# Socio-economic determinants of the food situation of households in the hunting zones of the national parks of Benin


## Abstract

In Benin, most studies on food security have focused on overall analysis at the national, departmental, and rarely municipal levels. Nowadays, food security programs face the challenge of targeting food-insecure areas and households. The objective of this study is to analyze the determinants of the food situation of households in the hunting zones of Benin's national parks. It took place in four villages in the hunting zones, including two villages in the Municipality of Kandi in the hunting zone of Park W. and two villages in the Municipality of Tanguiéta in the hunting zone of Pendjari Park. A purposive sample of 144 households was surveyed. Food security classes were determined by the food consumption score and the determinants of the food situation by logistic regression. The results show that 45.8% of households are food insecure, 28.5% are at risk of food insecurity, and 25.7% are in a food secure situation. The prevalence of food insecurity in the Pendjari zone is 64.1% compared to 24.2% for the parc W. The results of the logistic model reveal that agricultural credit, subsistence pressure, hunting zone, possession of savings accounts, number of dependents, and livestock determine the food security of households in hunting zones.



**Keywords:** Food situation, Determinants, national parks, hunting zones, Benin

## Introduction

The food issue began around the 1960s and continues to be a particularly sensitive indicator of political, economic, and societal issues for developing countries and especially Sahelian Africa. During the first years of their political independence, most of these countries focused their policies on agricultural production. Thus, they achieved almost self-sufficiency and exported 1.3 billion dollars of food (Holt Giménez, 2008). Since 1980, the situation has changed despite the important role that agriculture continues to play in the economic and social life of these countries. Indeed, agriculture employs more than 60% of workers and contributes to more than 35% of GDP for the majority of African countries and more than 40% in the least developed countries of Africa (Guèye, 2006). According to Lebailly (2006), it continues to represent the essential engine of economic and social development for the poorest countries. Importation and food aid have become strategies to fill the food deficit in these countries. According to the report on the state of food insecurity in the world, published jointly by the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD) and the World Food Program (WFP) 2014, 805 million people suffer from hunger in the world, or 1 in 9 people. The vast majority of these people live in developing countries where 13.5% of the population is undernourished. In sub-Saharan Africa, the number of undernourished people was 214.1 million in 2014, or 23.8% of its population (FAO, 2014). Currently, countries are struggling to change the situation.

In Benin, in 2009, 972,000 people were food insecure and 1,048, 000 were at risk of food insecurity (AGVSAN, 2009). In addition, the overall analysis of vulnerability and food security in 2014, carried out during the pre-hungry period, indicates that 11% of households were food insecure, i.e. 1.1 million people, and 34% were in borderline food security. The rate of food insecurity is higher in rural areas (15%) than in urban areas other than Cotonou (8%). The majority of studies on food security have focused on overall analysis at the national, departmental and rarely municipal level. Thus, they made it possible to assess the municipalities and departments in a situation of food insecurity or at risk of food insecurity. The issue of food security differs from one municipality to another and therefore depends on agro-pedological conditions and natural geographical situation.

The municipalities bordering the parks are, due to their natural geographical position, faced with the problem of land availability and a rapid decline in soil fertility, the main sources of food insecurity. In addition, most of these Municipalities have a high level of food

insecurity according to recent studies (AGVSAN, 2009 and INSAE, 2014). Additionally, the biggest challenge facing food security programs is targeting. It then becomes imperative to effectively combat hunger to analyze the determinants of the food situation of households in these particular areas.

## Materials and methods

### ⇨ Theoretical framework of food security

Theories on the relationship between population growth and agricultural production for the most part were born from the poor harvests of 1794 to 1800 causing misery and distress. Malthusian theory established a relationship between the possibilities for development of agricultural production and the increase in population. For Malthus (1766-1834), subsistence goods derived from agricultural production only increase in arithmetic proportion while the increase in population made possible by the increase in fertility evolves at a much faster rate, since the population increases in geometric proportion. This theory marked the economy for several years before encountering enormous criticism. Indeed, Malthus is mainly criticized for having minimized the role of technical progress in agriculture and the fact that population growth could stimulate growth and economic development. Achieving a balance between economic growth and demographic growth is possible according to the demographic transition theory. From these critiques was born contemporary Neo-Malthusianism (1975-1982) which analyzes the limits of the planet's carrying capacity in terms of humans and land given the Western-style way of life and production western style. The leaders of this school of thought call for family planning, the conservation of resources, the reduction of consumption in industrialized countries to help the poor. Other authors including Nurkse (1966) and Sen (1970) have analyzed the relationship between poverty and food insecurity. Nurkse, author of the vicious circle of poverty, believes that poverty results in low income, which does not allow one to save or save little. The resulting accumulation of capital is therefore low, which does not make it possible to increase productivity and therefore income. Low incomes result in malnutrition, productivity remains low and so do incomes. Sen's (1970) entitlements approach points out that the occurrence of famines is not necessarily linked to a decline in food availability but rather the consequence of accessibility problems. According to this approach, only individuals facing a lack of entitlements experience a lack of food. Criticisms of this theory come mainly from Watts (1991) and Ravallion (1997) who believe that people who voluntarily choose deprivation do not necessarily suffer from a lack of access rights.

These people rationalize their consumption in the short term in order to preserve their future entitlements.

### ⇨ Study area

Benin is a country belonging to the western part of the African continent. It is located between 6°30' and 12°25' North latitude and 0°45' and 3°55' East longitude. It covers an area estimated at around 113,000 km2. It has two national parks in its northern part: the W National Park and the Pendjari National Park, which are all Biosphere Reserves. The Pendjari Biosphere Reserve (RBP) is located in the Atacora department in the northwest of Benin between 10°30' and 11°30' north latitude and between 0°50' and 2°00' east longitude. It extends over the territories of the communes of Matéri, Tanguiéta and Kérou. It is a vast peneplain with an altitude of between 150 and 200 m. It is limited to the south by the Atacora chain. This range is oriented southwest-northeast with an altitude between 400 and 513 m. Within the park itself, a second chain runs parallel to the first with an altitude varying between 170 and 400 m (Sinsin et al. 2000). The Pendjari National Park is subdivided into several components including:

The Pendjari National Park, with an area of 266,040 ha fully protected, The Pendjari hunting zone (180,000 ha), and the Konkombri hunting zone (25,100 ha), which are located to the south and east of the national park and where sport hunting activities are authorized during the dry season.

Speaking of the W National Park, it is located in the northern part of Benin, and is limited to the north by the commune of Karimama, to the south by the commune of Banikoara, to the east by the Alibori river and the communes of Kandi and Malanville, then to the west by the Mékrou river. It is between 11° and 12°30 North latitude and 2°20 and 3°40 East longitude. The Niger River Complex W (Benin Part) covers an area of 762,438 hectares and is subdivided as follows:

- Park W with an area of 563,280 ha, the Djona hunting zone (115,200 ha) and

- The eastern part of the Atacora hunting zone, known as the Mékrou hunting zone, covering approximately an area of 110,000 ha.

The communes of Tanguieta and Kandi were chosen for the study respectively as a border commune to the Pendjari national park and the W park. Indeed, the Pendjari national park extends over the territories of three communes of the Atacora department: Matéri, Tanguieta

and Kérou. But the commune of Tanguieta is the gateway to the Pendjari National Park and is home to the largest hunting area in the Pendjari National Park. Likewise, the commune of Kandi, in addition to the fact that it houses, with the communes of Karimama, Banikoara and Malanville, the W park, is also the entry point to the W biosphere reserve.

The villages of Batia, Tanongou, Alfakoara and Thya respectively in the hunting zone of Pendjari National Park and W Park were chosen for the study. Batia and Alfakoara are the gateway villages respectively to the Pendjari and W parks while Tanongou, the capital of the district, is the largest village in the hunting zone of this biosphere reserve. Thya is also the largest village in the hunting zones of Kandi. One of the reasons for choosing the two villages in the two communes is also to take into account the variability of food situations in each hunting zone without omitting the accessibility of the village during the survey period. The two figures below present the study areas.

Figure 1

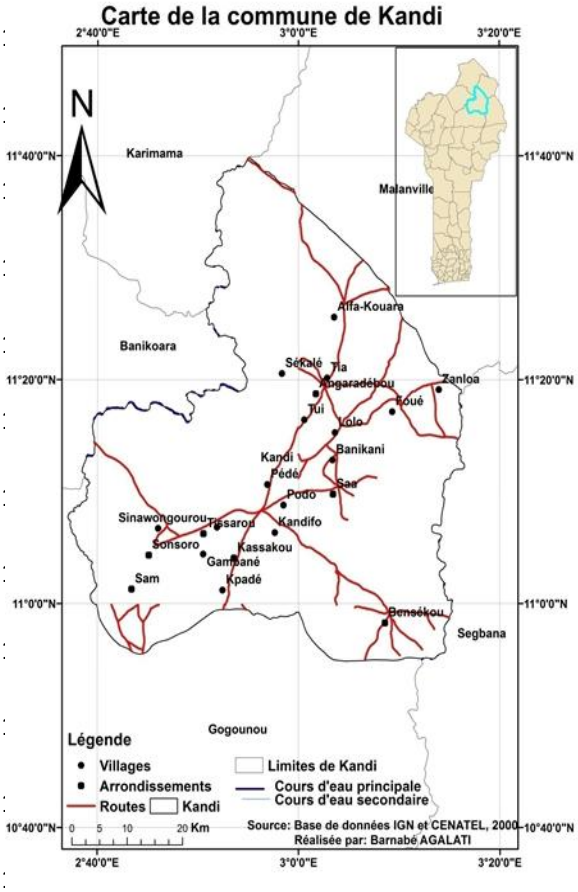
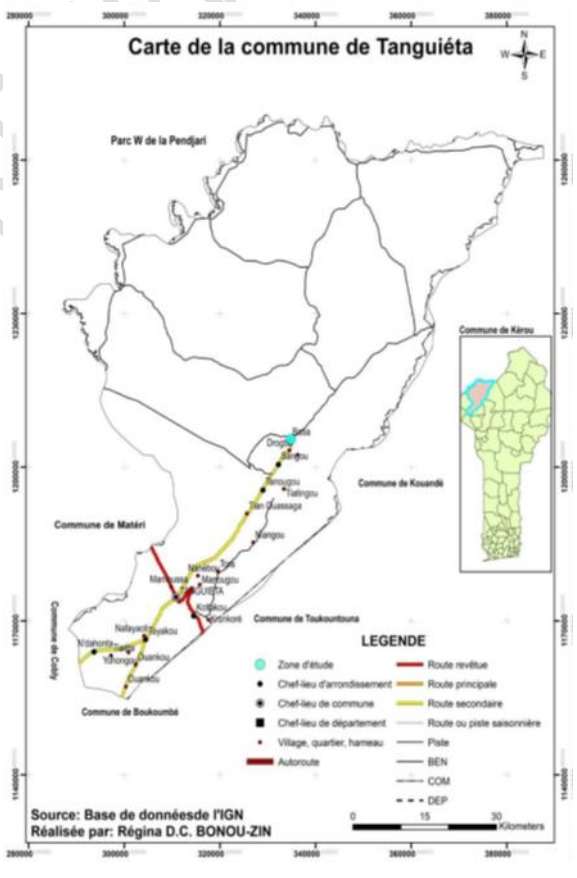



Figure 2




⇨ **Sampling and database**

Households constitute the research units. The observation units are the heads of household. Purposive sampling was used to choose the households studied. The households were selected according to their availability to work with the investigators, membership in the survey villages and the type of agricultural households encountered (Small, Medium and Large) established thanks to a qualitative typology of households during the exploratory phase with the household heads in focus group. This typology was made based on three criteria: the total cultivated area, the cleanliness of the land, the ability to recruit casual and permanent workers and the ability to market food without difficulty.

The data collected and the above characteristics of the types of agricultural households encountered made it possible to establish the structure of the sample by hunting zones and by type of agricultural household presented in the table below.

**Table 1: Sample structure**

| | | ***Types de ménages agricoles*** | | | |
|---|---|---|---|---|---|
| | | ***Small agricultural houshold*** | ***middle agricultural houshold*** | ***Big agricultural houshold*** | ***total*** |
| **Hunting zones** | **Park Pendjari** | 43 | 29 | 6 | 78 |
| | **Park W** | 16 | 18 | 32 | 66 |
| **Ensemble** | | 59 | 47 | 38 | 144 |

***Source: Tanguieta and Kandi 2023 field surveys***

The survey itself was carried out with a structured questionnaire administered to each of the sampled household heads from the villages in the hunting zones and made it possible to obtain primary data. The data collected is both quantitative and qualitative. They relate to the socio-demographic and economic characteristics of households, farm crops, household income and expenses and food consumption. Secondary data was obtained following documentation. Finally, participant observations and triangulation made it possible to verify the information obtained.

⇨ **Assessment of the household food situation**

The food consumption score (FCS) is a composite indicator (WFP standard) calculated to reflect the dietary diversity, frequency and relative nutritional intake of products and food

groups consumed by a household (AGVSAN 2009). The SCA is a good indicator of the accessibility dimension of food security and the quality of food consumption which influences nutritional status. This score was used to assess the food consumption of households in hunting areas. The household food consumption score (FCS) was calculated with the following formula:

$$SCA = Acéréales \times Xcéréales + Alegumessecs \times Xlegumessecs + Alegumes \times Xlegumes + Afruits \times Xfruits + Alait \times Xlait + Aanimal \times Xanimale + Asucre \times Xsucre + Ahuile \times Xhuiles$$

With :

Ai = the weight assigned to the food group.

Xi = the number of days of consumption relating to each food group (≤ 7 days).

Details of the different food groups with their weights are given in the table below.

**Table 2: Food groups and their weight in the food consumption score**

| **Foods** | **Food group** | **weight** |
|---|---|---|
| Corn, rice, sorghum, millet, bread, and other cereals | Cereals and tubers | 2 |
| Cassava, potato, yam, plantain, sweet potatoes, and other tubers | | |
| Beans, peas, peanuts, soya, cowpeas, lentils, etc. | Dried vegetables | 3 |
| Vegetables – leaves | Vegetables and leaves | 1 |
| Mangoes, oranges, bananas, and other fruits | Fruits | 1 |
| Beef, goat, poultry, pork, eggs, fish, and other meats | Animal protein | 4 |
| Milk, yogurt, and other dairy products | Milk | 4 |
| Sugar, honey, and sweet products | Sugar | 0.5 |
| Oils and fats | Oils | 0,5 |
| Condiments, spices | *Condiments | 0 |

**Source: WFP, used by AGVSAN-Benin 2019**

(*) Condiments are not considered a food group due to their zero weight.

The values of the scores thus calculated for each household are reported on a scale ranging from 0 to 112. The standard thresholds 21, 35 and 45 are used to determine household food consumption classes (poor, borderline, moderately acceptable and acceptable). So :

- If SCA < 21 the household has poor food consumption;

- If 21 ≤ SCA <35 the household has borderline food consumption;

- If 35 ≤ SCA <45 the household food consumption is moderately acceptable;

- If SCA ≥ 45 consumption is acceptable.

The method of confirming the food consumption score as a proxy indicator of food insecurity in the survey period used during the 2009 AGVSAN was applied. This confirmation was done in three stages: the typology of food consumption by principal component analysis (PCA) and non-hierarchical classification analysis (ACNH) carried out with the STATA.13 software, verification of this typology with the classification of the food consumption score by a cross-tabulation and finally verification of the correlation between the food consumption score and other food security indicators. It made it possible to have three food security groups: households in food insecurity (poor and borderline food consumption), at risk of food insecurity (moderately acceptable food consumption) and in food security (acceptable food consumption). Specification of the food situation regression model

The theoretical model was built based on the hypothesis that the food situation (SA) of a household i is influenced by j sociodemographic and economic characteristics noted X of the respondent, i.e. the relationship:

**〖SA〗_i=F(X_i) (1)**

This study categorized three food security groups: food insecure, at risk of food insecurity and food secure households. Given that households at risk of food insecurity straddle the two other groups and that they can become food secure or food insecure households following an external or internal shock, the model only took food security into account. Thus, a household cannot belong to two food security groups at the same time. Therefore, for a household i its food situation is either food secure (SA=1 if yes) or food insecure / at risk of food insecurity (SA=0 if no). From there, the food situation of a household i can be a linear combination of variable **Xi** which determine its food situation and coefficient **ai** to be estimated. Its expression is then mathematically given by:

208 **〖SA〗_ik= ∑α_ik X_ik (2)**

209 The probability P for household i to be food secure is then:

210 **P = P(SA = 1) (3)**

211 The food security variable is a random variable so if we designate its distribution function
212 by **F**, we therefore have:

213 The functional form of F is determined by that of the probability density function of the
214 random variable SA. For the logit model, it is a logistic function from which we deduce the
215 empirical equation from the theoretical model, which is as follows:

216 $$P(Yi = 1/SA) = \frac{1}{1+e^{-X}} \quad \text{and} \quad (5)$$

217 $$X = \alpha_0 + \alpha_1 ELE + \alpha_2 CA + \alpha_3 ASSO + \alpha_4 ALPHA + \alpha_5 AGE + \alpha_6 NPC + \alpha_7 PCI + \alpha_8 CREDIT$$
218 $$+ \alpha_9 PS + \alpha_{10} NCP + \alpha_{11} ZONE + \mu_i$$

219 Where $a_0$ is the constant term, $a_i$ the coefficients to estimate, and $u_i$ the error terms.
220 Several techniques are used to judge the quality of this type of model: it can be given by the
221 likelihood of the model, which follows a Chi-square distribution. All explanatory variables
222 introduced into the model are described in the table below.

223 **Table 3: Names, codes, modalities, and expected signs of the coefficients of the**
224 **explanatory variables included in the logit regression model**

| Noms des variables | Code | Modalités | Type (Code 0) | Signes attendus |
|---|---|---|---|---|
| Breeding | ELE | 0 = No, 1= Yes | D | +/- |
| Harnessed cultivation | CA | 0 = No, 1= Yes | D | +/- |
| Belonging to a peasant organization | ASSO | 0 = No, 1= Yes | D | +/- |
| Literacy | ALPHA | 0 = No, 1= Yes | D | +/- |
| Age of head of household | AGE | - | C | +/- |
| Number of dependents | NPC | - | C | +/- |
| Account ownership in an MFI | PCI | 0 = No, 1= Yes | D | +/- |

| | | | | |
|---|---|---|---|---|
| Obtaining credit | CREDIT | 0 = No, 1= Yes | D | +/- |
| Subsistence pressure | PS | - | C | +/- |
| Number of crops practiced | NCP | - | C | +/- |
| Hunting zone | ZONE | 0 = Parc W, 1= Park Pendjari | D | +/- |

(Code 0): D = Qualitative variable; C = Continuous quantitative variable

**Source: Tanguieta and Kandi 2023 survey**

**Results and discussion**

⇨ **Food situation of households in the hunting zones of the national parks of Benin**

The classification of households according to the food consumption score by hunting zone is presented in Table 5. It appears from this table that food consumption is not acceptable overall for the majority of households surveyed. Indeed, 25.7% of households have an SCA ≥ 45, therefore acceptable food consumption, 28.5% have an SCA between 35 and 45, therefore moderately acceptable food consumption, 7.6% and 38.2% have respectively poor and borderline food consumption. These results vary greatly from one hunting zone to another.

Households with poor food consumption are found only in the hunting zone of Pendjari Park and 50% of households in Pendjari have borderline food consumption compared to 24.2% for the W park zone. In sum, 45.8% of households in hunting zones have inadequate food consumption, which does not allow them to live a healthy and active life at the time of the survey, i.e., 64.1% for the Pendjari park zone compared to 24.2% for that of Park W. However, the results are closer to those of the 2014 global analysis of vulnerability and food security (AGVSA-Benin, 2014) which found that 48% of households in Atacora have inadequate food consumption with 65% for the commune of Tanguieta. It should be noted that this last study was carried out in the pre-lean season, that is to say from February to March 2013, unlike the present one which took place from November to December 2016, a period of abundance. The results are much lower than those of the global analysis of vulnerability and food and nutritional security of 2009 (AGVSAN-Benin, 2009) whose survey took place from November to December 2008 which found that only 29% and 2% of households respectively in Atacora and Alibori have inadequate food consumption.

**Table 4: Household food consumption score by hunting zone**

| Food consumption class | Hunting zone | | | | | |
|---|---|---|---|---|---|---|
| | Pendjari Park | | Parc W | | total | |
| | Number | Frequency | number | Frequency | Number | Frequency |
| Poor consumption | 11 | 14.1 | 0 | 0 | 11 | 7.6 |
| (ACS < 21) | 39 | 50 | 16 | 24.2 | 55 | 38.2 |
| Consumption limit | 21 | 26.9 | 20 | 30.3 | 41 | 28.5 |
| (21 ≤ SCA < 35) | 7 | 9 | 30 | 45.5 | 37 | 25.7 |

***Source: Kandi and Tanguiéta survey results, November and December 2023***

Following the confirmation of the food consumption score as a proxy indicator of food insecurity in the survey period, it follows that the food consumption score can be considered as an adequate proxy indicator of household food security at the time of the survey. Referring then to the survey period, the food security groups of households in hunting areas are recorded in Table 6. Food insecure households are those with poor or borderline consumption, households at risk of food insecurity are those with moderately acceptable consumption, and households with acceptable food consumption are considered food secure. From this table, it appears that 45.8%, 28.5%, and 25.7% of households in the hunting zones of Benin's national parks are respectively food insecure, at risk of food insecurity, and food secure. The Pendjari hunting zone contains 64.1% of food insecure households compared to 24.2% for the W park hunting zone.

**Table 5: Food security group by hunting zone**

| **Food situation** | **Study area** | | | | | |
|---|---|---|---|---|---|---|
| | **Pendjari Park** | | **Parc W** | | **total** | |
| | **Number** | **Frequency** | **number** | **Frequency** | **number** | **Frequency** |
| | 50 | 64.1 | 16 | 24.2 | 66 | 45.8 |
| **Food insecurity** | 21 | 26.9 | 20 | 30.3 | 41 | 28.5 |
| **At risk of food insecurity** | 7 | 9 | 30 | 45.5 | 37 | 25.7 |

***Source: Kandi and Tanguiéta survey results, November and December 2023***

The results of this study are closer to those of the 2011 modular survey with a slight increase in the prevalence of food insecurity in the hunting zones of Pendjari and a relative decrease in that of the hunting zone of W. Indeed, the hunting zones of the parks are faced with the eternal problem of poverty, agricultural land and their insufficiency. More particularly, the Pendjari area is framed in addition to the park by the mountains which further aggravate its situation due to the lack of arable land. According to producers in these areas,

the administration has only granted them land for more than 25 years for the Pendjari hunting zone and more than 10 years for the W zone. In addition, in Batia, the gateway to the Pendjari park, the level of food insecurity deserves attention. In this village, drinking water is non-existent, the absence of a small shop and this makes households in a situation of total dependence on the Tanongou market which is 12 km away or that of Tanguieta 45 km away. Given the period during which this study was carried out, which is from November to December 2016, the results are comparable to those of the AGVSAN of 2009 and this allows us to affirm that hunting areas are subject to food insecurity than other original municipalities.

**Description of the variables of the logistic regression model**

There are four explanatory quantitative variables introduced into the models: the age of the head of the household (36.25 years), the number of crops planted per household (3.51), the number of dependents (9.45), and subsistence pressure (2.29). Seven (07) qualitative explanatory variables were also used to establish the regression model (Table 7). These are literacy, the practice of breeding, harness cultivation, having an account, obtaining agricultural credit, belonging to a peasant organization, and the hunting zone. The prevalence of food insecurity in hunting areas is 45.8% compared to only 25.7% of food secure households. Less than 50% of household heads in these areas are literate and practice animal husbandry or animal agriculture. Households with an account in a microfinance institution or having taken out agricultural credit are also below 50% of respondents. However, those who come from the Pendjari zone, who are members of a peasant organization and who are young exceed 50% of the number of respondents.

292 **Table 6: descriptive statistics of regression model variables**

| | | | | |
|---|---|---|---|---|
| Explanatory variables of regression models | | | | |
| Quantitative explanatory variables | | | average | Standard error |
| Age of head of household (year) | | | 36.25 | 10.84 |
| | | | 3.51 | 1.02 |
| Number of crops planted by the household | | | 9.45 | 5.76 |
| Number of dependents (Person) | | | 2.29 | 2.05 |
| Subsistence pressure (Ha/Adult) | | Code | Frequency | Purcentage |
| Qualitative explanatory variables | No | 0 | 127 | 88.2 |
| Literacy | Yes | 1 | 17 | 11.8 |
| | No | 0 | 87 | 60.4 |
| | Yes | 1 | 57 | 39.6 |
| Breeding | No | 0 | 82 | 56.9 |
| | Yes | 1 | 62 | 43.1 |
| | No | 0 | 114 | 79.2 |
| Harnessed cultivation | Yes | 1 | 30 | 20.8 |
| | No | 0 | 119 | 82.6 |
| | Yes | 1 | 25 | 17.4 |
| Account ownership in a microfinance | No | 0 | 9 | 6.3 |
| institution | Yes | 1 | 133 | 92.4 |
| Agricultural credit for the last | Parc W | 0 | 66 | 45.8 |
| campaign | Parc Pendjari | 1 | 78 | 54.2 |
| Explained variables of regression models | | | | |
| Qualitative explained variables | | | Qualitative explained variables | Purcentage |
| Food safe household | Food safe household | 0 | 107 | 74.3 |
| Explained variables of regression models | Explained variables of regression models | 1 | 37 | 25.7 |

293 ***Source: Kandi and Tanguiéta survey results, November and December 2023***

294

⇨ **Determinants of the food situation of households in hunting areas**

**Table 7: Results of logistic models for estimating the determining factors of the food situation**

| | Food secure | | |
|---|---|---|---|
| **Variables** | **Coefficient** | **z** | **Effet marginal** |
| Constant | 0.522 (1.731) | -0.05 | - |
| Livestock (ELE) | ***1.438* (0.872)*** | ***1.60*** | ***0.184* (0.111)*** |
| Harnessed cultivation (CA) | -1.825 (1.229) | -1.30 | -0.204 (0.154) |
| Belonging to a peasant organization (ASSO) | 2.133 (1.334) | 1.64 | 0.265 (0.157) |
| Literacy (ALPHA) | -0.888 (0.8) | -1.38 | -0.147 (0.106) |
| Age of head of household (AGE) | -0,.040 (0.027) | -1.48 | -0.005 (0.004) |
| Number of dependents (NPC) | ***0.164*** (0.057)*** | ***2.89*** | **0.022*** (0.007)** |
| Account ownership in an MFI (PCI) | ***1.449* (0.856)*** | ***1.40*** | 0.161 (0.113) |
| Obtaining credit (CREDIT) | ***-2.453** (1.028)*** | ***-2.05*** | ***-0.276** (0.128)*** |
| Subsistence pressure (PS) | ***-0.314 *(0.179)*** | ***-0.09*** | -0.001 (0.016) |
| Number of crops practiced (NCP) | -0.335 (0.274) | -1.34 | -0.047 (0.035) |
| Hunting zone (ZONE) | ***-3.51*** (1.23)*** | ***-2.69*** | ***-0.423*** (0.144)*** |
| ***Number of observations: 144*** | | Prob > chi2 : 0,000 | |
| ***Loglikehood : -59.776 ; Pseudo $R^2$ : 0,2715**** | | ***LR chi2 : 44.56*** | |

NB: ( ) Standard error *** significant at the 1% threshold, ** significant at the 5% threshold,* significant at the 10% threshold,

***Source: Kandi and Tanguiéta survey results, November and December 2023***

The results of the logistic regression model identify six factors determining the food security of these households. These are the practice of livestock breeding, having an account in a microfinance institution (MFI), subsistence pressure, obtaining credit, the number of dependents and the hunting zone respectively significant at the threshold of 10%, 1%, 10%, 5%, 10% and 1% (table 8).

**Livestock breeding:** the practice of livestock breeding by a household increases its probability of being food secure compared to a household which does not do so. Thus, food-secure households practice livestock farming, which remains the main source of animal proteins consumed by the household. In other words, when a household raises livestock, its probability of being food secure is increased by 18.4%. Indeed, rural households rarely spend

on purchasing meat. They consider meat to be a luxury food whose consumption is reserved for the wealthiest.

**The number of dependents:** food secure households are those with more dependents. In other words, the probability that a household is food secure increases by 2.2% (ceteris paribus) when the household has more dependents. The level of agricultural mechanization being low in hunting areas, agriculture remains highly dependent on family labor. As a result, more dependents means more agricultural assets and therefore more land to cultivate, hence food security.

**Having an account in a microfinance institution:** when a household has an account in a microfinance institution, the probability of being food secure is better. Indeed, having an account is synonymous with savings and access to credit for more profitable activities. Saving requires better planning of expenses for both activities and household food.

**Obtaining credit**: credit has a negative effect on food security since this result states that households having obtained credit are less food secure compared to those who have not obtained any. In other words, food insecurity is more prevalent among households that have obtained credit. Far from being a tool for improving food security, credit when misused is a source of food insecurity. In reality, households take agricultural credit to pay for agricultural inputs with the aim of having a better yield in order to alleviate the problem of land poverty in these areas. But for the most part the return is not as expected and households fall into arrears. Thus, they are forced with pressure from MFIs to sell other food to pay the credit and the interest rate.

**Subsistence pressure:** subsistence pressure is the ratio of available surface area to household size. The result shows that subsistence pressure has a negative effect on food security. So, food secure households are those with low subsistence pressure. This result is normal since food secure households have a large household size and therefore more availability of agricultural assets allowing them to plant a larger crop area and therefore more income.

**The hunting zone:** belonging to the Pendjari hunting zone reduces its probability of being food secure by 42.3% ceteris paribus. This means that food insecure households come more from the Pendjari hunting zone. This result could be explained by the lack and infertility of agricultural land which is more worrying in this area. In addition, this area is surrounded by mountains, thereby reducing the area of arable land. Finally, the granting of land by the park

administration to the populations of this area dates back more than 25 years, according to local residents.

## Conclusion

This study analyzed the food situation of households in the hunting zones of the national parks of Benin and their determinants. The results show that the prevalence level of food insecurity in hunting areas is very high, i.e. 45.8% of households are food insecure, 28.5% at risk of food insecurity and only 25.7% in a food secure situation. The prevalence of food insecurity in the Pendjari zone is 64.1% compared to 24.2% for the W zone. This prevalence is higher in the hunting zones than in the original communes of these zones. The econometric analysis showed that the factors which negatively influence the food security of households in hunting zones are: agricultural credit, subsistence pressure and the hunting zone against the possession of savings accounts, the number of dependents and livestock which have a positive effect on the food security of households in hunting zones. Animal farming is not a factor determining the food security of households in hunting areas.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Bibliography

AGVSAN, 2009. Analyse globale de la vulnérabilité, de la sécurité alimentaire et de la nutrition, Bénin.168p.

Clement, Mathieu., 2009. *Amartya Sen the socio-economic analysis of famines: scope, limits and extensions of the entitlements approach.* University of Bordeaux, Gretha UMR CNRS 5113, notebooks of Gretha.22p.

FAO, IFAD and WFP, 2014. *The State of Food Insecurity in the World: Creating a More Conducive Environment for Food Security and Nutrition*.

Gueye, B., 2006. *Policy, poverty and agricultural development to support small scale farmers in Sub Saharan Africa.* Reflections from West Africa 40.

Holt-Giménez, E., 2008. The world food crisis: What's behind it and what we can do about it. Policy brief.

INSAE, 2012. Integrated modular survey on household living conditions: Main indicators.

INSAE, 2014. Analyse Globale de la Vulnérabilité et de la Sécurit é Alimentaire (AGVSA), rapport de synthèse par commune. Cotonou, Bénin.

INSAE, 2015. Integrated modular survey on household living conditions: 2nd edition.

Lebailly, M.P., 2006. The curse of raw materials for developing countries 18.

WFP, 2014. *Global Analysis of Vulnerability and Food Security in Benin* (AGVSA).

WFP, FAO, UNICEF, INSAE, 2009. *Global Analysis of Vulnerability, Food Security and Nutrition* (AGVSAN).

Sinsin, B., Saidou, A., Tehou, A., Daouda, I.H., Nobimé, G., 2000. *Wildlife enumeration in the Pendjari Biosphere Reserve*. Technical report, CENAGREF, Pendjari-GTZ Project. Benin 54.

UNICEF, 2011. *Modular Integrated Household Living Conditions Survey (EMICoV)*. Cotonou: UNICEF.