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Migration Dynamics and Recomposition of Agricultural Landscapes in the Municipality of Ouesse in Central Benin

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Abstract

Migration patterns are a major factor in the transformation of rural areas in Benin. This study analyzes the influence of agricultural migration flows on the reshaping of agricultural landscapes in the municipality of Ouèssè. The methodology combines the use of demographic data from the National Institute of Statistics and Demography (INStaD), diachronic analysis of satellite imagery, and questionnaire surveys of 307 farming households. The results reveal a significant increase in the proportion of agricultural migrants, rising from 13% in 2002 to 38% in 2025, driven by land accessibility and proximity to Nigerian markets. Spatially, the transition matrix highlights a strong agricultural presence: cultivated and fallow land units increased from 26.4% to 40.1% of the municipality's territory, expanding primarily at the expense of wooded and shrubby savanna formations, which decreased from 55.8% to 39.8%. Access to land remains asymmetrical, dominated by inheritance among indigenous populations (63%) and by purchase through monetary means among migrants (48%). These landscape changes call for a strengthening of local land governance to guarantee sustainable agricultural development and mitigate human pressures on ecosystems.

Keywords

Ouèssè, Migratory Dynamics, Agricultural Landscapes, Access to Land

1. Introduction

The intensification of rural-urban migration flows is profoundly reshaping demographic balances and radically altering the spatial structure of agricultural production basins. The globalization of food markets and the liberalization of trade

are stimulating intensive contract farming, transforming vast traditional agricultural landscapes into standardized agro-industrial spaces [1]. International and internal climate migrations act as powerful catalysts, forcing rural populations to abandon degraded ecosystems in favor of forest frontiers or fragile peri-urban areas [2]. In many regions of the industrialized world, the aging of the peasantry and agricultural decline are contributing to land abandonment, while countries in the Global South are facing land scarcity exacerbated by population pressure. The rapid expansion of global megacities is irreversibly encroaching on the best arable land in urban food belts, raising critical questions about the sustainability of urban food supplies [3].

In sub-Saharan Africa, migration patterns are a major driver of rural transformation. Increasing population pressure, the scarcity of arable land in certain regions, and the search for better land and agro-ecological opportunities are pushing many farmers to migrate to areas offering more favorable conditions [4]. These agricultural migrations are leading to a redistribution of rural populations and profoundly influencing the organization of host territories [5]. Human mobility is primarily manifested through seasonal labor migrations and the movement of frontier farmers in search of more fertile virgin land. The influx of rural migrants into savanna and forest areas is accelerating deforestation, fragmenting agricultural landscapes into a mosaic of cultivated plots and increasingly shorter fallow periods [6]. The reshaping of agricultural landscapes is strongly influenced by increased competition between extensive peasant farming and large-scale land investments orchestrated by transnational actors. The transformation of pastoral transhumance corridors, disrupted by the expansion of agricultural frontiers and the private appropriation of land, generates landscapes of permanent conflict between herders and farmers [7]. The progressive sedentarization of nomadic and semi-nomadic populations is permanently altering the organization of rural space, combining intensive livestock farming with subsistence food crops. Financial transfers (remittances) from the diaspora play a decisive economic role in the reshaping of African lands, often used to finance land purchases, mechanization, and horticultural intensification [8]. In areas of intense migration, the mass departure of able-bodied young people leads to a feminization and aging of the agricultural workforce, resulting in the abandonment of outlying plots [9].

In Benin, the economic attractiveness of the region stimulates both cyclical and permanent migration patterns that convert traditional subsistence lands into residential and speculative zones. Migration flows from mission areas or the Atacora region to the agricultural basins in the center of the country are redefining land ownership and use patterns [10]. The transformation of Benin's agricultural landscapes is evident in the dramatic expansion of oil palm, maize, and cassava cultivation at the expense of tree cover and lowland ecosystems [11]. For several decades, the Municipality of Ouèssè has emerged as a magnet for agricultural migrants due to the relative availability of arable land, soil fertility, and favorable agro-climatic conditions. The gradual settlement of these migrant populations is

accompanied by an expansion of cultivated areas, a diversification of production systems, and a modification of land use patterns through the opening of new agricultural frontiers, the transformation of vegetation cover, and increased pressure on natural resources [12]. In this context, analyzing the interactions between agricultural migration and landscape transformations appears essential for understanding the ongoing land tenure changes in rural areas. This research aims to analyze migratory dynamics and the reshaping of agricultural landscapes in the Municipality of Ouèssè.

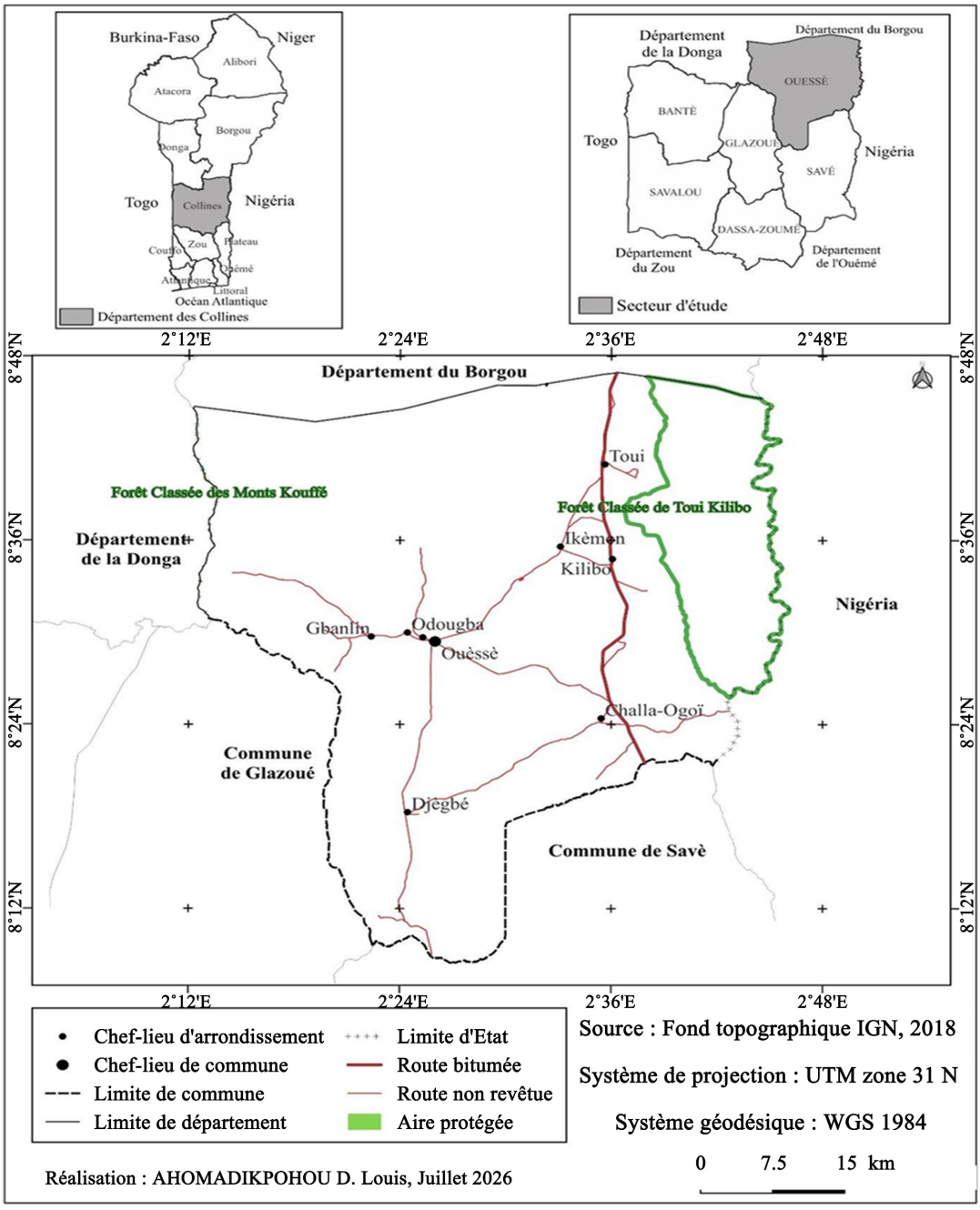


Figure 1. Geographical and administrative situation of the Municipality of Ouèssè.

2. Study Area

Located in the heart of Benin, the Municipality of Ouèssè is one of the six municipalities in the Collines Department. It lies in the northeast of this department, between 2˚10' and 2˚47' East longitude and between 8˚07' and 8˚47' North latitude. It stretches between the Okpara River to the east and the Ouémé River to the west, covering an area of approximately 3200 km^2, which represents 2.56% of the total national territory. The Municipality of Ouèssè occupies a strategic geographical crossroads, sharing its borders with the Municipality of Tchaourou to the north, the Municipalities of Savè and Glazoué to the south, and Bantè and Bassila to the west, while also opening onto the Federal Republic of Nigeria to the east. This strategic geographic location gives it a great diversity in its physical environment, making it an area favorable to agricultural activity and population mobility [13]. Observation of **Figure 1** shows that the Ouèssè Municipality is subdivided into nine (9) districts: Challa-Ogoi, Djègbè, Gbanlin, Kèmon, Kilibo, Laminou, Odougba, Ouèssè-Centre, and Toui. These districts comprise a total of 39 villages and urban neighborhoods [14]. **Figure 1** presents the geographic layout of the Ouèssè Municipality.

3. Materials and Methods

The data used in this study come from both secondary and primary sources. Demographic and agricultural data were obtained from the National Institute of Statistics and Demography (INStaD) through the results of the Fourth General Population and Housing Census (RGPH4, 2013), as well as other statistical documents relating to the municipality of Ouèssè. This information allowed for a better understanding of demographic dynamics, migration patterns, and their influence on agricultural activities in the study area. The population estimate for the municipality by 2025 was based on the annual population growth rate of 3.45% observed in 2013. This demographic projection is based on the projection formula recommended by INstaD (2023), expressed as follows:

$$P_n = P_0 (1+r)^n$$

with:

- P_0 = 12,499 (population of agricultural households 2013);
- r = 3.45% = 0.0345 (population growth rate 2013);
- n = 2025 − 2013 = 12 years. Thus,

P_n = 19,142 agricultural households in 2025.

Furthermore, quantitative data relating to the socioeconomic characteristics of producers, agricultural migration flows, production systems, climate-smart farming practices, and perceptions of climate change were collected directly from farming households.

An agricultural migrant is defined as any individual who has left their locality or country of origin to settle temporarily or permanently in a new geographical area, primarily to engage in activities related to agriculture, livestock farming, or

agronomy. The first criterion used to characterize these respondents is their origin, which entails a geographical relocation across administrative or national boundaries, distinct from their place of birth or initial residence. The second criterion concerns the duration of residence, distinguishing between seasonal or temporary migration and long-term settlement in the host region. The third criterion is the actual engagement in an agricultural activity, whether crop production, livestock farming, processing, or wage labor in the agricultural sector, ensuring that the relocation is directly motivated by the primary sector. Applying this definition, the category of "immigrants" encompasses individuals born abroad or arriving from another region who settle in the study area to work the land. Conversely, "emigrants" refers to farmers from the local community who have left their home territory to pursue agricultural activities elsewhere. The overarching concept of "migrants" thus encompasses all such inward and outward flows driven by agricultural opportunities. Finally, "non-native" farmers are specifically those agricultural migrants who have settled in a host territory without being from there, distinguishing them from the local agricultural population. Consequently, by rigorously combining the factors of origin, duration of stay, and agricultural activity, it is possible to precisely classify each respondent into these various migratory categories.

The field survey included both local farmers and migrants settled in the municipality of Ouèssè. The sample size was determined using the probabilistic formula of [15]: $N = (Z_a)^2\ pq/i^2$, which amounts to 307 households, with: $Z_a = 1.96$; $p =$ population of agricultural households in the department/population of agricultural households in the municipality; $q = 1 - p$ and $i = 0.5$.

Applying this formula yielded a sample of 307 farming households, distributed across the different districts of the municipality. The survey protocol is based on a sampling frame derived from a census of households in the targeted districts of the municipality, providing an exhaustive list of housing units. The household selection procedure employed a multi-stage stratified random sampling method, ensuring that every household in the sampling frame had a known, non-zero probability of being selected. The distribution of the sample across the districts was proportional to the demographic weight of each administratively defined area, ensuring an accurate spatial representation of the entire municipal territory. A high response rate was achieved during field data collection, thereby minimizing non-response bias and preserving the validity of the observations. Within this overall sample, a clear distinction is made between native respondents (those originally from the municipality) and migrant respondents (those who settled there following a geographical relocation). This rigorous structure ensures that the final sample of 307 households accurately reflects the demographic, spatial, and sociological diversity of the municipality, allowing the findings to be generalized to the entire population under study. This data was used to analyze migration patterns, agricultural practices adopted by producers, and transformations in production systems within a context marked by climate change.

The survey results were quantified based on the actual score for each section of the questionnaire, rather than on the total number of individuals surveyed. The number of responses for each type of question was expressed using the following statistical formula:

$$P_1 = n/N \times 100;$$

where "n" represents the number of agricultural households that provided positive responses, and "N" represents the sample size at the municipal level. The analysis of migratory dynamics and the recomposition of agricultural landscapes in the municipality of Ouèssè is based on an integrated approach combining methods of demographic analysis, spatial analysis by remote sensing and geographic information systems (GIS), as well as data from socioeconomic surveys carried out with agricultural households.

3.1. Analysis of Agricultural Migration Dynamics

The analysis of migration dynamics is based on data from field surveys conducted with 307 farming households, supplemented by demographic statistics from the National Institute of Statistics and Demography (INStaD). The information collected includes migrants' places of origin, periods of settlement, factors contributing to migration, methods of accessing land, and cultivated areas. To assess the significance of migration in rural transformations, the agricultural migration rate (T_m) was calculated using the following formula:

$$T_m = \frac{P_m}{tP} \times 100$$

Or:

- P_m = migrant producers;
- tP is the total number of producers surveyed.

This analysis made it possible to assess the contribution of agricultural migrations to the growth of the agricultural workforce and to the occupation of production areas.

3.2. Diachronic Analysis of Land Use

The study of landscape changes is based on the use of Landsat satellite images from two observation dates (2004 and 2024) representative of the recent evolution of the municipal territory. The images underwent radiometric, geometric, and atmospheric corrections before their supervised classification using ArcGIS 10.8.

The accuracy of the classifications was verified using GPS data collected in the field and high-resolution images available on Google Earth.

The evolution of land cover units was determined through the calculation of surface variation:

$$\Delta U = \text{S2024} - \text{S2004}$$

Or:

- S2004 = Area of an occupancy unit in 2004;

- S2024 = Area of this same unit in 2024;
- ΔU corresponds to the observed variation in surface area between the two dates.

The interpretation of the results is as follows:

- $\Delta U = 0$: stability of land cover;
- $\Delta U > 0$: progression of the land cover unit;
- $\Delta U < 0$: regression of the land cover unit.

The land-cover analysis methodology relies on the rigorous processing of Level-2A Sentinel-2 imagery, supplemented by very-high-resolution Google Earth base imagery to optimize the identification of landscape features. To capture vegetation phenology, effectively distinguish between different crop types, and differentiate open water from marshy areas, data were acquired during two contrasting periods: the end of the dry season and the peak of the rainy season. The study utilizes a 10-meter spatial resolution derived from the blue, green, red, and near-infrared spectral bands. Supervised classification was performed using the Random Forest algorithm, which is noted for its robustness and ability to mitigate overfitting. The model was trained using data obtained from GPS-based ground-truth surveys, supplemented by photo-interpretation. Its final accuracy and statistical reliability were rigorously validated using an independent test dataset, with results presented via a confusion matrix that calculates overall accuracy and the Kappa coefficient. Methodologically, the comparison between 2004 and 2024 is based on satellite imagery that was harmonized and resampled to a common spatial resolution of 10 meters, then processed using the Random Forest supervised classification algorithm, the reliability of which was confirmed via an independent confusion matrix.

3.3. Analysis of the Relationship between Migration and Landscape Recomposition

To assess the influence of agricultural migration on observed spatial transformations, a cross-analysis was conducted between migration data and indicators of land-use change. The empirical analysis focuses on five key variables to understand the complexity of socio-environmental changes: the number of agricultural migrants, cultivated areas, different modes of land access, changes in vegetation cover, and adaptation practices adopted in response to climate change. The results were interpreted through descriptive and spatial statistical analysis to identify areas where migration patterns are associated with significant agricultural expansion, reduced vegetation cover, or intensified land use. This methodological approach thus provides a robust analytical framework for understanding the interactions between agricultural mobility, climate change, and the transformation of agricultural landscapes in the municipality of Ouèssè. It not only allows us to quantify the observed spatial transformations, but also to identify their socio-environmental determinants and implications for the sustainable management of land resources.

The cross-analysis of migration dynamics and landscape transformations was

conducted at the level of the spatial unit of analysis (or village territory), enabling a precise linkage between socio-demographic data derived from household surveys and land-cover change matrices. Methodologically, the statistical approach employs spatial regression models (or multinomial logistic regression for landscape transitions) to assess the strength of the relationship between the presence or influx of migrants and the conversion of vegetation and agricultural cover. The estimated effects quantify the relative impact of migration flows on the probability of deforestation, agricultural intensification, or the expansion of cultivated areas, while measures of uncertainty are rigorously documented using 95% confidence intervals and robust standard errors (along with their associated p-values). Finally, the results are framed cautiously as robust statistical associations rather than simplistic causal links. This methodological safeguard is further strengthened by the fact that the multivariate analysis incorporates and accounts for the influence of other key determinants of land-cover change, such as road accessibility, overall population growth, and shifting conditions in agricultural markets.

4. Results

4.1. Rural Migrations in the Municipality of Ouèssè

The migration patterns observed in the Collines department highlight a contrast between municipalities that are sources of and recipients of population. While Dassa-Zoumè, Glazoué, and Savalou experience a negative net migration, reflecting high emigration rates, Savè, Ouèssè, and Bantè are centers of migration. Figure 2 shows the distribution of agricultural migrant flows recorded in the sample between the 2002 and 2025 population censuses.

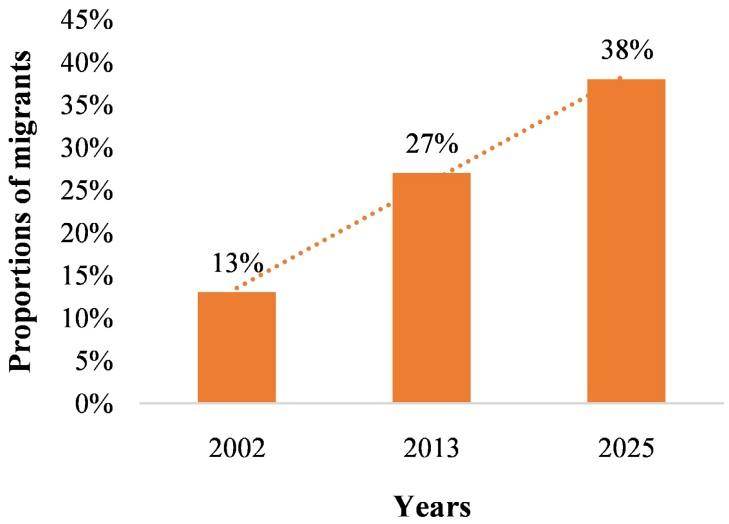


Figure 2. Proportion of agricultural migrants between 2002 and 2025. **Source:** Results of field surveys, June 2026.

Analysis of this figure shows a continuous increase in the proportion of agricultural migrants in the municipality of Ouèssè, rising from 13% in 2002 to 27%

in 2013, and then to 38% in 2025. This trend reflects the growing attractiveness of the municipality, primarily linked to the availability of agricultural land and its strategic geographic location, which facilitates mobility and trade. It also demonstrates an intensification of migratory patterns that increase pressure on land resources and transform agricultural landscapes.

4.2. Origins of Agricultural Migrants

In the Municipality of Ouèssè, migration flows originate from regions both within and outside the country. Figure 3 presents some of the origins of these flows.

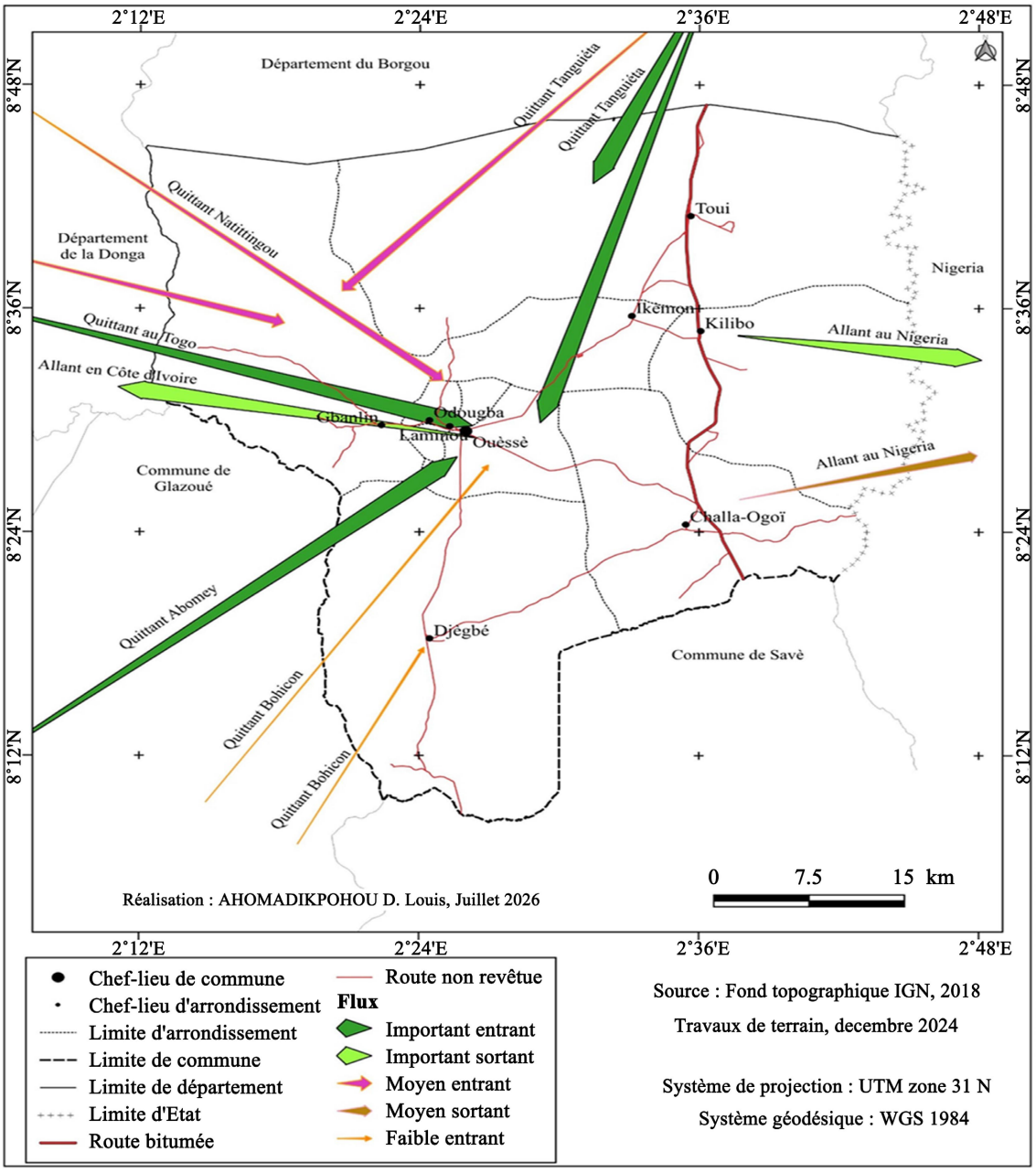


Figure 3. Mapping of migration flows in the Municipality of Ouèssè.

Analysis of this figure highlights the strong migratory appeal of the municipality of Ouèssè. The main inbound flows originate from Zou (Bohicon-Abomey: 16%), Atacora (Natitingou-Tanguiéta: 12%), Donga (Djougou: 3%), and Togo (2.1%), reflecting the municipality's attractiveness due to the availability of agricultural land. Outbound flows to Nigeria, Côte d'Ivoire, and Togo also reveal bidirectional mobility. Ouèssè's strategic geographic location, its accessibility, and its land resources thus reinforce its role as a migratory hub in the Collines department.

4.3. Profiles of Agricultural Migrants

Analysis of the profiles of agricultural migrants settled in the municipality of Ouèssè highlights the main socio-demographic characteristics of those involved in rural migration. The variables studied, including geographic origin, age, and education level, allow us to assess their settlement conditions, their adaptability, and their ability to adopt agricultural practices adapted to climate change. Table 1 illustrates the diversity of the profiles identified.

Table 1. Comparative profiles of migratory flows in the Municipality of Ouèssè.

Types of migrants	Immigrants				Emigrants.			
Ages	]30; 40]	[40; 50]	[50; 60]		]30; 40]	[40; 50]	[50; 60]	
Proportions	17%	49%	34%		55%	32%	13%	
Origin/ Destination	Origins				Destinations			
	Interior		Outside		Interior		Outside	
Proportions	63%		37%		18%		82%	
Education level	None	Primary	Secondary	University	None	Primary	Secondary	University
Proportions	37%	32%	27%	3%	43%	25%	31%	1%

Source: Results of field surveys, June 2026.

Analysis of Table 1 shows that immigrants are predominantly adults aged 40 to 60 (83%), reflecting migration motivated by the search for farmland. In contrast, emigrants are mainly young people aged 30 to 40 (55%), who head to other regions of Benin or neighboring countries, particularly Nigeria, in search of better economic opportunities. Educationally, immigrants have a low level of education, with 37% having no formal education and only 3% having attained higher education. Emigrants are relatively more educated, with 31% having a secondary education. This situation reflects a loss of relatively skilled young workers, while the municipality primarily receives a poorly educated agricultural workforce, which may influence the adoption of climate-smart agricultural practices. These migratory movements are explained by several factors, illustrated in Figure 4.

Analysis of Figure 4 shows that the low cost of land is the primary factor influencing migrants' settlement in the municipality of Ouèssè (score of 5 on the Likert scale). Soil fertility and proximity to Nigeria come in second (score of 4), high-

lighting the importance of agricultural potential and market opportunities. Financial stability (3) and agro-climatic conditions (score of 2) also influence settlement decisions, but to a lesser extent. In contrast, professional reasons (score of 1) are marginal. These results confirm that migration to Ouèssè is primarily driven by access to land resources and agricultural production opportunities, thus contributing to the reshaping of the municipality's agricultural landscape.

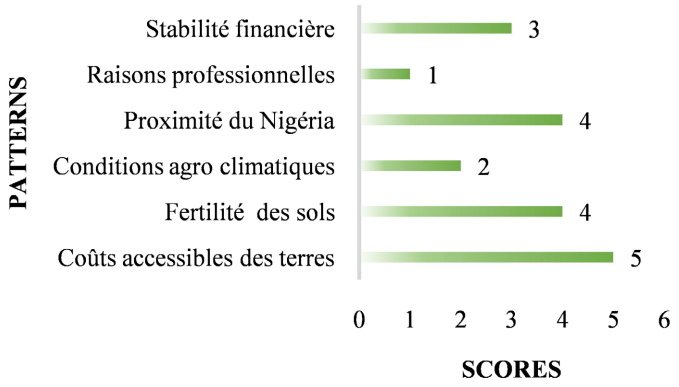


Figure 4. Reasons for migratory movements in the Municipality of Ouèssè. **Source:** Results of field surveys, June 2026.

4.4. Evolution of Land Cover Units between 2004 and 2024

Analyzing the evolution of land cover units between 2004 and 2024 highlights the spatial transformations that have occurred in the municipality of Ouèssè over the past two decades. It provides information on land-use changes driven by agricultural dynamics and migration patterns, and allows us to appreciate the reshaping of agricultural landscapes through the evolution of vegetation, cultivated areas, and human-modified zones. Figure 5 presents the characteristics of the land cover units in 2004.

A comparative analysis of land cover maps from 2004 and 2024 reveals a significant evolution in the agricultural landscapes of the Ouèssè municipality. In 2004, the landscape was largely dominated by wooded and shrubby savannas (55.85%), reflecting a clear predominance of natural formations, far ahead of crops and fallow land (26.42%), plantations (4.70%), and gallery forests (4.13%). By 2024, this hierarchy is partially reversed: wooded and shrubby savannas decline sharply (39.75%), giving way to a significant expansion of crops and fallow land, which increase to 40.13% of the municipal area and thus become the main spatial dynamic observed. Urban areas, although showing slight growth, remain marginal in terms of land use, representing only 0.69% of the total area in 2024. The maps also show a densification of agricultural areas, particularly around major roads and population centers. These transformations reflect a gradual reshaping of the landscape, driven by the combined effects of expanding agricultural activities, growing human settlements, and the migratory patterns that characterize the Ouèssè municipality. The transition matrix presents a synthesis of these units (Table 2).

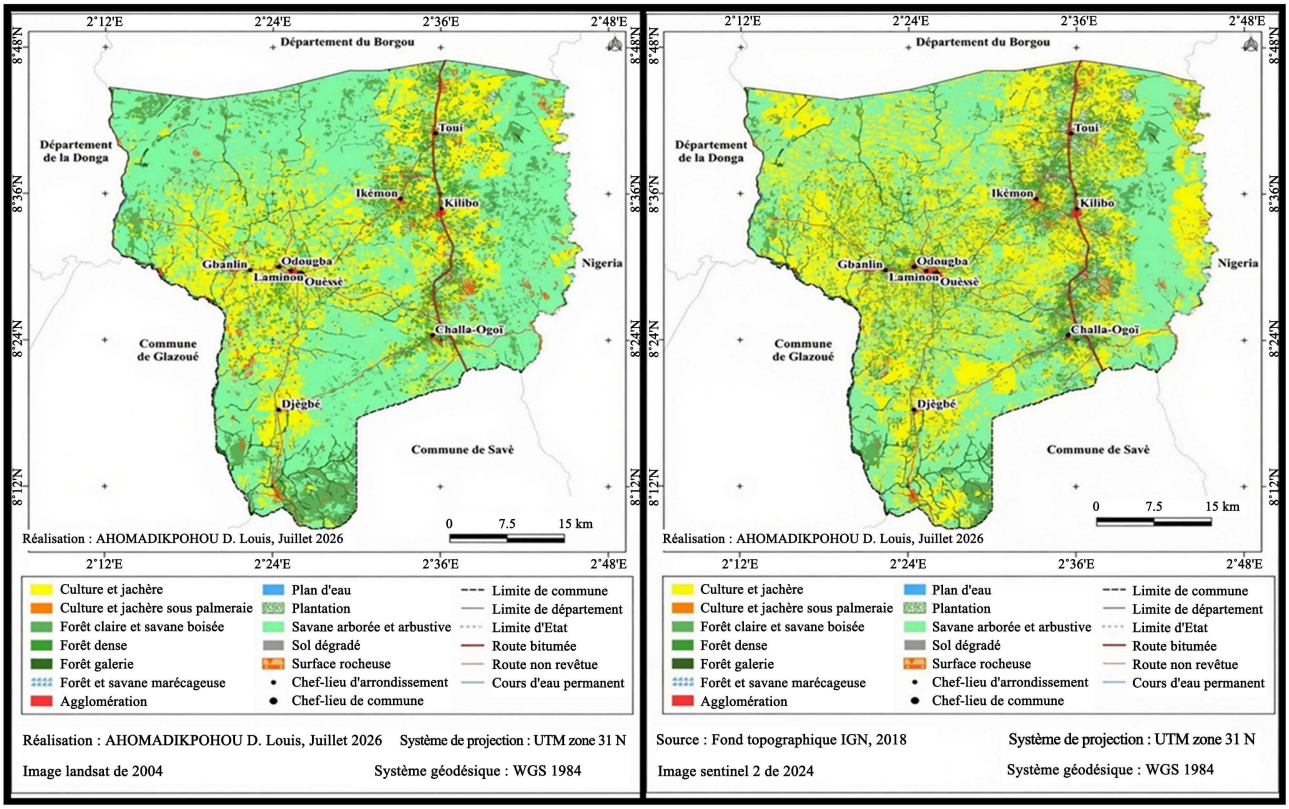


Figure 5. Land use in the Municipality of Ouèssè in 2004 and 2024.

Table 2. Land cover unit transition matrix from 2004 to 2024.

UOT	FG	FD	FCSB	SASa	FSM	PLAN	CJ	CJP	PE	SR	SED	HA	Sup_2004 (ha)
FG	11670.11	0	0	0	0	0	101.73	0	0	0	0	0	**11771.84**
FD	0	79.57	108.78	9.07	0	0	50.36	0	0	0	0	0	**247.79**
FCSB	0	2.01	8249.45	6220.83	0	56.41	6006.29	0	0		0	2.01	**20537.01**
SASa	0	1.01	819.91	104341.98	0	1409.16	50937.10	0	0	0	0	195.41	**157704.56**
FSM	0	0	0	0	49.36	0	0	0	0	0	0	0	**49.36**
PLAN	0	0	0	19.14	0	12983.57	246.78	0	0	0	0	26.19	**13275.68**
CJ	0	0	7.05	1652.91	0	16533.15	55964.33	7.05	0	0	0	427.08	**74591.57**
CJP	0	0	0	0	0	0	0	9.07	0	0	0	0	**9.07**
PE	0	0	0	0	0	0	0	0	418.01	0	0	0	**418.01**
SR	0	0	0	0	0	0	0	0	0	2475.84	0	1.01	**2476.85**
SED	0	0	0	0	0	0	0	0	0	0	1.01	0	**1.01**
HA	0	0	0	0	0	0	0	0	0	0	0	1297.35	**1297.35**
Sup_2024 (ha)	**11670.11**	**82.60**	**9185.20**	**112243.93**	**49.36**	**30982.29**	**113306.59**	**16.12**	**418.01**	**2475.84**	**1.01**	**1949.05**	**282380.08**

Legend: FG: gallery forest; FD: dense forest; FCSB: open woodland savanna; SASa: shrubby woodland savanna; CJ: cultivated land and fallow; CJP: cultivated land and fallow under palm grove; PLAN: plantation; PE: body of water; SR: rocky surface; SED: degraded bare soil; HA: agglomeration; UOT: land use unit; Sup: area in hectares.

A diachronic analysis of the transition matrix reveals a clear decline in savanna-type vegetation (SASa), which fell from 55.85% of the municipal land area in 2004 to 39.75% in 2024. This decline is primarily driven by the expansion of cropland and fallow land (CJ), which increased from 26.42% to 40.13% over the same period, while built-up areas (HA) remain marginal, accounting for only 6.05% of the municipal territory in 2024. Although these spatial dynamics suggest an intensification of the agricultural frontier at the expense of natural vegetation, the statistical link between the arrival of migrant households and the expansion of cultivated land requires further substantiation through spatial statistical models (such as spatial regression or autocorrelation tests). Furthermore, multivariate analysis reveals that when controlling for confounding factors (road accessibility, local population density, and distance to markets), the presence of migrant households is significantly associated with the conversion of savannas into cropland ($\beta = 0.32$; 95% CI: [0.16, 0.48]; $p < 0.001$). This finding confirms the strength of the statistical association observed at the municipal level, while also highlighting the limitations of a strictly causal interpretation.

4.5. Modes of Access to Land

In the Municipality of Ouèssè, the approaches to acquiring land titles vary according to social status (native or non-native farmers). Non-native farmers are all those who have immigrated to the Municipality. The identified methods of access for both groups are: inheritance, purchase, sharecropping, rental, and loans (Figure 6).

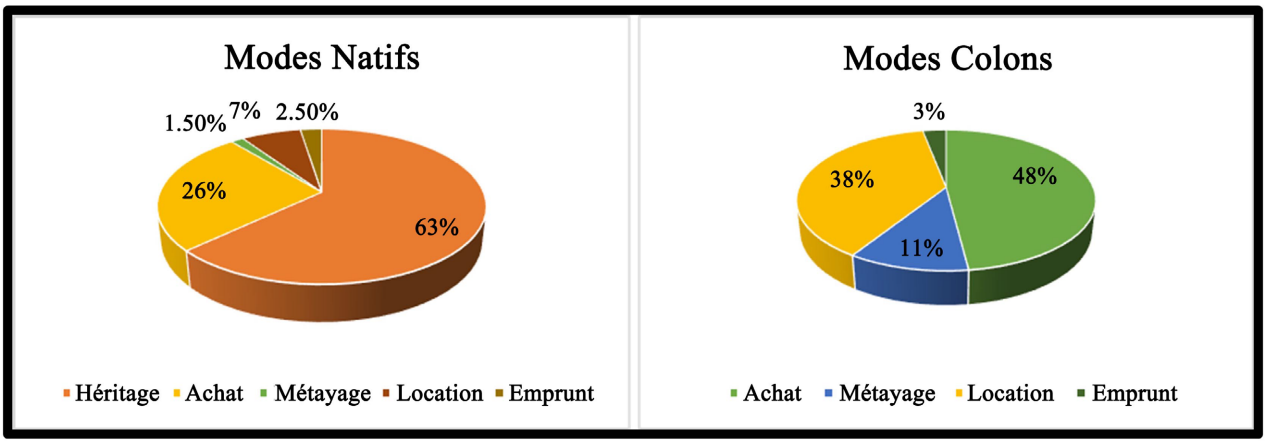


Figure 6. Comparison of land access methods between indigenous people and non-indigenous farmers.

The two pie charts illustrate a clear difference between the land access strategies of Indigenous and non-Indigenous farmers. Among Indigenous peoples, inheritance is the dominant method (63%), reflecting their strong historical and familial ties to the land. Purchase comes second (26%), indicating a desire to expand or secure landholdings through formal means. Other methods, such as sharecropping (1.5%), leasing (7%), and borrowing (2.5%), are rarely used, highlighting

land stability and less reliance on temporary contracts. In contrast, among non-Indigenous farmers, purchase is the primary method of access (48%), revealing a dynamic of land appropriation through monetary means, as they do not have inheritance rights. This is followed by leasing (38%) and sharecropping (11%), which reflect more precarious or temporary forms of access. Borrowing remains marginal (3%), highlighting the difficulty migrants face in accessing land free of charge. It is worth noting that these figures reveal a contrast between the land security of indigenous people, based on inheritance, and the dependence of non-indigenous farmers on transactions and contracts to access land. This reflects both a hierarchy of seniority and an imbalance in sustainable access to land resources. Land inheritance is a transfer of land and its resources from generation to generation [16]. In the Municipality of Ouèssè, inheritance is shared between children of both sexes. Women, once marginalized, have managed to carve out a place for themselves in the division of land inheritances. This system is currently under serious threat from the arrival of agricultural migrants whose interest in farmland is constantly growing. Only the indigenous population of the area benefits from this system. However, it remains the most widespread system in the Municipality. Land purchase is the method by which a beneficiary acquires ownership of a portion of land in exchange for payment, usually in cash or by check to the landowner. This method of access allows for the transfer of ownership [17]. It should be noted that both local farmers and non-native farmers adopt this method. It is much more common among non-native farmers. The cost of a kanti (400 m^2), the local unit of measurement, varies between 50,000 and 70,000 CFA francs. Also known as sharecropping, sharecropping is defined as a lease agreement for a farm where the financial compensation lies in the sharing of the harvest between the tenant and the landowner. This system is based on collaboration between the two parties: the landowner provides the land, while the sharecropper invests their labor. Although sharecropping allows landless farmers to access agricultural production, it can also create a certain economic dependence on the landowner. This method is adopted by both local farmers and non-native farmers, but much more so by the latter. Renting is a method of accessing land in which an individual, called a tenant, farms a plot belonging to a landowner in exchange for rent, generally fixed for a given annual or seasonal period [18]. This method of access offers some flexibility to farmers without land, but it limits their land security, as the contract can be terminated or not renewed at the landowner's discretion. In the Municipality of Ouèssè, renting is frequently used by non-native farmers to temporarily access arable land. Land borrowing is a method of accessing land based on a verbal or written agreement by which a landowner temporarily makes a plot available to a third party, without financial compensation. This method, often based on social, familial, or neighborhood ties, relies on trust between the parties. In the Ouèssè Municipality, lending is particularly common among local people or members of the same community, especially during periods of agricultural solidarity. However, this type of access remains precarious, as the lender can reclaim their land at

any time, thus limiting the beneficiary's long-term investments. In the Ouèssè Municipality, the predominance of customary arrangements and the gradual rise of market transactions are profoundly redefining the structure and appearance of agricultural lands. The influx of migrant farmers and the increasing number of land transfers are accelerating the fragmentation of vegetation cover, transforming fallow land and wooded areas into a patchwork of intensive crops, particularly maize and yams. This spatial restructuring under land constraints weakens local ecosystem balances and exacerbates competition for land use between agriculture and livestock farming. Land lending is a method of accessing land based on a verbal or written agreement whereby a landowner temporarily makes a plot available to a third party, without financial compensation. This method, often based on social, familial, or neighborhood ties, relies on trust between the parties. In the Ouèssè Municipality, lending is particularly common among local people or between members of the same community, especially during periods of agricultural solidarity. However, this type of access remains precarious, as the lender can reclaim their land at any time, thus limiting the beneficiary's long-term investments. In the Ouèssè Municipality, the predominance of customary arrangements and the gradual rise of market transactions are profoundly redefining the structure and appearance of agricultural land. The influx of migrant farmers and the increasing number of land transfers are accelerating the fragmentation of vegetation cover, transforming fallow land and wooded areas into a patchwork of intensive crops, particularly maize and yams. This spatial recomposition under land constraints weakens local ecosystem balances and exacerbates competition for land use between agriculture and livestock farming. Land lending is a method of accessing land based on a verbal or written agreement whereby a landowner temporarily makes a plot available to a third party, without financial compensation. This method, often based on social, familial, or neighborhood ties, relies on trust between the parties. In the Ouèssè Municipality, lending is particularly common among local people or between members of the same community, especially during periods of agricultural solidarity. However, this type of access remains precarious, as the lender can reclaim their land at any time, thus limiting the beneficiary's long-term investments. In the Ouèssè Municipality, the predominance of customary arrangements and the gradual rise of market transactions are profoundly redefining the structure and appearance of agricultural land. The influx of migrant farmers and the increasing number of land transfers are accelerating the fragmentation of vegetation cover, transforming fallow land and wooded areas into a patchwork of intensive crops, particularly maize and yams. This spatial recomposition under land constraints weakens local ecosystem balances and exacerbates competition for land use between agriculture and livestock farming.

4.6. Farm Size

The size of farms in the municipality of Ouèssè varies according to producer category, reflecting differences in land access between local farmers and migrant

farmers. Table 3 provides a summary of the farm sizes of the individuals surveyed in the municipality of Ouèssè.

Table 3. Farm size according to status.

Producer category	Farm size in hectares	Status	Percentage
Small farmers	]0.5; 2]	Non-native farmers	15%
		Indigenous peoples	3%
Medium-sized operators	[3; 5]	Indigenous peoples	37%
		Non-native farmers	13%
Large operators	[6; +∞[	Indigenous peoples	19%
		Non-native farmers	13%
Total			**100%**

Sources: field surveys, March 2026.

Analysis of Table 3 shows that medium-sized farms (3 to 5 ha) are the most represented, accounting for 50% of producers, the majority of whom are indigenous (37%). Large farms (>6 ha) account for 32% of producers and include both indigenous (19%) and non-indigenous farmers (13%), reflecting the capacity for land expansion of both groups. In contrast, small farms (0.5 to 2 ha) represent 18% of the sample and are mainly farmed by non-indigenous farmers (15%), reflecting their initially more limited access to land. These results highlight a profound land divide between indigenous farmers, the historical holders of customary rights, and migrant producers, forced to resort to precarious or costly arrangements. This unequal distribution of resources creates a marked agrarian dualism that directly influences households' crop choices and investment strategies. This dichotomy accelerates the fragmentation of land and profoundly reshapes the morphology and sustainability of the agricultural landscapes of the municipality of Ouèssè.

4.7. Access to the Workforce

Indigenous farmers traditionally rely on family labor and the mobilization of supportive community networks to carry out fieldwork. On the other hand, non-indigenous or migrant farmers, often driven by a desire to maximize cultivated land, structurally turn to agricultural wage labor and the recruitment of seasonal day laborers. This functional distinction highlights an operational dualism that directly influences productivity and the expansion of cultivated areas within the communal territory. However, this agricultural production system faces major structural constraints fueled by demographic shifts and the attractiveness of regional urban centers. Indeed, persistent rural exodus and the scale of seasonal migrations are gradually draining the able-bodied workforce, depriving farms of essential human capital during peak periods. This chronic labor shortage is particularly acute during critical periods of the agricultural calendar, notably during

plowing, sowing, and harvesting. This situation is confirmed by the Allan coefficient (L = 1.35 > 1), which reflects low labor availability in the municipality. This ratio unequivocally quantifies the understaffing and the pressure exerted on the available workforce in the municipality. Ultimately, this scarcity of able-bodied workers hinders agricultural intensification, limits the expansion of arable land, and jeopardizes the resilience of local agricultural systems in the face of food security requirements.

5. Discussion

The results of this study show that agricultural migration to the municipality of Ouèssè is primarily driven by the availability of arable land, soil fertility, and agricultural opportunities. This observation aligns with the work of [19], according to which areas with significant land resources attract rural populations seeking better production conditions. However, this attractiveness is accompanied by an intensification of land use and a gradual transformation of agricultural landscapes.

The expansion of cultivated areas observed in Ouèssè is also consistent with the findings of [20], which show that climate-related migrations increase pressure on natural resources in host areas. Furthermore, the results reveal a low frequency of land conflicts between migrants and local populations, which contrasts with the work of [21]. The main tensions are rather conflicts between farmers and transhumant herders, related to access to natural resources. The weak institutional framework for migrant settlement confirms the analyses of [22], which emphasize the need for more effective land governance to reconcile migratory attractiveness, land tenure security, and sustainable management of natural resources. These results show that migratory dynamics contribute to the reshaping of the agricultural landscapes of Ouèssè, while also posing challenges in terms of land management and adaptation to climate change.

6. Conclusion

This study highlights the crucial role of migration patterns in reshaping the agricultural landscapes of the Ouèssè municipality. The territory's attractiveness, linked to the availability of farmland, soil fertility, and its geographical location, fosters a continuous increase in agricultural migration flows. This dynamic translates into an expansion of cultivated areas, an evolution in land access patterns, and a gradual transformation of land use. The results also reveal disparities between local populations and migrants in terms of land access, farm size, and labor availability, which can influence production systems. Despite the low incidence of land conflicts between these groups, the weak institutional framework for migrant settlement poses a major challenge for the sustainable management of resources. It therefore appears necessary to strengthen land governance and promote sustainable agricultural practices in order to reconcile migratory attractiveness, land tenure security, and adaptation to climate change.

Declaration of Generative AI and AI-Assisted Technologies in Manuscript Preparation

During manuscript preparation, the authors used Claude (Anthropics) solely for limited language editing of selected sentences in order to revise in order to improve clarity. No AI tool was used to generate research content, analyze data, interpret results, or prepare references; the ideas, argument, and intellectual contribution of the paper are entirely original. All AI-assisted suggestions were reviewed, revised where necessary, and approved by the authors, who take full responsibility for the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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