as a reference) is assumed to reduce food insecurity. Male-headed households are expected to benefit from greater food security, as female-headed households

are generally characterised by a lack of knowledge of agricultural technologies and a lack of resources. Abdullah *et al.* (2019) and Ningi *et al.* (2021) found a positive relationship between these variables. A positive sign is expected from this variable.

Several studies have established a positive relationship between household head education and food security (Abdullah *et al.* 2019; Adeniran & Adebaya 2022). Educated heads of households have a better chance of managing their farms by adopting improved practices and diversifying their sources. Thus, in this paper, a negative relationship is expected between education level and food insecurity. Marital status is a binary variable, taking the value 1 for married heads of household and 0 for single heads of household. Married couples benefit from mutual support and a better division of labour, which improves access to resources and the implementation of effective food security strategies (Nkoko *et al.* 2024). This variable is expected to have a negative impact on food insecurity.

A negative relationship between household size and food security was established by Saliga and Alinsato (2021) and Vwima *et al.* (2022). Indeed, an increase in household size involves more people feeding from the same limited sources. But a large household can also mean a high number of workers, which can lead to sufficient food for household members (Drammeh *et al.* 2019). The expected sign is then mixed.

Household income is a determinant of food security. Higher income allows households to access a wider range of goods and services, including food, which increases stability (Fikire & Zegeye 2022; Nkoko *et al.* 2024). A negative correlation with food insecurity is expected.

Access to credit is expected to reduce food insecurity, as it increases households' purchasing power and enables income diversification through investment, consistent with Dassou *et al.* (2019) and Ningi *et al.* (2021).

The value chain stages comprise a categorical variable that indicates the stage of the NTFP value chain in which the household operates. The variable thus takes 1 for households in production, 2 for households in processing, 3 for households in marketing and 4 for households in consumption. Households involved in the NTFP value chain have opportunities to improve their level of food security either through direct consumption or through revenues from chain activities. As there are a lack of studies on NTFP value chain stages and household food security status, we assume that this variable positively affects household food security (or negatively affects food insecurity). The summary of variables used in this article is shown in Table 2.

Table 2: Summary of variables

Variable definition	Nature	Expected sign
CARI: 1 = severe food insecurity; 2 = moderate food insecurity; 3 = food security limit; 4 = food security	Categorical variable	Dependent
Value chain stages: 1 = consumption; 2 = production; 3 = processing; 4 = marketing	Categorical	+
Age of head of household	Quantitative	+
Gender of head of household: 1 = male	Dichotomous	+
Education of head of household: 1 = no level	Categorical	+
Marital status	Dichotomous	+/-
Household size per adult equivalent	Quantitative	+/-
Household income	Quantitative	+
Access to credit: 1 = access	Dichotomous	+

Source: Author

4. Results and robustness analysis

4.1 Descriptive statistics

4.1.1 Characteristics of households

Figure 1 and Table 3 provide details of the descriptive statistics of the qualitative and quantitative variables used in the model for the estimates, respectively.

The analysed sample is predominantly female, with women accounting for 59.38% of the respondents compared to 40.62% for men. Regarding the level of education, 51.56% of the surveyed households have no formal education, while 48.44% have received some form of schooling. Socially, most household heads are married (90.62%), with single individuals representing 9.38%. Access to credit is almost evenly distributed, with 49.48% of households having access to it. Finally, concerning the stage of the NTFP value chain in which households operate, the sample is primarily focused on consumption (33.33%) and production (31.25%), followed by processing (22.14%) and marketing (13.28%).

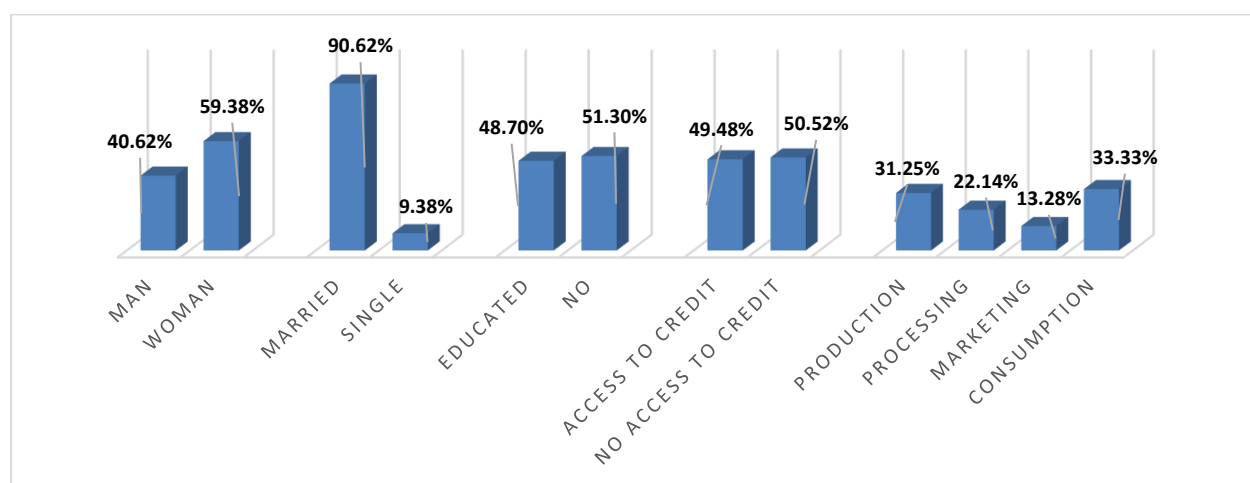


Figure 1: Descriptive statistics of qualitative variables

Source: Author, based on data collected in January and February 2024

The results in Table 3 indicate an average age of 41.39 years, with a variation ranging from 19 years (minimum) to 85 years (maximum) within the sample. The average household size is 4.19 people, ranging from one person (minimum) to 21 people (maximum). Finally, household income varies in thousands from 7.5 to 550, with an average of 88.290.

Table 3: Descriptive statistics of quantitative variables

Variable	Observations	Mean	Minimum	Maximum
Age	384	41.390	19	85
Household size per adult equivalent	384	4.192	1	21
Household income	384	88.290	7.5	550

Source: Author, based on data collected in January and February 2024

4.1.2 CARI descriptive analysis

Figure 2 and Table 4 show the distributions of the sampled households' food security status by CARI indicator and by CARI, respectively.

From the information in Figure 2, the results show that, for the indicator of the livelihood-based survival strategy index (SSI), 42.19% of the sample is in food security, 12.76% is on the limit of food security, 15.10% is moderately food insecure, and 29.95% is severely food insecure.

According to PDA with share of food expenditure (SFE), 40.10% of households surveyed are food secure, while 24.74% are on the limit of food security. The levels of moderate and severe food insecurity are 16.67% and 18.49%, respectively.

For DE with food energy deficit (FDE), the results show that almost half of the households (48.96%) are in food security. However, a significant proportion (36.46%) are severely food insecure. Levels of moderate food insecurity and limited food security are relatively low, at 7.81% and 6.77%, respectively.

Finally, the food consumption score indicator ranks the majority of households (51.04%) in food security, while a significant proportion (38.02%) are on the limit of food security. Only 10.94% of households are moderately food insecure.

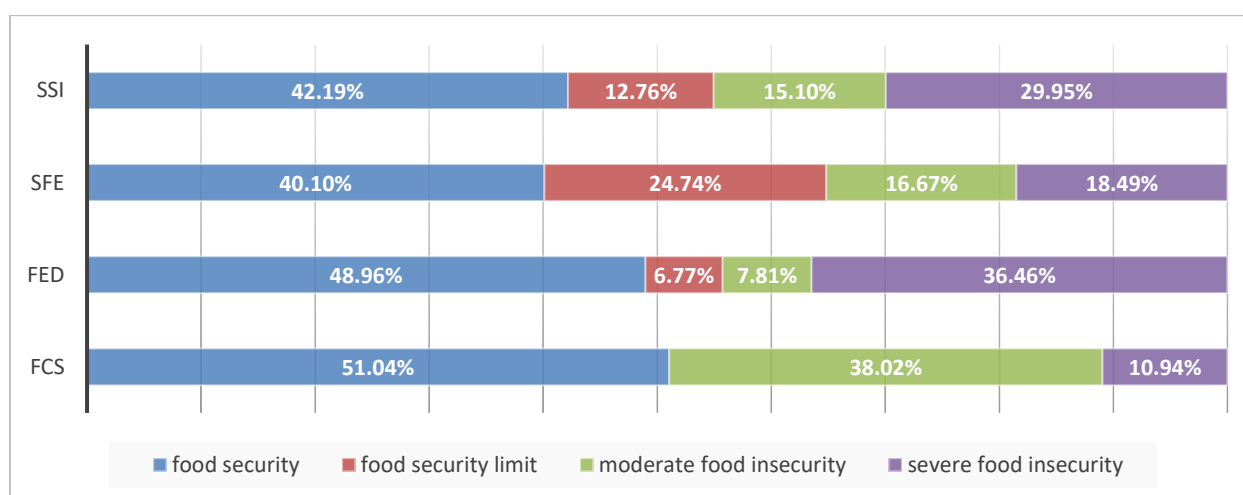


Figure 2: Sample distribution by CARI indicators

Source: Author, based on data collected in January and February 2024

Regarding the distribution according to the CARI index, Table 4 shows that, out of 384 households, 32.55% are classified in food security and 20.83% at the limit of food security. Regarding food insecurity, 27.34% of households are classified as being in moderate food insecurity and 19.27% as being in severe food insecurity.

Table 4: Sample distribution by CARI

CARI	Headcount	Percentage
Food security	125	32.55
Limit pf food security	80	20.83
Moderate food insecurity	105	27.34
Severe food insecurity	74	19.27

Source: Author, based on data collected in January and February 2024

The data presented in Figure 3 illustrate the levels of food security and insecurity in the four stages of the NTFP value chain (production, processing, marketing and consumption). The results conclude that, among households in the production stage, only 3.64% are in food security, while 4.42% of households are at the limit of food security. Levels of food insecurity are higher, with 11.45% of those experiencing moderate food insecurity and 11.71% of those experiencing severe food

insecurity. For the processing stage, 10.42% of households in this stage are in food security, which is significantly higher than the limit level of food security (5.21%). Levels of food insecurity are lower, with 3.90% being moderately food insecure and 2.61% severely food insecure. Regarding the marketing stage, the results show that 5.74% of households in this stage are classified as being in food security, while 3.13% are at the limit of food security. Food insecurity levels are relatively low, with 2.61% being moderately food insecure and 1.82% severely food insecure. Finally, in the consumption stage, 12.76% of households in this stage are in food security, which is the highest among the four stages. Furthermore, 8.07% of children are at the limit of food security, 9.37% of children are moderately food insecure and 3.13% of children are severely food insecure.

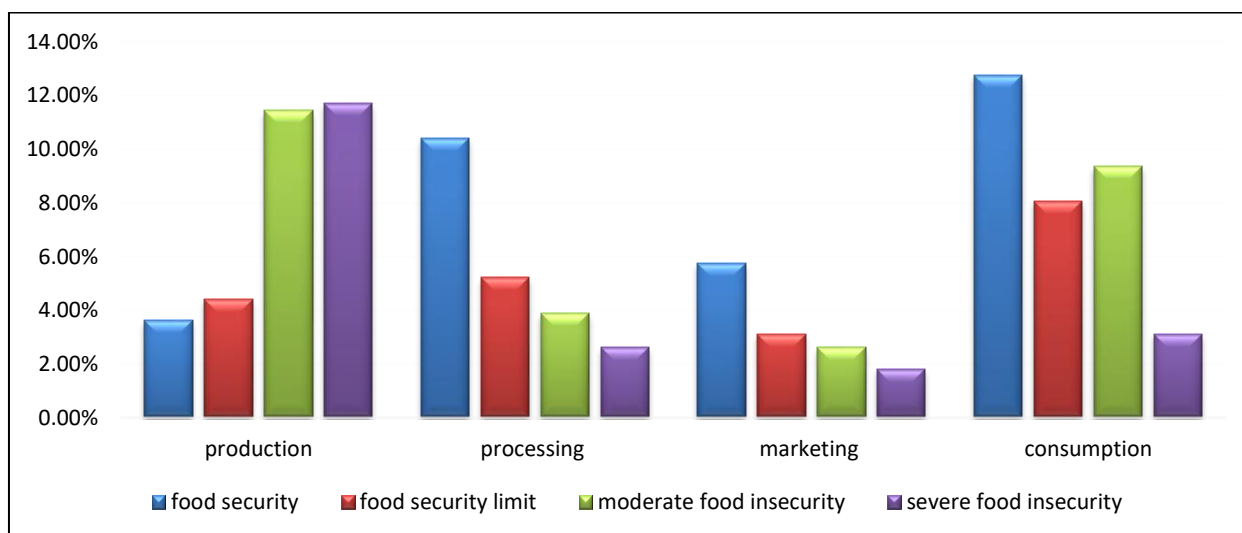


Figure 3: Distribution of household food security status by NTFP value chain stages

Source: Author, based on data collected in January and February 2024

4.2 Effect of NTFP value chain stages and household characteristics on food security

The results concerning the effects of NTFPs on food security are presented in model 2 of Table 5. The overall model fit is strong, as indicated by a significant Prob > χ^2 of 0.000. The Atanhrho value (-1.580) is statistically significant, confirming the existence of a correlation between the error terms of the two models. This significance justifies the use of the CMP model to correct for endogeneity. The multicollinearity test between the explanatory variables also shows an absence of multicollinearity between the explanatory variables (calculated VIFs are less than 4 and the average VIF is 1.32).

The results of Table 5 also show that the value chain stages, such as marketing, production and processing, are all positively linked to the probability of households experiencing food insecurity at 1%. This means that households operating in these stages of the value chain are more likely to increase their level of food security (or reduce their level of food insecurity) compared to NTFP-consuming households. Households involved in production, processing and marketing not only generate income that enables them to diversify their diets and reinvest to ensure stable, high incomes, but also, like consumer households, they have access to foodstuffs intended for direct consumption. This reduces their likelihood of experiencing food insecurity. Similar results have been found in some previous work in Niger, Mozambique and Burkina Faso that used other proxies to analyse the importance of NTFPs in improving household food security (Hama *et al.* 2019; Gerald *et al.* 2021; Sawadogo 2023).

The age of the head of household is also significant and positively related to the probability of the household being in food security at the threshold of 5%. One explanation for this result could be that the head of the household acquires more experience in food security with age. In addition, the average

age of the sample is 41.39, which means that heads of households are still active and can work to support their families. This result is in line with those found in Nigeria and Pakistan in the work of Adeniran and Adebaya (2022) and Abdullah *et al.* (2019), respectively.

The level of education is significant and positive at the 1% level. So, compared to uneducated heads of household, educated heads of household are more likely to be food secure. This can be explained by the fact that education can improve the skills and knowledge needed to effectively manage the resources derived from the activities of these NTFPs, which in turn can improve food security. This finding corroborates those established by several previous studies in Pakistan and Nigeria (Abdullah *et al.* 2019; Adeniran & Adebaya 2022).

Regarding household size, it is negatively related to the probability of households being food secure, at the 10% level. This means that the larger the household, the higher the risk of food insecurity. One explanation for this result could be that, unlike some studies (Drammeh *et al.* 2019), which have found that a large household means a high number of workers, in the case of our sample, given the average of the demographic dependency ratio (1.066), a large household would mean more people to feed with limited sources. This result is consistent with those of Saliga and Alinsato (2021) and Vwima *et al.* (2022) in their work in Benin and the Democratic Republic of Congo, respectively.

Table 5: Result of econometric estimation

Variables		Model 1 (<i>Stages</i>)	Model 2 (<i>CARI</i>)
Value chain stages, 1 = consumption	marketing		1.088*** (0.120)
	production		0.416*** (0.150)
	processing		1.642*** (0.160)
Age of head of household (HH)		-0.006 (0.005)	0.012** (0.005)
Gender of HH, 1 = male		0.007 (0.112)	0.046 (0.109)
Household size		-0.001 (0.027)	-0.051* (0.030)
Education of HH, 1 = educated		-0.272** (0.123)	0.347*** (0.124)
Marital status of HH, 1 = married		-0.216 (0.191)	0.188 (0.184)
Access to credit, 1 = access		-0.094 (0.117)	0.508*** (0.156)
Total assets		0.053** (0.025)	
NTFP income		0.002*** (0.0005)	
Household income			0.0013** (0.0006)
LR chi ² (24)		219.02	
Prob > chi ²		0.000	
Observations		384	
Atanhrho		-1.580* (0.388)	
Rho		-0.918	

Notes: * = significant at 10%; ** = significant at 5%; *** = significant at 1%

Source: Author, based on results

Access to credit is positively linked to the probability of households being food secure, at 1%. Thus, compared to households with access to credit, households without access to credit are more vulnerable to food insecurity. Indeed, loans allow households to intensify their production, processing or marketing of NTFPs through investment. This ensures high and stable incomes and thereby reduces their vulnerability to food insecurity. This result is consistent with those of Dassou *et al.* (2019) and Ningi *et al.* (2021) in Benin and South Africa, respectively.

Finally, and unsurprisingly, a higher overall household income significantly increases food security, at the 5% level. This relationship confirms Sen's rights-based approach, according to which income is the main means for households to obtain food, particularly in a context where subsistence agriculture is vulnerable to climatic and security shocks, as is the case in Burkina Faso. A higher income indeed enables households to buy food on the markets during the annual hunger gap, diversify their diet with nutritious foods and invest in productive assets to build resilience and long-term stability, thus breaking out of the vicious circle of poverty and food insecurity. These results corroborate those found in the literature in Lesotho and Ethiopia (Fikire & Zegeye 2022; Nkoko *et al.* 2024).

5. Conclusion and implications of economic policies

This article has analysed the effects of non-timber forest products on food security in Burkina Faso, using primary data collected from 384 randomly selected households and the construction of an index (CARI) to capture household food insecurity status. It also used the conditional mixed process (CMP) model for econometric analysis. From the econometric analysis, it appears that households operating in the marketing, production and processing stages of NTFPs are more likely to reduce food insecurity compared to consuming households. The results also show that the age of the household head, level of education, access to credit, household income and size influence the level of household food security.

These findings confirm that NTFPs are an important lever against food insecurity in the study area. Supporting their domestication, sustainable harvesting, processing and marketing – through training, access to lucrative markets and processing support – can help secure higher, more stable incomes and reduce households' exposure to food insecurity.

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