

Case crops in the riverfront areas of the Pendjari biosphere reserve in northwestern Benin

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Abstract

Small-scale farming constitutes an important source of diverse food and employment in the Pendjari Biosphere Reserve. It also represents a source of monetary income for many producers in these specific areas. This research aims to study the production practices of these crops in village lands bordering the reserve.

The methodological approach is based on a literature review and field surveys conducted with 194 farmers, followed by data processing and analysis of the results. Data were collected using a questionnaire, an interview guide, and an observation grid. Data processing was carried out using Microsoft Word and Excel 2013 for descriptive statistics, and ArcGIS 10.7 for thematic mapping. A chi-square test was performed to analyze the results.

The results show that inheritance is the primary method of land acquisition, accounting for 92% of respondents, compared to 6% for gifts. Family labor is the most frequently used (100% of female and 97% of male producers). Conversely, hired labor (74% of men versus 58% of women) and mutual aid (67% of men versus 16% of women) are more commonly used by male farmers. Hoes, dabas, and machetes are used by almost all respondents (99%). Crop rotation is practiced by 84% of women and 66% of men. The most common cultivation technique is flat plowing (91%), followed by ridge plowing (73%) and hilling (34%). Finally, soil preparation is primarily carried out by slash-and-burn clearing (63%).

Keywords: Home Gardening; Agricultural Production; Farming Practices; Producers; Food; Pendjari Biosphere Reserve; Benin.

1. Introduction

Agriculture, initially designed to meet basic food needs, has undergone profound changes due to the combined effects of population growth and technological innovations (Ouattara, 2014). Globally, of the 1.4 billion people living in extreme poverty, nearly one billion reside in rural areas and depend primarily on agriculture for their livelihoods (IFAD, 2010). In sub-Saharan Africa, this sector employs a significant portion of the working population and is a key driver of Gross Domestic Product (Kadjègbè, 2014, p. 12; Topanou, 2015). However, the intensification of farming practices is often accompanied by the massive use of chemical inputs (fertilizers, pesticides, herbicides), which permanently alters ecosystems (Monde Fifatin, 2019).

In Benin, agriculture remains the cornerstone of the national economy. It employs approximately 70% of the active population and contributes nearly 33% to GDP (INStatD, 2015). This activity relies on various production systems with unequal environmental and socio-economic impacts (Fangnon, 2012). Dominant practices remain characterized by

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extensive, shifting cultivation and slash-and-burn agriculture, resulting in significant human pressure on natural resources.

In the Pendjari Biosphere Reserve (PBR), agriculture is the primary activity of local communities. However, it frequently relies on unsustainable techniques, heavily dependent on the continuous exploitation of local forest ecosystems. This study therefore aims to analyze the specific production practices of smallholder crops in these areas, in order to understand farmers' strategies and assess their sustainability.

2. Study environment

The Pendjari Biosphere Reserve is located in northwestern Benin, in the Atacora department, and extends across the territories of the municipalities of Matéri, Tanguiéta, and Kérou. The geographical location of the Pendjari Biosphere Reserve is shown in Figure 1.

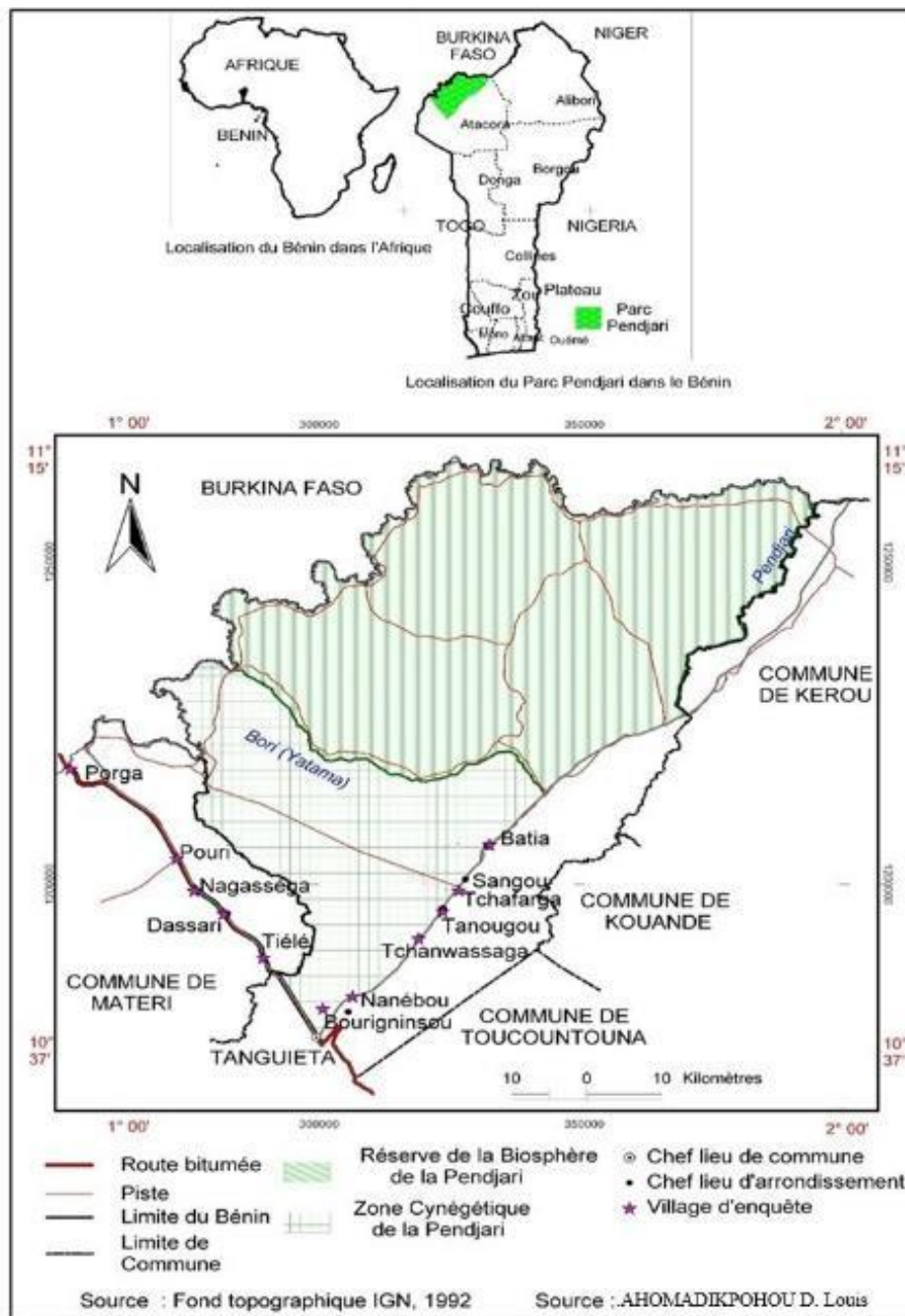


Figure 1 Geographical location of the research area

The figure shows that the Pendjari Biosphere Reserve is bordered to the north by the Republic of Burkina Faso, to the south by the town of Tanguiéta, to the east by the Atacora mountain range, and to the west by the Benin–Burkina Faso interstate highway. It covers a total area of approximately 4,661.4 km² and comprises the Pendjari National Park (PNP: 2,660.4 km²), the Pendjari Hunting Zone (ZCP: 1,750 km²), and the Konkombri Hunting Zone (ZCK: 1,750 km²) (Kiansi, 2012).

The study area extends between 10°37' and 11°15' north latitude and between 1°00' and 2°00' east longitude. It covers only the riverside villages, grouped into fourteen (14) villages which administratively belong to the municipalities of Matéri and Tanguiéta.

3. Material and methods

The methodological approach is based on participatory and empirical research. Direct observations were conducted in the fields, combined with questionnaires administered to producers and interviews with key informants. Participatory Research Methodology (PRM) was used to triangulate information. In addition, focus groups with approximately ten farmers helped refine the qualitative assessment of the data.

The study took place in the communes of Tanguiéta and Matéri (Atacora Department). The selection of the 11 villages surveyed was based on their proximity to the RBP (Rural Biosphere Reserve), their accessibility, and the predominance of agricultural activity. The sample was defined according to Schwartz's formula (1995), resulting in the selection of 194 producers and 2 agricultural extension agents.

Data processing was carried out using Microsoft Word and Excel 2013 software for descriptive statistics, and ArcGIS 10.7 for thematic mapping.

4. Results

4.1. Land Tenure Systems

In the village areas bordering the RBP, access to land is intrinsically linked to local customs. The results reveal that family inheritance is the primary method of acquisition (92% of respondents). Gifts, often formalized retroactively by local administrative authorities, account for 6%. Indirect methods of access, such as loans and leases, remain marginal (1% each) and are sometimes a source of conflict.

It is important to highlight the significant vulnerability of land tenure: almost all farmers lack any official title deeds. Furthermore, women experience significant land marginalization, with 73% of respondents confirming that they are frequently excluded from land control due to spatial saturation or their social status.

4.2. Work Organization and Agricultural Equipment

The size of farms depends heavily on the availability of labor, which is predominantly young. Family labor remains the foundation of production (100% for female producers, 97% for male producers). Male farmers supplement this workforce with wage labor (74%) and mutual aid (67%), options less accessible to women (58% and 16%, respectively).

Faced with the bottlenecks of the agricultural calendar (weeding, harvesting), producers compensate for the labor shortage through the extensive use of plant protection products: 91.2% use herbicides and 8.8% use pesticides. Tools, however, remain archaic. Hoes, dabas, and machetes are used by 99% of producers, while animal traction (carts) is adopted by only 31% of them.

4.3. Cropping Systems

To optimize limited land with declining fertility, farmers adopt two main strategies: crop rotation and intercropping.

Crop rotation is practiced by 84% of women and 66% of men. It generally begins with demanding crops such as maize, yam, or cotton. Intercropping, which allows for better soil cover and reduces risks associated with climate hazards, is favored by 34% of men and 16% of women. Table I summarizes the main intercropping systems observed.

Table 1 Typology of Intercropping Systems

Types of association	Agronomic benefits
Maize - Cowpea	The most common association ; cowpeas, harvested early, fix atmospheric nitrogen
Maize - Millet / Maize - Sorghum	Practices less frequent, limited by spatial and water competition.
Mil - Sorgho	Millet – Sorghum
Sorghum - Cowpea	Cowpea residue (harvested early) fertilizes the soil for sorghum growth
Yam - Rice	Specifically suited to lowland areas, meeting the high water requirements of both crops

Source : Field survey, February 2023

Analysis of Table I shows a diversity of intercropping practices employed by farmers in the study area to maximize the value of cultivated land. However, this practice also has limitations, particularly in terms of competition for water and nutrients between crops. Figure 1 shows the intercropping practices in the study area.

**Figure 1** Okra intercropped with chili peppers in Dassari (Matéri)

Photo taken by : Ahomadikpohou, October 2023

Photo 1 shows okra sown among chili peppers in Porga, where both crops are exhibiting normal growth.

Farmers also practice crop rotation, which helps maintain soil fertility. Different crops are grown successively on the plots to prevent nutrient depletion in the soil. For example, legumes can be used to enrich the soil with nitrogen, while cereals are grown for their grains. The rotation order aims to maintain soil fertility, take advantage of the residual effects of mineral fertilizers or crop residues, and control certain weeds. In the rotation process, respondents favored maize (55%), cotton (18%), yam (16%), and other crops (11%).

It is important to note that the different rotations are not mutually exclusive, and many farmers combine several crops depending on their needs and resources.

4.4. Soil Preparation and Fertilization Techniques

Cultivation practices are highly land-intensive. Slash-and-burn clearing remains the norm (63%), although it contributes to biomass degradation. The dominant cultivation technique is flat plowing (91%), followed by ridging (73%) and hilling (34%), the latter being reserved for tubers.

Land pressure has led to the near disappearance of fallow land (practiced by only 7% of farmers). To compensate for the loss of fertility, farmers are turning massively to mineral fertilizers (NPK and urea), used by 89% of men and 84% of women, mainly for cotton, maize, and rice. Organic fertilization remains marginal (14% of men, 5% of women) and is limited to market gardening.

4.5. Factors Determining Cultivated Areas

To identify the variables influencing farm size, a chi-square test was performed (Table II).

Table 2 Results of the Chi-square test on factors influencing cultivated areas

Variables	χ^2	Degree of freedom	P-Value
Type of crop (cash, subsistence)	10.33	2	0.006
Workforce (employees, family members, mutual aid)	25.33	2	0.000
Type of equipment (traditional, modern)	5.83	1	0.016

The analysis reveals that all these variables significantly influence the cultivated areas. Indeed, all p-values are below the 5% significance threshold (0.05). Thus, the cultivated areas are logically larger when cash crops are involved, when external labor (paid or in-kind) is used, and when the farmer has access to modern equipment.

4.6. Seeds, Harvesting, and Storage

While 98% of producers use seeds from previous harvests, 63% supplement this with improved seeds, primarily for maize, soybeans, and rice, acquired from regional agricultural development agencies (ATDA).

Harvesting is done entirely by hand. To mitigate post-harvest losses, various storage methods are employed: packaging in plastic bags or drums (by over 50% of farmers), use of plant protection products for preservation (17%), or traditional storage in granaries and clay pots with the addition of ash (24%).

Figure 1 shows some images of these storage methods.

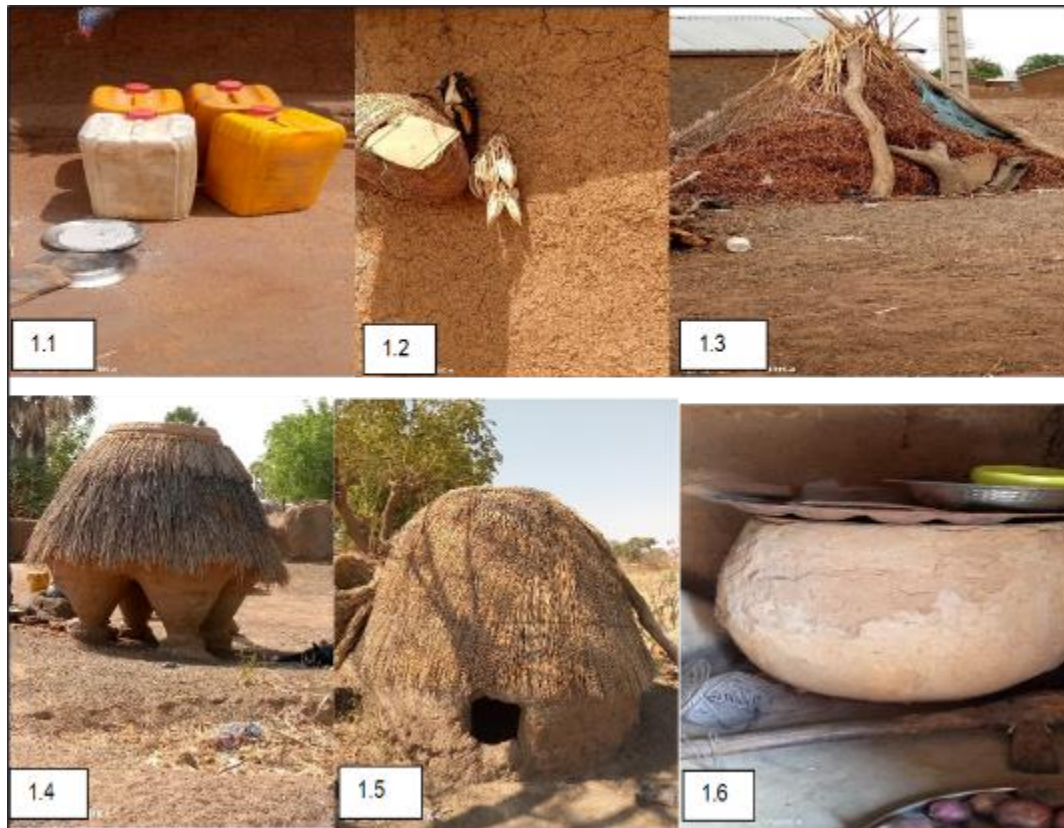


Figure 1 Methods of preserving reserves after harvest

Photographs taken by : Ahomadikpohou, March 2023

Plate 1 presents some seed preservation methods adopted by farmers in the villages bordering the Penjari Biosphere Reserve to preserve their agricultural products.

Photo (1.1) shows jerrycans used for storing beans and bambara groundnuts. Photo (1.2) illustrates yams stored in a shed built from wood and straw, and surrounded by yam ropes to prevent animals from accessing it.

Photos (1.4) and (1.5) show storage granaries. It should be noted that these granaries sometimes serve multiple purposes : they are used not only for storing agricultural products, but also as chicken coops, depending on their shape, as illustrated in photo (1.5).

Photo (1.6) shows a clay pot used for preserving agricultural products. This container holds bambara groundnuts, beans, and sorrel seeds, preserved in layers and mixed with ash.

5. Discussion

Agriculture in the peripheral areas of the Penjari Biosphere Reserve illustrates a complex phase of agrarian transition. It remains rooted in an extensive model using archaic tools, but is accompanied by increasing chemical intensification (mineral fertilizers, herbicides) to compensate for labor shortages and the scarcity of fertile land. These dynamics inevitably lead to the degradation of vegetation cover and soil depletion, confirming Tondro's findings (2019).

Despite these environmental constraints, the production of household crops plays a fundamental role in ensuring the food and financial security of local households. The diversity of cropping systems (rotation and association), observed at high rates, demonstrates a farmers' rationality aimed at minimizing climatic and economic risks. These observations align with the analyses of Ahomadikpohou (2015) in the Atlantic region and Fangnon (2012) in the Couffo region, who documented similar adaptation strategies through diversification.

Nevertheless, the near disappearance of fallow land and inequalities in access to land and infrastructure, particularly affecting women producers, highlight the limitations of this transition model, as defined by Kadjebin (2014). A shift towards ecological intensification appears essential to reconcile the imperatives of agricultural production with the conservation requirements of the Biosphere Reserve.

6. Conclusion

This research highlights the complexity of home crop production practices in village lands bordering the Pendjari Biosphere Reserve. Although essential to the survival of communities, local agriculture remains trapped in an extensive system with practices often ill-suited to current population pressures. The hegemony of customary law and inheritance weakens land tenure security, particularly for women.

To circumvent land saturation and the decline in fertility resulting from the abandonment of fallow periods, producers combine local knowledge (crop rotation, intercropping) with modern inputs (mineral fertilizers, herbicides). However, the widespread use of slash-and-burn clearing and chemical products directly threatens the integrity of the ecosystem bordering the reserve. This situation calls for the promotion of agroecological innovations capable of ensuring food security for local residents while guaranteeing the environmental sustainability of the territory.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

References

- [1] AHOMADIKPOHOU Dèdègbê Louis, 2015, Agricultural Production and Food Security in the Atlantique Department of Southern Benin : Diagnosis and Perspectives, Doctoral Thesis, EDP-FLASH-UAC, 225 p.
- [2] FANGNON Bernard, 2012, Soil Quality, Agricultural Production Systems, and Environmental and Socio-economic Impacts in the Couffo Department of Southwestern Benin. Doctoral Thesis in Geography. Abomey-Calavi, EDP/FLASH/UAC, 308 p.

- [3] INSAE, 2015, National Accounts in 2014, Presentation Note on 2014 GDP according to the 1993 SNA, 23 p.
- [4] IFAD (2010): We Make a Difference. Rome : International Fund for Agricultural Development (IFAD), 32 p.
- [5] KADJEGBIN Tundé Roméo Ghislain, 2014, Agricultural Production and Food Security in the Communes of Dassa-Zoumè and Glazoué in Benin, Doctoral Thesis in Environmental Geoscience and Spatial Planning, UAC Abomey-Calavi, 329 p.
- [6] Monde Fifatin Médard Arnaud, Ahouangninou Christian, Ayena Arnaud Aristide, Massèdé Stéphane, and Tente Bienvenu, 2020, Analysis of Chemical Input Management in Market Gardening in the Commune of Tori-Bossito in Benin. International Journal of Progressive Sciences and Technologies, Volume 22, Number 2, 2108 p.
- [7] OUATTARA Sidiki, 2014, Impact of Chemical and Organic Inputs on Soil Macrofauna and Maize Yield. Master's Thesis in Rural Development Engineering, 59 p.
- [8] TONDRO MAMAN Abdou-Madjidou, 2019, Dynamics of agricultural spaces in the commune of Bassila in northern Benin : actors, exploitation strategies, and manifestations. Doctoral thesis, EDP/FASHS/UAC, 274 p.
- [9] TOPONOU LIGAN Francine Olivia Dona, 2015, An attempt to assess the sustainability of agriculture: application to farms using agricultural mechanization in the commune of Gogounou in northern Benin. Doctoral thesis, University of Abomey-Calavi, 282 p.