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Family Farming as a Contribution to Food Sovereignty, Case Guarainag Parish

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Abstract: The objective of this research is to analyze how family farming contributes to food sovereignty; the Guarainag parish of the Paute canton in the province of Azuay-Ecuador is taken as a case of study. This work responds to the necessity to explain the elements that impact food sovereignty in the existing food crisis in Latin America and specifically in Ecuador in search of self-sufficiency for healthy food products and people's own local culture. For this purpose, a Food Sovereignty Index was constructed through ten quantitative and qualitative indicators. The research has a correlational and explanatory scope; quantitative methods were used to measure food sovereignty through a binary logit regression model, which provided an answer to the hypothesis of the research, which consisted of testing the influence of family farming on food sovereignty. Furthermore, to collect the information, a survey was applied to 372 small farmers with the support of digital mapping and the Kobol Tulboox software version 1.27.3. The result was a Food Sovereignty Index of 59.79%, which, according to the scale used, places the territory in a high average. In addition, the hypothesis was verified, concluding that there is a direct relationship among the following elements of family farming such as number of household members, family labor, group of products, type of animals, tillage technology, natural fertilizer, and altitudinal levels with food sovereignty. For future research, it is recommended that the variable of climate change has to be incorporated in order to observe its impact on food sovereignty.

Keywords: family farming; food sovereignty; agricultural; diversification; family labor force

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1. Introduction

The food crisis requires that we reformulate the current capitalist agrifood model and build a new relationship that respects the cultural system and natural ecosystems; in this context, family farming represents a new way of looking at economic activity. Hence, the food crisis is an opportunity because it has allowed a debate on the importance of food sovereignty, as a right of the population to obtain their own food system, which allows the consumption of healthy, nutritious food produced under technologies compatible with the environment [1]. Food sovereignty is also focused on defending the rights of peasant communities harmed by the policies that promote economic globalization [2].

The pandemic revealed the significance of this kind of agriculture since the health crisis could not have been managed if the production of food from peasant production had been interrupted. The close relationship between family farming and food sovereignty is also evident.

Agriculture productive units (UPAs) dedicated to family farming produce around 80% of food worldwide, on an average area of 70% of agricultural land globally [3], while in Ecuador, family farming provides 60% of the food demanded by the population [4]. In the same way, in the Guarainag parish, the productive units dedicated to family farming occupy 2.53% (42.74 hectares) of the total agriculture area, the same ones that are located on different bioclimatic floors and adjacent to populated centers.

The concept of family farming in Latin America originated at the end of the 19th century and the beginning of the 20th century, from the publications made by the historians Chayanov and Ayala who call it the "family economic unit" [5], which means: "a farm of sufficient size to provide the livelihood of a family and that in its operation does not require salaried labor, but that could be attended with the labor force of the family itself" [6].

However, it must be emphasized that, from the year 2000, after the end of the dictatorships, the term family farming began to be used with greater emphasis in the region due to the resistance of this segment to economic shocks [7]. The use of this term was also influenced by the declaration of the United Nations General Assembly (UNGA), in which 2014 was nominated as the year of Family Farming.

Likewise, food sovereignty is analyzed as a concept that emerged from the year 1996, promoted by the social organization called Vía Campesina, in the different sceneries of the fight against hunger [1]. It emerges as an opposition to the policies that promote capitalist agricultural activity [8] and as a response to food sovereignty proposed by the Food and Agriculture Organization of the Nations—FAO [9]. It also constitutes a tool that aims to change food systems from the bottom up [10]. It makes it possible to carry out studies on its characterization and contribution to the economy of the region; that is, family farming became the mobilizing axis of a series of events, academic studies, and public policies [11].

In 2017, the Food and Agriculture Organization of the Nations-FAO and the Latin American and Caribbean Parliament (Parlatino) published the Parlatino Family Farming Model Law, as a basis for the formulation of laws and policies in the region, in which the concept of family farming was established as a productive unit and a way of life in which men and women from the same family nucleus work and their production is used for self-consumption, exchange, and commercialization.

Family farming systems in general, and home gardens in particular, are important settings for the implementation of agroecological practices [12]; its administration is in charge of the family and the family resides in it or in a nearby place [11], a way of life of community work which differentiates it from other types of capitalist economy [13].

The Inter-American Institute for Cooperation in Latin America (IICA) states that family farming is a social category made up of individuals who live in rural areas, work the land for productive and reproductive purposes, and in which family work predominates, due to which it has been positioned in different countries as a relevant social subject [14].

In addition, family farming is not only a productive activity, but also a way of life of the peasant population [11,15]; it is characterized by the high number of people who work in it [16]. Both men and women from the same family unit [17,18] mainly use family labor and occasionally hired labor [19]. Furthermore, they are owners of their means of production, use low-tech tools and equipment, are friendly to the environment (animal traction, picks, shovels), and they are located on different altitudinal floors where agricultural activities are carried out which allows them to have a high diversification of their production [20].

This is related to the approach of Fabron and Castro [18] and Acebedo [19], who state that family farming is the basis of food sovereignty. It provides healthy and nutritious food with strong identity roots, which gives it elements of multidimensionality. This criterion also coincides with both Byaruhanga and Isgren and [21] Wald and Hill [22], who consider that the multiscale perspective plays an important role in the analysis of food systems and their implementation.

Food sovereignty is focused on the rights of both the State and the people in order to democratically define what to sow in their agricultural production units without external imposition [22]. Food sovereignty is also established as a right that people have to a diet with nutritious, accessible products produced under an agroecological approach that represents their culture, and also to freely choose what they want to produce for their food [23]. Food sovereignty is a political proposal promoted by social organizations at the international level and subsequently assumed by the different States within their regulatory frameworks [9].

From the literature review, it has not been possible to find a study that shows the analysis of the role of family farming in family sovereignty, which allows us to formulate the following research question: How does family farming contribute to food sovereignty in Guarainag Parish? The research hypothesis shows that there is a positive influence of family farming on food sovereignty, according to which was proposed the objective of analyzing how family farming contributes to food sovereignty. The Guarainag parish of the Paute canton in the province of Azuay-Ecuador is taken as a case.

Ecuador is a pioneer country in terms of food sovereignty, incorporating it into the Ecuadorian Constitution of 2008 [24]. In Article 281, it states that: "Food sovereignty constitutes a strategic goal and an obligation of the State to guarantee that individuals, communities, people, and nationalities achieve self-sufficiency in healthy and culturally appropriate food on a permanent basis" [25]. In the case of Ecuador, the Heifer International Foundation in 2018 characterizes family farming as a productive system linked to mainly family labor and it is the family nucleus that decides what to plant and how it organizes work, and manages the transmission of knowledge [26].

In Guarainag, despite the problems caused by migration and the effects of changing land use, family agricultural production is maintained, characterized by its diversification, ancestral techniques in crops, employment of family labor, and the concentration of UPAs around their homes, thereby contributing to food sovereignty through access to health products, for which qualitative indicators and quantitative analysis were used through an inferential statistic.

2. Materials and Methods

The research was carried out in the Guarainag parish, belonging to the province of Azuay of the Paute canton, which borders the cantons: Azogues (Cañar province), Sevilla de Oro, Guachapala, and the Tomebamba parish (Azuay province). The parish is made up of 8 communities: Las Juntas, Llamacón, Selel, Ucumarina, Bella Unión, Rambran, Coyal, and Guarainag Center, as shown in Figure 1.

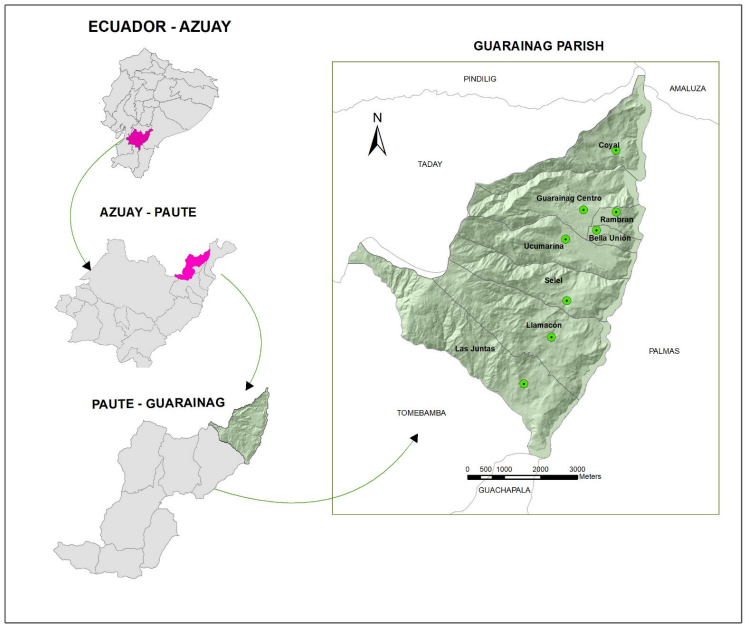

Figure 1. Location of the research area.

The reason why this parish was chosen to carry out the study is that its agricultural productive units present characteristics of family farming based mainly on the use of family labor, product diversification, and ancestral productive practices, among others which allowed us to determine to what extent this family farming contributes to food sovereignty. The study is based on the application of the inductive and deductive methods

to understand the theoretical generalities regarding the proposed study, and how family farming contributes to food sovereignty based on estimates of the logistic regression econometric model. The development of the research was carried out in 4 stages according to Figure 2.

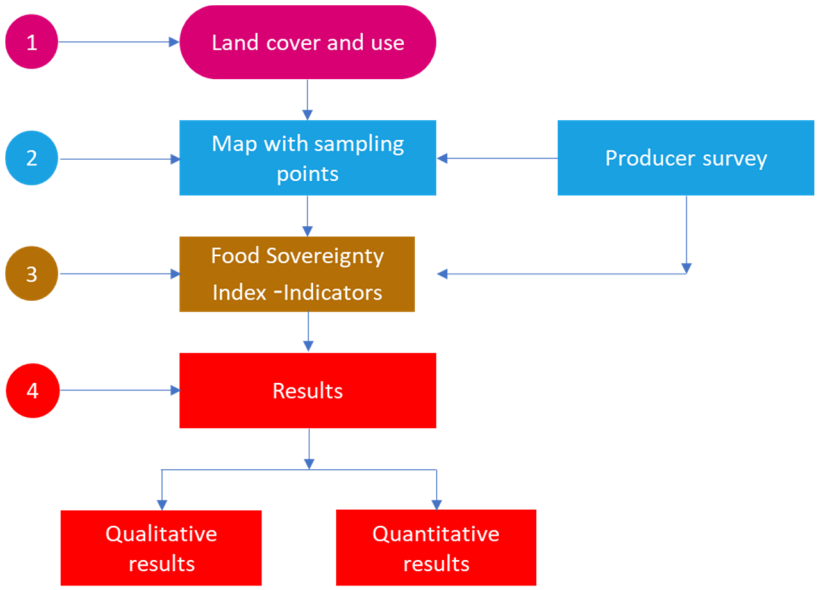

Figure 2. Research Stages.

(1) Compilation of cartographic material at a scale of 1:5000 of the coverage and use of the land of the Guarainag parish.

(2) Cartographic identification of agricultural productive units (UPAs) through a map which provided the number of UPAs dedicated to family farming, and which were validated by the directors of the Parish Government. The lack of knowledge of the exact number of these units was a limitation for the development of this research since there is little updated official information available due to the fact that the last agricultural census in Ecuador was carried out in the year 2000. This problem was solved with cartography updated to 2020, where a total of 387 UPAs dedicated to family farming were identified.

Based on the total number of UPAs, the sample was established with a total of 372 surveys to be collected randomly. The formula selected for the sample responds to the characteristics of the study where the population universe is known. The formula used is described in Equation (1).

The formula for the sample:

$$n = NPQ/(N-1)\left(\frac{E}{K}\right)^2 + PQ \quad (1)$$

Fountain: [27]
Where:
n = sample size
N= population size
P = probability of success
Q = probability of failure
E= error 1%
K = 1.96

$$n = \frac{387(0.5 * 0.5)}{(387-1)\left(\frac{0.01}{1.96}\right)^2 + (0.5 * 0.5)} = 372$$

With the number of samples determined, a map was made with the sampling points where the survey was applied. The location of the UPAs to be surveyed was carried out by means of a simple random sampling where each family agricultural productive unit had the same possibility of being included [28].

To carry out the sampling, each of the geo-referenced plots was numbered and the statistical probability calculation function in Excel software version 16.0.4266.1003 was used to select the plots to be surveyed. Figure 3 shows the UPAs where the surveyed households are located in relation to the total.

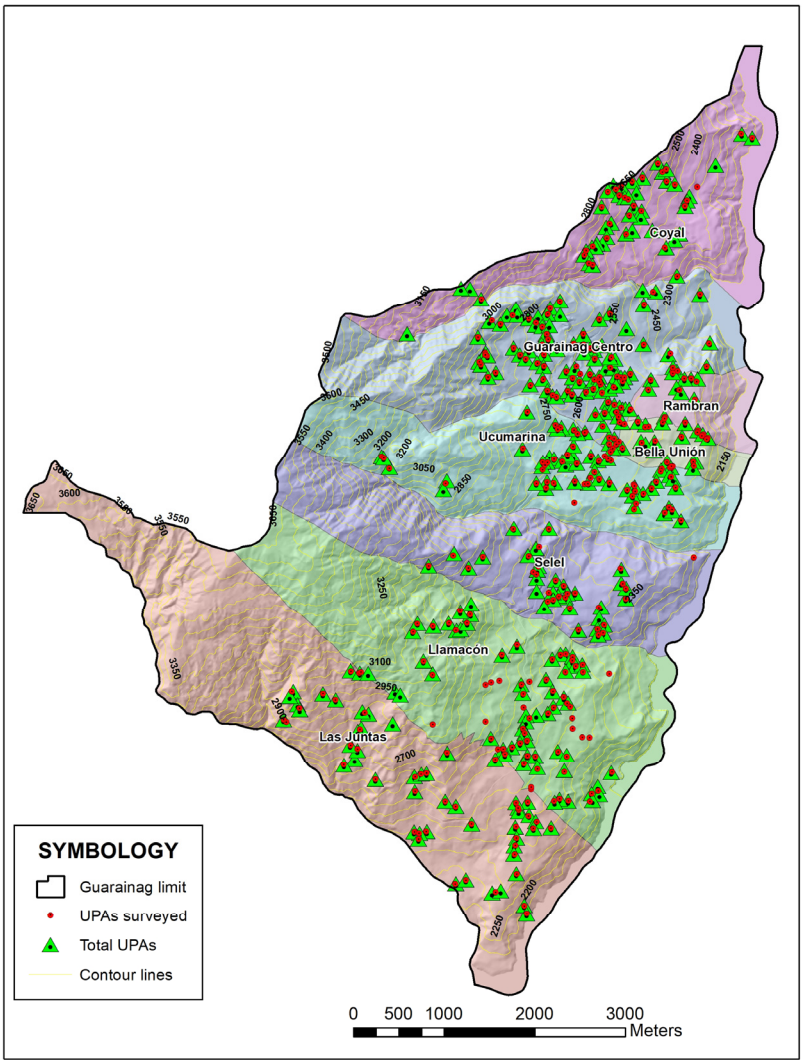

Figure 3. Location of the UPAs surveyed.

(3) A Food Sovereignty Index (IDS) was constructed as a criterion for measuring the food sovereignty variable. The following process was followed to construct the IDS: establish the factors of each variable, assign indicators for each factor, and assign its scale or measurement value [29–32]. The summary of this process is observed in Table 1, where the indicators are expressed as a percentage and the IDS is a simple average of food consumption (products, animals).

Table 1 shows that IDS has been formed based on 10 indicators, which were chosen from Johanes M. Waldmueller y Laura Rodríguez [24], Salgado et al. (2020) [33]. The IDS is the result of the simple average of the 10 indicators that compose it. It was decided to give the same weight to each variable due to the insufficiency of empirical and theoretical evidence as reference for making decisions regarding the weights of these indicators.

Table 1. Indicators of food sovereignty.

Indicators (%)
Average of vegetables you consume from your crops
Average of legumes consumed from their crops
Average of cereals consumed from their crops
Average of tubers consumed from their crops
Average of fruits consumed from their crops
Average of dairy consumed from its production
Average of chickens that you consume from your property
Average of guinea pigs that you eat from your property
Average of cattle consumed from the farm
Average of pigs consumed from your farm
Food Sovereignty Index

This may be a limitation of the present research; however, in the authors' opinion, it constitutes a first approximation that has a practical application in the measurement of food sovereignty in rural parishes. The analysis of the weights of each of the indicators on food sovereignty will be considered for future research.

The Food Sovereignty Index–IDS was established with a stratification; the Likert scale was used in 5 ranges: *Low,* those with <20% IDS; Middle-Low, among the range of >20%–<40%; Half, in the range >40%–<60%, High average, in the range >60%–<80%, and High, between the ranges >80%–<100%. This classification can be seen in Table 2.

Table 2. Ranks of the Food Sovereignty Index.

Ids Ranges	Rating of the Food Sovereignty Index
IDS < 20%	Low
20% < IDS < 40%	Middle-low
40% < IDS < 60%	Half
60% < IDS < 80%,	High average
80% < IDS < 100%	High

Table 3 shows the 3 axes and the 12 indicators that were used to measure the family farming variable. The choice of these was based on: Victor Hugo Verdezoto y Jorge Enrique Viera [27], Johanes M. Waldmueller y Laura Rodriguez [24].

Table 3. Indicators of family farming.

Axes	Indicators	Unit
Labor	Family labor	%
	Hired labor	%
Production units	Products group	Number
	Animals group	Number
	Property tenure	% own
		% rented
Technology	Ancestral tillage technology	%
	Plowing technology	%
	Associated products	%
	Agricultural calendar	%
	Rotation practices	%
	Access to irrigation	%
	Natural fertilizer	%

(4) The determination of the results where the quantitative indicators that allowed to determinate the association and correlation between variables were analyzed. For the

treatment of the data and the elaboration of the econometric model, the Stata statistical software version 14.0 was used, where 11 predictors were entered for the Logit Model, which validates the correlation between the dependent and independent variables. Likewise, the qualitative indicators that describe and characterize the studied variables were also analyzed [27]. The Logit model was constructed with the IDS as the dependent variable and the 11 predictor variables are those corresponding to the family farming indicators found in Table 4. The specification of the model can be seen in Equation (2).

Specification of the logit model:

$$\Pr(Y = 1|X_1, X_2 \ldots X_{11}) = \frac{1}{1 + \left(\frac{1}{e^{(\beta_0 + \beta_1 X1 + \beta_2 X2 + \cdots + \beta_{12} X11)}}\right)} \quad (2)$$

When the IDS is greater than 60%, it takes the value of 1 and is classified as having food sovereignty, and if the IDS is less than 60%, it does not have food sovereignty, qualifying it as 0. According to the above, 65.68 would be the percentage that had food sovereignty and 34.32% that did not. Hence, the description and categorization of the predictor variables can be seen in Table 4.

Table 4. Variables predictors.

Axes.	Variable	Categories
Independent variables	Number of household members managed by the Productive Unit	Membership
	Labor used UPA	1. Labor is Family 0. Labor is hired
	Group of products that it harvests Type of animals you raise	Number of product groups Animal type number
	Technologies used in tillage	1. Plow management 0. Tractor handling
	Use of the associated sowing technique	1. If they plant associates 0. Do not sow associates
	Use of rotation practices	1. If you do rotation practices 0. Does not carry out rotation practices
	Use of natural fertilizer	1. If you use natural fertilizer 0. Does not use natural fertilizer
	Tenure of the land	1. Own 0. Leased, rented, at first
	Acquisition of seeds	1. Own harvest 0. Another way of acquiring
	Altitudinal floors	1. Altitude of 2140–2499 2. Altitude of 2500–2799 3. Altitude of 2800–2999 4. Altitude of 3000–4000
Dependent variable	Food Sovereignty Index	0 < 60% without food sovereignty 1 ≥ 60% with food sovereignty

The bivariate analysis method allows us to analyze the correlation between variables through the Chi-Square test (chi2), the same one that contrasts from the observed frequencies if the differences between the two groups are attributable to chance [28].

3. Results

According to the established methodology, the results are presented below in two sections: qualitative and quantitative indicators.

3.1. Qualitative Indicators

As mentioned above, the family farming variable is measured through the 12 qualitative indicators in Table 3, as well as the food sovereignty variable, measured with the 10 indicators in Table 1. Table 5 shows them for each of the variables, axes, and indicators.

Table 5. Variables of family farming and food sovereignty results.

Variables	Axes	Indicators	Unit	Value
Family farming	Labor	Family labor	%	77.75
		Hired labor	%	22.25
	Production units	Products group	Number	6
		Animals group	Number	4
		Property tenure	% own	95.71
			% rented	4.29
	Technology	Ancestral tillage technology	%	86.06
		Plowing technology	%	13.94
		Associated products	%	93.03
		Agricultural calendar	%	91.42
		Rotation practices	%	97.32
		Access to irrigation	%	6.70
		Natural fertilizer	%	91.69
Food sovereignty		Average of vegetables you consume from your crops	%	58.17
		Average of legumes consumed from their crops	%	38.57
		Average of cereals consumed from their crops	%	82.88
		Average of tubers consumed from their crops	%	15.28
		Average of fruits consumed from their crops	%	23.82
		Average of dairy consumed from its production	%	91.58
		Average of chickens that you consume from your property	%	90.89
		Average of guinea pigs that you eat from your property	%	95.06
		Average of cattle consumed from the farm	%	86.05
		Average of pigs consumed from your farm	%	87.34

Based on the variables identified in Table 1, it can be observed that the labor used in the productive units is closely linked to family labor with 77.75%, and hired labor with 22.25%; the latter is mainly due to the aging of the population which is linked to agricultural production. The surveys conducted showed that family farming in the case of Guarainag has a diversity of products, which are grouped into six categories: vegetables, legumes, cereals, fruits, dairy products, and tubers, and in terms of livestock, they raise small animals (guinea pigs, pigs, poultry) and cattle. This characteristic coincides with what was stated by [6].

Likewise, the characteristics of the Agricultural Productive Units—UPAs dedicated to family farming, their concentration, area, diversity of products, animal husbandry, bioclimatic floors, irrigation systems, and property ownership were analyzed. Regarding the concentration of family UPAs, these are adjacent to the populated centers of the parish communities, as we can see in Figure 4.

The average area of the agricultural area dedicated to family farming is 2893 square meters, where there is a diversity of products grouped into six species: vegetables, legumes, cereals, fruits, dairy products, and tubers. Regarding the raising of animals, there are four types: chickens, guinea pigs, pigs, and cattle. Livestock and crop production are located in four bioclimatic zones. Likewise, 86.33% of the family farms dedicated to family agriculture

are located in two bioclimatic floors, ranging from 2140 to 2499 and 2500 to 2799 m above sea level, as shown in Figure 5.

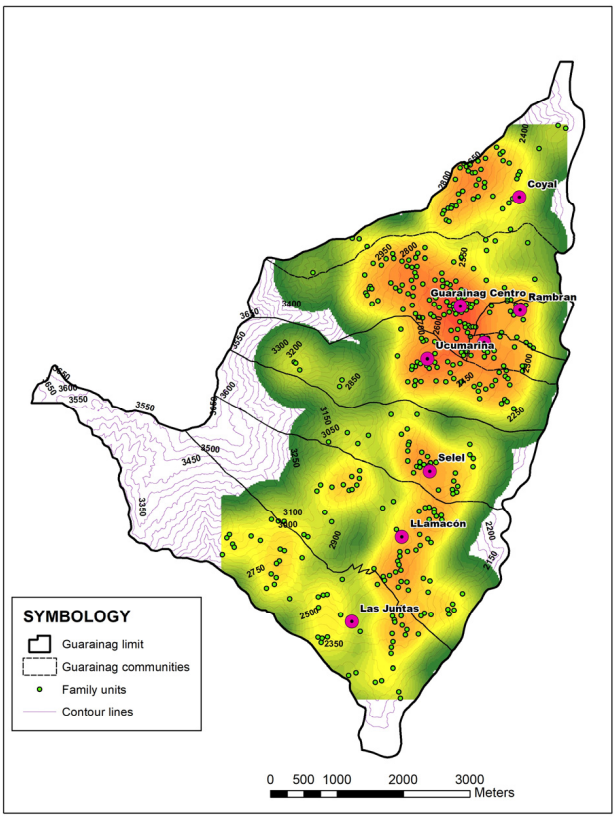

Figure 4. The concentration of family UPAs.

The 95.71% of the land dedicated to family farming is owned; furthermore, 91.69% do not have access to irrigation. Regarding the technology applied to the agricultural area, 86.06% of the family productive units use the animal traction system (plow) and 13.94% use the agricultural tractor; 91.69% practice crop rotation, 93.03% use the sowing technique with associated products, 97.32% use natural fertilizer, and 91.42% use the agricultural calendar.

In relation to access to food, family farming contributes on average to the family diet with 58.57% vegetables, 38.57% legumes, 82.58% cereals, 15.28% tubers, 23.82% fruit, 91.58% dairy, 90.89% chickens, 95.06% guinea pigs, 86.05% sheep, and 87.34% pigs.

According to the analysis carried out in Table 6, it can be seen that 59.79% have high average food sovereignty, 28.95% are rated as average, 5.9% as high, and 5.36% average low, with access to the consumption of healthy food (produced with natural fertilizer), including nutritious (they are important sources of minerals, calcium, potassium, magnesium, iron, iodine, proteins) and diversified products with sustainable environmental and cultural production models (use of animal traction).

Table 6. Ranks of the Food Sovereignty Index.

Ids Ranges	Rating of the Food Sovereignty Index	Ids	Percentage (%)
IDS < 20%	Low	0	0.00
20% < IDS < 40%	Middle-low	20	5.36
40% < IDS < 60%	Half	108	28.95
60% < IDS < 80%,	High average	223	59.79
80% < IDS < 100%	High	22	5.90
	Total	373	100.00

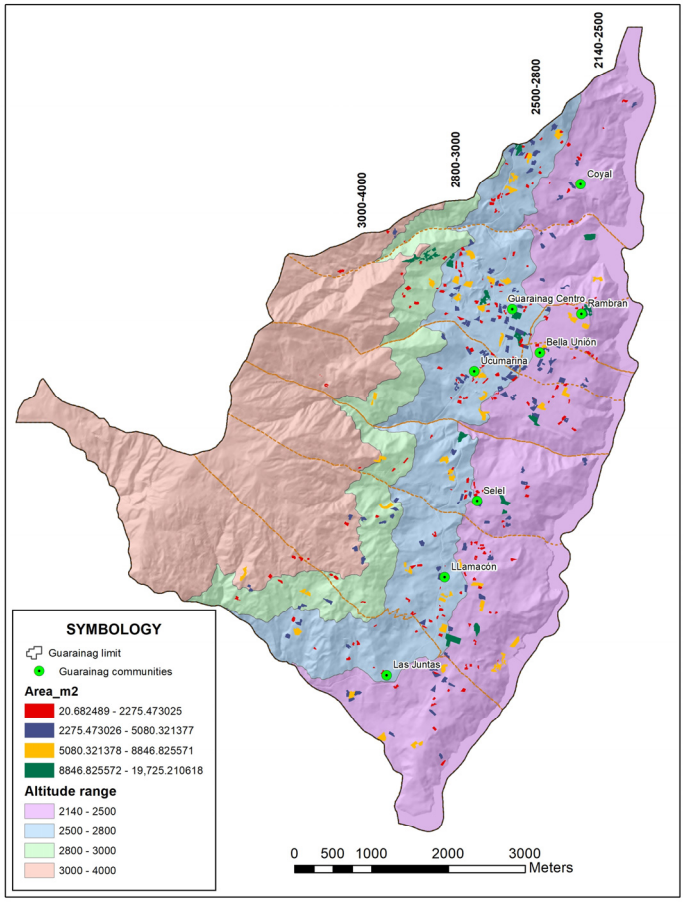

Figure 5. Location of family UPAs by bioclimatic floors.

3.2. Quantitative Indicators

This type of indicator analyzes the contribution of family farming to food sovereignty through the "Logit Model", which allows for a binary analysis between independent and dependent variables. As mentioned in the methodological part, food sovereignty has been chosen as the dependent variable. The results of the descriptive statistics of this variable are shown in Table 7.

Table 7. Dependent variable results.

IDS	Frequency	Percentage	Accumulated
0	128	34.32	34.32
1	245	65.68	100.00
Total	373	100.00	

Table 8 shows the results of the binary logit model which was run with the STATA software version 14.0.

The results in Table 8 show that the variables (Number of household members managed by the Productive Unit, Labor used UPA, Group of products that it harvests, Type of animals you raise, and Altitude of 2500–2799) are significant at a 95% confidence level. In addition, the variable (Use of natural fertilizer) is significant at 90% confidence level. The variables (Use of the associated sowing technique, Use of rotation practices, Tenure of the Land, Acquisition of seeds, Altitude of 2800–2999 and Altitude of 3000–4000) were not significant, and therefore, they cannot be interpreted. Hence, we could say that the variables that were found to be significant have a positive influence on food sovereignty.

Table 8. Logit model.

IDS	coef.	Std. Err.	Z	$p > z$	[95% Conf.	Interval]
Number of household members managed by the Productive Unit	0.5025217	0.1671353	3.01	0.003	0.1749424	0.8301009
Labor used UPA	0.9958676	0.377439	2.64	0.008	0.2561008	1.735634
Group of products that it harvests	2.157564	0.2682683	8.04	0.000	1.631768	2.683361
Type of animals you raise	0.7180205	0.2693447	2.67	0.008	0.1901146	1.245926
Technologies used in tillage	−1.015121	0.4436787	−2.29	0.022	−1.884715	−0.1455264
Use of the associated sowing technique	0.5246096	0.6221096	0.84	0.399	−0.6947027	1.743922
Use of rotation practices	0.4377693	0.9790197	0.45	0.655	−1.481074	2.356613
Use of natural fertilizer	0.9456437	0.5628639	1.68	0.093	−0.1575491	2.048837
Tenure of the land	0.3423796	0.6503339	0.53	0.599	−0.9322514	1.617011
Acquisition of seeds	−0.9963864	0.719643	−1.38	0.166	−2.406861	0.4140879
Altitudinal floors						
2. Altitude 2500−2799	0.6919243	0.3196482	2.16	0.030	0.0654253	1.318423
3. Altitude 2800–2999	0.2862071	0.5218403	0.55	0.583	−0.7365811	1.308995
4. Altitude 3000–4000	0.1517798	0.7863475	0.19	0.847	−1.389433	1.692992
_cons	−12.41432	2.139603	−5.80	0.000	−16.60787	−8.220778

3.3. Indicators of the Fit of the Logit Model

Table 9 shows the indicators used to measure the model's goodness of fit which are analyzed through Pseudo R^2 and the ROC Curve.

Table 9. Indicators of the fit of the Logit Model.

Indicators	Parameters
Number of obs =	373
LR chi^2 (13) =	171.28
Prob > chi^2 =	0.0000
Pseudo R^2 =	0.3570
log likelihood	−154.24019

The goodness of the logistic model is based on the Pseudo R^2, so the Pseudo R^2 statistic allows us to measure the goodness of a logistic model. It is a statistic used as a proxy of the model with respect to its endogenous variable based on empirical evidence; the following ranges are proposed [28]:

- First, Pseudo R^2 has a value less than 0.2; the model presents a bad fit.
- Second, Pseudo R^2 is in a range of 0.2 and 0.4; the model presents a normal fit.
- Third, Pseudo R^2 has a value greater than 0.4; the model fits the data appropriately.

For the purposes of this research, the calculation carried out has a normal fit because it corresponds to a Pseudo R^2 of 0.357 and the Probability > chi^2 is 0.0000; therefore, it is less than 0.05, concluding that the model is reliable.

The ROC curve is a graphical representation of the sensitivity and specificity of the logistic regression model. The area at the bottom of the ROC curve is an overall measure of the accuracy of a diagnostic test. The area under the curve must be greater than 0.5 for the model to discriminate adequately. In the research carried out, the curve has an ROC of 0.87 which is a good discrimination since it is close to 1; see Figure 6.

Depending on the statistics obtained for each variable, the following considerations fit: the contribution of family farming to food sovereignty is made based on the marginal effects and Odds Ratio, as shown in Table 10.

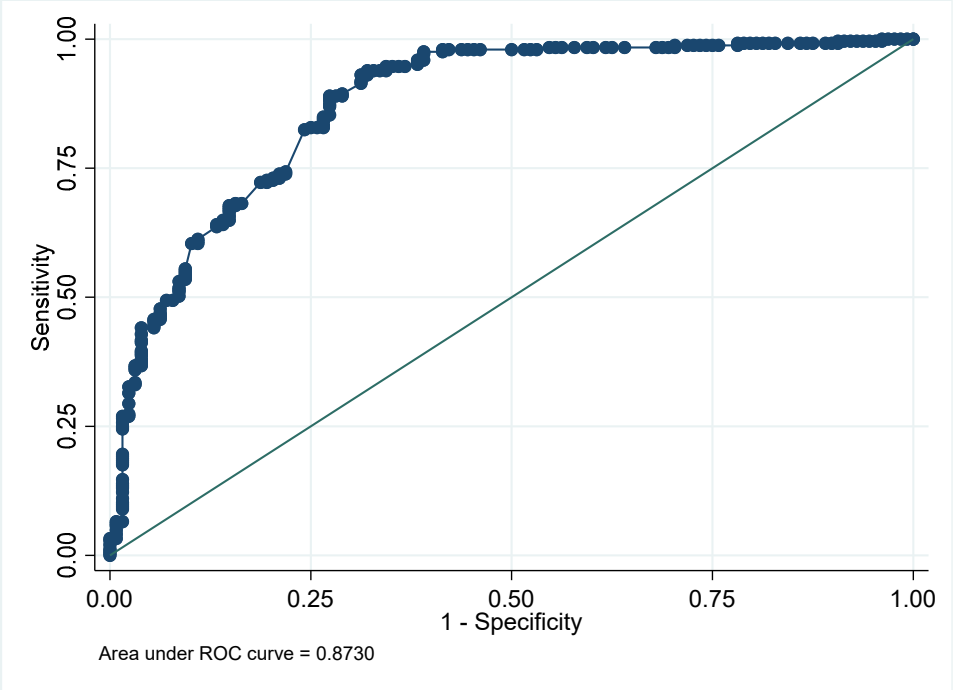

Figure 6. ROC Curve.

Table 10. Marginal Effects and Odds Ratio.

	dy/dx	*p* > z	Odds Ratio
Number of household members managed by the Productive Unit	0.0673586	0.002	1.652884
Labor used UPA	0.1386551	0.008	2.707072
Group of products that it harvests	0.2892024	0.000	8.650045
Type of animals you raise	0.0962443	0.006	2.050371
Technologies used in tillage	−0.1292463	0.013	0.3623587
Use of the associated sowing technique	0.0730374	0.411	1.689799
Use of rotation practices	0.0606742	0.663	1.549247
Use of natural fertilizer	0.1337408	0.099	0.257447
Tenure of the Land	0.0470397	0.606	1.408295
Acquisition of seeds	−0.1414668	0.175	0.3692112
Altitudinal floors			
2. Altitude 2500–2799	0.0916678	0.025	1.997556
3. Altitude 2800–2999	0.0391849	0.577	1.331368
4. Altitude 3000–4000	0.020973	0.845	1.163904

- The variable that refers to the number of members per household of families dedicated to family farming presents a positive coefficient and an Odds Ratio greater than the unit Exp (0.67) = 1.65, which indicates that, for each unit of increase in the number of members in the household, there is 1.65 times more probability of contributing to food sovereignty.
- The variable family labor presents a positive coefficient and the Odds Ratio greater than one unit–Exp (0.13) = 2.70. Thus, it indicates that for each unit of family labor increased, there is 2.70 times the probability of contributing to food sovereignty.
- The variable of the number of groups of products that they cultivate has a positive coefficient and the Odds Ratio is greater than the unit Exp (0.28) = 8.65, indicating that due to an increase of one unit in the diversity of products, it is 8.65 times more likely to contribute to food sovereignty.
- The variable referring to the number of types of animals raised in their production units has a positive coefficient and the Odds Ratio greater than the Exp unit

(0.096) = 2.05, showing that with each increase in the breeding of one type of animal, it is 2.05 times more likely to contribute to food sovereignty.

- The tillage technology variable with the use of the team has a negative coefficient and the Odds Ratio is greater than the Exp unit (−0.091) = 0.36 (inverse 2.77). Thus, it indicates that for each increased unit of use of the team in the UPAs, it is 2.77 times more likely to contribute to food sovereignty.
- The variable related to bioclimatic floors has a positive coefficient and the Odds Ratio is greater than the Exp unit (0.91) = 1.99, indicating that due to the increase of a farm unit located in the bioclimatic floor that goes from 2500 to 2800, it is 1.99 times more likely to contribute to food sovereignty; all of the above mentioned corresponds to the fact that within this bioclimatic floor the soil is loamy and black in color, contains nutrients, moisture, humus, good drainage, and infiltration of water and air which present better characteristics for agricultural cultivation [34].

4. Discussion

The results of the research agree with the criteria of some authors who focus on the direct link between family farming and food sovereignty [33] and consider it as an alternative to capitalist agriculture [28], which is reflected in the Constitution of the Republic of Ecuador 2008, where food sovereignty is proposed as an alternative for people to have a healthy, nutritious diet, and this is achieved with the contribution of family farming [25] with diversified production [6]. Furthermore, food diversity and the use of organic fertilizers are important elements as a contribution to food sovereignty. This coincides with the profile found by García (2023) [35] in a study on self-consumption gardens in the Huelva mountains where farmers committed to the environment grow a range of products with a wide variety and a high commitment to the use of organic fertilizers [36]. In addition, it supports the point of view that food sovereignty is likely to increase when production units have a greater diversity of products [34], and the raising of small and large animals is accomplished with a clean technique [5], the use of ancestral techniques (animal traction), and with mainly family labor [33]. In short, these factors contribute to food sovereignty [20]. Thus, local agrobiodiversity supports food sovereignty [37].

The 59.79% food sovereignty indicator obtained shows that there is still room for improvement in the Guarainag parish case study. Among the aspects that should be worked on is the consumption of fruits, legumes, and tubers. Moreover, a similar study is that of Salgado et al. (2020) [33] who, in their research on vulnerability to food insecurity conducted in Quilombola, found an indicator of food insecurity of 53% of households. In this case, the program applied showed changes in eating habits, creating new habits due to access to a greater diversity of foods.

Food sovereignty occurs when populations have access to healthy, organic, and diverse food. To achieve food sovereignty, family farming plays an important role which becomes a reality when there is a will of families to produce the land with environmentally friendly and ecological techniques and technologies. In this sense, Mann (2014) [36] and Sélingué (2007) [38], also cited by Byaruhanga and Isgren (2023) [39], believe that in order to achieve the above, it is very important to guarantee the rights of people to determine their own food and agricultural systems which guarantee the right to culturally appropriate and healthy food, as well as ecologically sound production.

5. Conclusions

This study concluded that family farming has a positive influence on food sovereignty in the case study of Guarainag parish. The factors that were found to be significant are: Number of household members managed by the Productive Unit, Labor used UPA, Group of products harvested, Type of animals raised, Altitude of 2500–2799 and Use of natural fertilizer.

The food sovereignty variable was obtained from the construction of the Food Sovereignty Index based on ten indicators. The result obtained from its calculation was 59.79%, which

places it on a high average scale according to the qualitative classification defined for it. On the other hand, the indicators that most influenced this qualification are: family production units that are characterized by their proximity to population centers, the use of family labor, ancestral practices (animal traction), high diversification of product groups such as vegetables, legumes, cereals, dairy products, fruit, and the raising of various species of animals, and the destination of their production being mainly for family consumption. Nonetheless, it is necessary to point out that one of the limitations of the study is the method of calculating the IDS based on the simple average. Future research will analyze more complex methods of calculation and incorporate other indicators of family farming such as the effect of climate change.

This study is considered a tool of practical importance in local public policy decision-making. In the opinion of the authors, family farming should be treated as a provincial policy, which would have a comprehensive impact on strengthening food sovereignty as a means to achieve zero hunger, as proposed in the 2030 Sustainable Development Goals.

Thus, with the results obtained and as a contribution of the study to the strengthening of family farming in food sovereignty, three lines of action are recommended. They are addressed to the competent and governing bodies of agricultural activity established in the Organic Code of Territorial Organization—COOTAD [36]. These are:

- Incorporate, in the guidelines for updating the land management plans, parameters that establish regulations on permitted and complementary uses which promote family agriculture.
- Since agricultural development is the exclusive responsibility of the Provincial Government and concurrent with the Parochial Governments, comprehensive programs must be promoted to strengthen family farming, and in this way, guarantee the population's food sovereignty.
- Make strategic alliances between the sectional government, families dedicated to family farming, and academia for the transfer of technology adapted to the area and with cultural characteristics that boost the productivity of agricultural production units.

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