

Exploitation of palms wine in the municipality of Ze (Benin): socio-economic and physical impacts

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Abstract: The exploitation of palm wine is one of activities which many people from southern Benin particularly the municipality of Ze have engaged. This study aims to analyze the socio-economic and environmental impacts of the exploitation of palm wine in the municipality. The methodology consisted of collecting demographic, agricultural, socio economic data, processing and analysis of data collected in real area based on components of the Leopold matrix. The exploitation of palm wine has changed the agricultural landscape of the municipality of Ze. The soil is becoming unproductive for food crops after a long fallow palm wine causing impoverished land due to overuse. The vegetation is endangered because of the rarity of certain plant species like *Acacia* sp (acacia), *Antiaris africana*, *sapadi Blighia* (bligia tasty), *Chloroophora excelsa*, *Cola nitida*, etc. But, in other aspect this activity is contributing to improve the living conditions of farmers and reduce the production of oil palm in this area. The production of alcohol provides employment to about 42% of the active population in the municipality of Ze, (municipality of Ze, 2007). At various levels of production that is from felling to alcohol distillation there are large numbers of people being employed. [Journal of American Science. 2010;6(11):95-102]. (ISSN: 1545-1003).

Key words: palm wine; sodabi; socio- economic and physical impact; municipality of Ze.

1- Introduction

Benin is one of the developing countries in Western Africa. Its size is just over 110.000 km² with a population of almost 8.500.000. Agriculture is a backbone of Benin in which about 70% of the active population is involved. It represents 90% of exports and contributes more than 40% to Gross Domestic Product (INSAE, 2008). Exploitation of Palm wine for local alcohol production is an activity in which farmers of southern Benin especially the people from the municipality of Ze have been involved. There are different types of palm trees which are palm wine, palm date and palm toddy (Brand and Durosset, 1995). However, this study was focused only on palm oil which has been grown in the municipality.

Previous studies on palm oil have not identified the impacts of exploitation of palm wine on the economic environment of Ze. Most of studies carried out in Benin focused on the palms of the plateau of Adja and Oueme without providing both the main socio-economic and environmental impacts of palm wine exploitation. The goal of this study is to identify and analyze the socio-economical and physical impacts of palm wine exploitation. This analysis is important to the authorities to have a view for mitigation of impacts through: the reduction strategy for felling of palm wine for alcohol production, improved processing techniques,

improved living conditions of farmers and their role. The production of alcohol is specific and important to local inhabitants of southern Benin. Historically, The "sodabi", drinking palm wine and homemade, was prepared for the first time by the brothers Gbèhalaton Bonou and Sodabi Kiti in the village Sèdjè Houègoudo Allada in the municipality of Ze in Benin. However, constantly growing of the population and the number of agricultural active has promoted the increment production of alcohol. After one decade, production of palm schemes is constantly decreasing in the locality due to periodic and selective felling of palms for the production of alcohol added to climate change.

2-Methodology

2-1 Area of study

The municipality of Ze is one of the 77 municipalities of Benin located between 6 ° 34 ' and 6 ° 37 ' North latitude and 2 ° 10 ' and 2 ° 13 ' longitude in the southern Benin. It covers an area of 543 km². The municipality of Ze housed a population of 58185 inhabitants in 1992. In 2002, the population rose to 68315 inhabitants, an increase of 10130 people in ten years (INSAE). This evolution reduces the arable land. Also, People attach themselves most importantly to the transformation of derivatives of palm oil especially palm wine. Land is moderately favorable

for the cultivation of perennial plants. The choice of this area is also justified by the fact that forest resources are threatened (OVIGEPAF, 2005) and

there are poorer soils as a result of the abuse of palm wine.

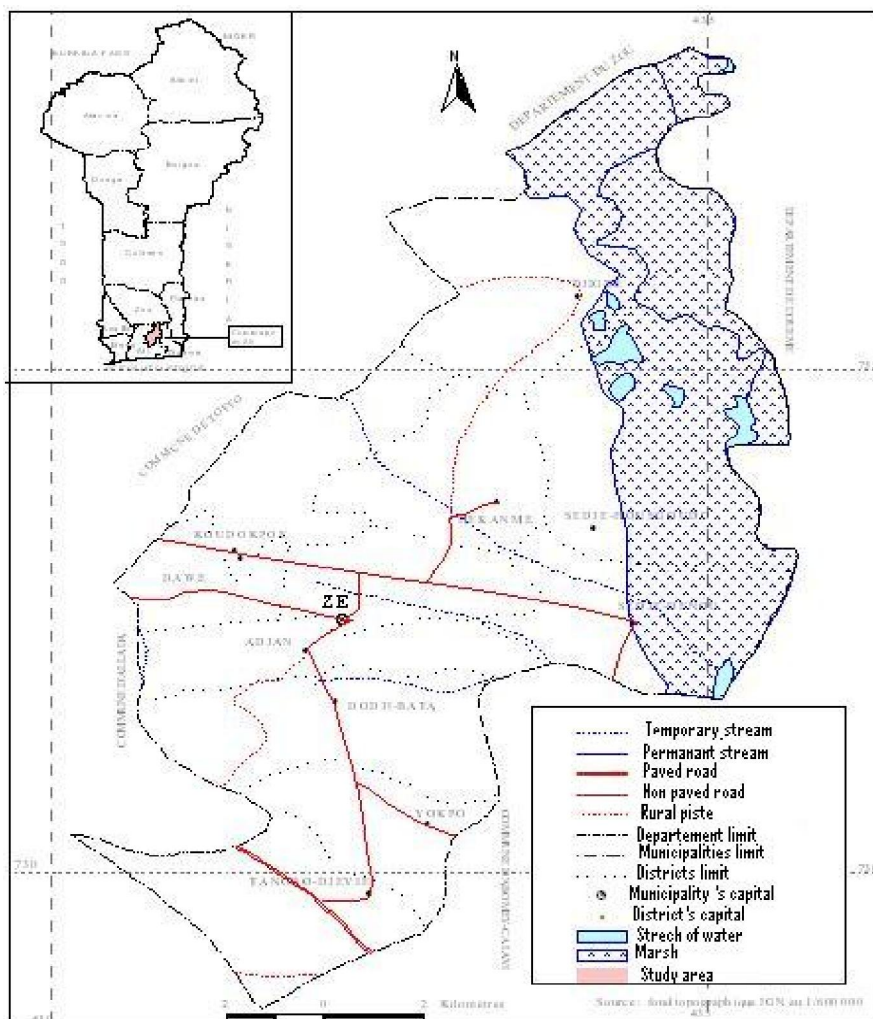


Figure 1: Geographic localization of area of study (Ze)

2-1-1 Climate

As we know, wine palm is a perennial plant that needs a minimum of 1800 mm of rain per year to grown up. A high and constant temperature with maximum average of about 29 ° and 33 ° and the mean minimum of about 22° to 24° is necessary for the palm wine. Also, they need constant sunshine of at least five to seven hours per day. However, the

municipality is under influence of climate subequatorial whose features are moderately favorable to the exploitation of the palm wine.

2-1-2 Precipitation

The average annual rainfall is around 1365.91 mm in this municipality. Figure 2 reflects the rainfall in the municipality of Ze from 1976 to 2005.

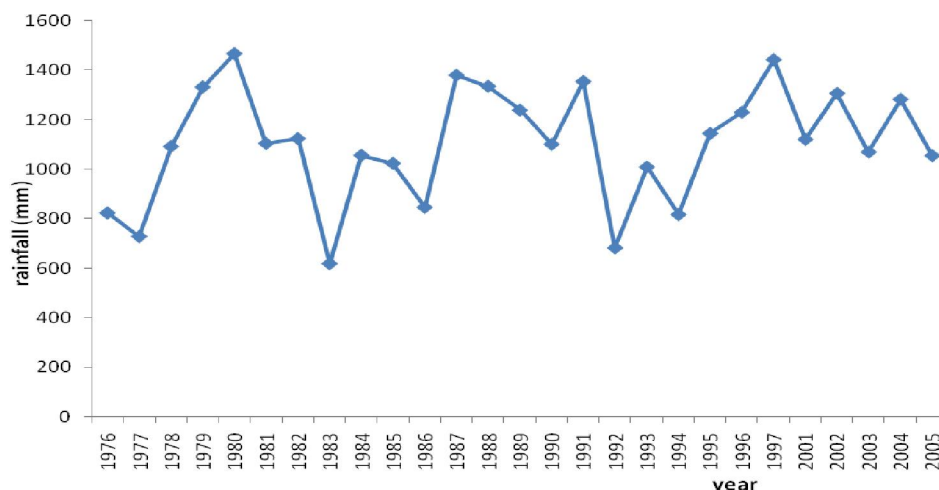


Figure 2: evolution of precipitation in Niaouilli (1976-2005)

Source: ASECNA, 2005.

The rainfall is generally unimodal, one year in five. The observation of Figure 2 identifies three levels. Of the 30 years the maximum rainfall 1478 mm was in 1987, 1310.7 mm in 1998 and 1395.2 mm in 2001. This situation has not been very favorable for the cultivation of palm trees, since the minimum required for its Growth is 1800 mm / year. This regime has encouraged the development of natural plant species which are threatened daily by the strong human influence.

2-1-3 Vegetation and soil

It is an area mostly covered with a large industrial plantation of palm trees organized into five cooperatives with an average of 600 hectares each, and private plantations of natural selected palm trees. The municipality of Ze is characterized by a sedimentary cover moderately favorable for the cultivation of palm trees. There are three types of soil, illustrated in Figure 3 (CeCPA, Ze).

- Ü The land bar or Continental Terminal, which covers more than half of the locality. It is favorable for growing food and palm wine;
- Ü Hydro-morphic soils in the valley of Oxeye at Djigbé, Sèdjè-Denou and Houégoudo. They are not favorable for the cultivation of palm wine;
- Ü Lateritic soils which are also favorable to palm wine.

Overall, the Continental Terminal is mostly favorable to the cultivation of palm wine than other types of soil.

2-2 Data analysis

The methodological approach used here was the collection, processing and analysis of data, and interpretation of results. The data collected here was both qualitative (access to land, access to credit, farming techniques, labor, etc.) and quantitative (the profitability of farming, the agricultural workforce, etc.) which allows the determination of parameters to identify the impacts associated with the exploitation of palm wine. There was much focus on those relating to socio-economic, agronomic and biophysical indicators and in addition, the collection of these data required an appropriate method in collecting literature.

2-2-1 Data collection

Firstly, a literature review was conducted which provided guidance in collecting information that was relevant and gave orientation on the choice of the title to this paper. Information related to statistical data on palm wine, the evolution of vegetation cover and the felling of palms, the agricultural economy and living conditions of farmers were collected from different institutions namely: INSAE, INRAB, MAEP, OVIGEPAF, CeRPA and MEPN in Benin.

The second phase was for the field survey. It took place in villages of six districts of the municipality where the wine activity is very intense (Ze centre, Koundokpoe, Djigbé, Adjan, Sèdjè Houégoudo, and Hekanmè). Research units selected were the operators of palm wine or liquor producers as well as the various technical institutions responsible and Elders of the locality.

The choice of sampling was based on three basic criterions:

- Ø Farmer or producer of palm wine in the resort;

- Ø Processor of palm wine from the resort;
- Ø Occupation of the land under palm trees.

These investigations were made on the basis of self-administered questionnaires sent to farmers and processors derivatives of palm wine. The semi-direct have been made for the simple reason that over 50% of people surveyed were illiterate and were unable to complete questionnaires. The interviews were conducted, which helped to confront and complement the information gathered for using questionnaires and focus groups. This technique enhanced community participation at each level of the research.

Finally, observations were made on field to understand types of plantations, the palm operating systems, the state of vegetation cover, the chain of production of alcohol, systems of land tenure, etc.

2-2-2 Analytical method

Identification of potential impacts of the exploitation of palm wine on each element of the environment and the socio-economic framework was made by using Leopold Matrix method. It is a two dimensional array used to identify interactions between activities, appearing in rows, and environmental components which appears in the columns. It allowed us to establish the link between wine activity and its impacts on the natural environment. Impacts of the exploitation of palm wine identified were characterized by their nature (direct or indirect), their importance and scope. The overall impact was evaluated according to the magnitude of the impact and value of the element affected.

<i>legend</i>		susceptible activities and actions cause impacts								
		wine-palm cultivation	felling of palm wine	pruning	extraction of wine	distillation of alcohol	Sales and marketing channel	investment related to the preparation of alcohol	trunks of palm trees abandoned in fields	Remove of waste water
1. Minor negative impact										
2. Minor positive impact										
3. Major negative impact										
4. Major positive impact										
0. impact not significant										
Or Impact not determined										
Environmental component										
biophysical area	Soil and geology	1	3	0	0	1	0	0	3	3
	Vegetation	2	3	0	0	0	0	1	0	1
	Wildlife	1	1	0	0	0	0	0	0	0
	Air quality	0	0	0	1	1	0	0	0	3
Socio-economic area	Population	4	4	4	4	4	2	4	0	1
	Health risks	0	0	0	0	1	0	0	0	1
	Profitability	4	2	0	0	4	4	4	0	0

Table: Leopold matrix method adapted to the exploitation of palm wine in the municipality of ZE.

In order to understand the magnitude of impacts in the municipality using the Leopold matrix method, two indicators were used which were, the degree of impact on the environment element (dI) and the frequency of impact fI which could allow to establish the nature of the impact. Two formulae have been used:

$$dI = \sum_{i=1}^n \frac{x_{ij}}{n}$$

with

- x_{ij} is the positive or negative matrix of the environment component which appear frequently
- n= 9

Analysis of degree of impact is based on following criteria: when $dI < 0.5$ is considered that the element is partially affected, $0.5 < dI < 1.5$, the element is said affected and $dI > 1.5$, the element is said severely affected.

$$fI = \frac{e}{n} * 100 \text{ with}$$

- e is number of positive impact (minor and major) or negative impact(minor and major) on the element
- n=9

3-Results and discussion

Two types of exploitation were observed in the municipality of Ze; the first one is traditional exploitation which is an artisanal process of local alcohol which needs to meet certain conditions and processing techniques before the actual production. This kind of exploitation occurs to both natural and private palm grove users. Second one is selective exploitation which relates to the palm industry and is organized by the authorities of the CAR and UR-CAR in the municipality. Palms which are felled are sold to local alcohol producers. For these two types of exploitation, they both have an implication on socio-economic and environmental impacts.

3-1 Socio-economic impact of exploitation of Palm wine

Local alcohol production is providing employment to population of the municipality of Ze. These jobs are at different levels in the chain production. The degree of impact $dI = 3 > 1.5$ with $nI = 88.88\%$ for the population and $dI = 2.11 > 1.5$ with $nI = 46.6\%$ for the profitability. Analysis shows that more than 33.33% of palm wine producers surveyed employ between 3-12 workers per hectare against 71.41% of wine processors that employ between 5-20 workers per day and per hectare for work on the felling, pruning, and the extraction of wine; in other way how the transformation of derivatives of palm wine is labor-intensive. The manpower recruited running a seasonal periods due to unfavorable wine activities that occur during the year. Also, according to surveys, 80% of producers of palm wine put their legacy parcels in palm grove planting. Thus, the retail foot palm allowed them to meet food needs and fulfill the obligations of customary order. In fact, from 300 feet of natural palm wine felled per hectare, on average 4800 liters of alcohol were produced locally by the processor in the interval of three months. After sales, the gross income per season from the operator was approximately \$969 per month an estimated profit of more than \$80 if the activity covered all year. It means that their income can contribute up to 50% for the family. Furthermore, in

the case of processors who sorely depend on this business, the production exceeds 4800 liters per farmer.

In the districts where investigations were conducted, the production of alcohol occurs only in dry season which is the peak period; the rainy season was often reserved for fieldwork. Figure 2 shows information on the proportion of each activity by peasant farmers from the total income.

The production of alcohol remains the main financial source. The income from this production is used for household, health care, etc. The evolution of alcohol production, reduced production of palm oil in the municipality of Ze has led to the scarcity of palm schemes which are also linked to climatic conditions, the pruning of young seedlings, especially the felling of palms. The low productivity of palm oil is also due to high costs and number of cheap laborers employed throughout the transformation process scale. According to the surveys, 80% of palm oil producers used an average 15 workers per day against an average of 8 workers in the alcohol producers. Figure 3 shows the frequency of each product from the processing of derivatives in the municipality of Ze.

3-2 Environmental impact

The exploitation of palm wine affects two major components of the environment. From the analysis, it has been shown that dI of soil was inferior to 1.5 and $nI = 33.33\%$. That mean the soil is the most negatively affected. Impoverished land due to overuse (cropping systems consist of a virtually continuous food crop palm wines plantations) has completely changed the agricultural landscape in the district of Adjan, Koundokpoé, Djigbé, Ze -center and Hêkanmè (CeCPA-Ze, 2007). The soils become unproductive for food crops after a long fallow palm wine. Nutrients in vegetation and soils were slow to be recovered, therefore, causing a decrease in soil fertility (INRAB). This work gives an understanding as to why the municipality of Ze still imports food despite its climate favorable conditions to agriculture. However, palm improves soil fertility which enhances growth for certain food crops such as maize and cassava. It is also advantageous since people are compelled not to make fires. Ultimately, the vegetation that grows eventually decomposes thus increasing the organic matter in the soil there by returning the biological life.

In the district of koundokpoe, the field observation and analysis of data collected shows that after a fallow, there arises a problem of overuse of land, which does not favor good growth of some crops such as beans and peanut. Figure 4 illustrates the evolution of the felling of palms for the production of alcohol from 1997 to 2007 in the municipality of Ze. From 1997 to 2000, felling private Palms as well as industrial plantations had increased. This is due to the

increment of demand for alcohol and increased number of the alcohol producers. From 2000 to 2005, that amount had fallen due to the scarcity of natural palm trees and also the culling campaign co-organized by Rural Development of the municipality. In 2006, this amount had increased due to the regeneration of palms and also the lack of culling campaign by cooperatives.

On the other hand, the felling Palms' site has significantly better physical and chemical fertility characteristics within the radius of one meter and increases even more above 2m. All this is explained as the radius of one meter is rich and mostly because of inflorescences, fruits and almonds which fall on the ground and eventually decompose. Within the radius of 2 meters that is enriched by palm, there are about 100 plants per hectare. The fertilizing effect begins in the 2nd year. During the first year after the felling of palms, there is decomposition of roots and plant debris in soil, immobilizing some of the nutrients such as nitrate (N), phosphate (P), potassium (K), calcium (Ca), magnesium (Mg) and nitrogen (Na). After plant decomposition, soils become richer and nutrients are available for crops.

In regards to the vegetation, the degree of impact dI was equal to $0.77 > 0.5$ and nI equal to 55.55%. That means the vegetation was also mostly negatively affected. The cultivation of the palm wine and its exploitation for the production of alcohol requires destruction of natural vegetation formations. The use of plant species for the production of alcohol and the felling of regular palm is an alarming call to reduce deterioration of the physical environment of Ze. This was confirmed by comparative analysis of land use maps of 1994 and 2006 which show the evolution of vegetation cover. Figure 4 shows the decline of plant species, which is linked to human activities including palms exploitation for the production of alcohol.

Figure 6 shows the rate of decline and increasing environmental components in the municipality of Ze. Training swamps, savannas and shrub lands as the relict forests have declined significantly between 1994 and 2006. The cultivation of over 40,000 of palm trees had led to the destruction of vegetation cover in about 50 hectares in the northwestern part of the town. (CeCPA, Ze). The vegetation such as savannas, patches of dense forests (forest of worship "OR0"), swamp forests and forest reserves on Djigbé were threatened. The energy source used in the preparation of alcohol is the wood energy provided by different forest types of riverside villages. The lack of arable land due to the increment of population numbers is leading to pressure on forest products despite the prohibition laws. This has led to the loss of over a tenth of the total forest area of

3647ha per year. Plant species such as *Acacia sp* (acacia), *Antiaris Africana*, *Blighia sapadi*, *Chloroophora excelsa*, *Cola nitida* etc are gradually disappearing at an expense of agricultural crops in the municipality.

4-Conclusion

The palm wine, particular oil palm is a multidimensional plant due to its multifaceted and varied character. The exploitation is one of the main activities of people in the municipality of Ze. From the production, processing and marketing of raw materials high numbers of labor are mobilized. It is emerging as a real source of income for the population and has been contributing for the improvement of living standards of farmers. In environmental terms, the exploitation of palm wine contributes to the degradation of the environment, including soil and vegetation. It is therefore necessary to have mitigation measures related to reduction strategies and improvement of impacts associated with the exploitation of palm wine.

Amongst these measures, some of them are; the strategy of reducing felling of palm wine for the production of alcohol; adoption of the technique known as "tapping", which can improve processing techniques, soil fertility and living conditions of farmers by diversifying to other agriculture activities such as food crops and livestock farming. Diversification has a positive effect on the well-being of farmers in the sense that total revenue is high and the quality of the alcohol from palms is also improved since the volume of the alcohol produced is not much which brings in much focus during the production. In the long run, the beverage can also be enjoyed in all corners of Benin.

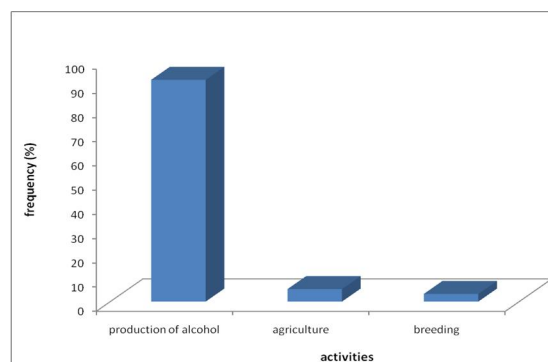


Figure 3: Comparison of annual activities for alcohol producers, farmers and ranchers. **Source:** Survey Results, January 2009

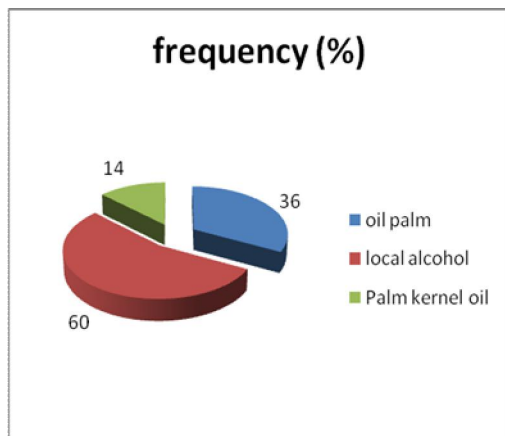


Figure 4: Frequency of production of palm wine processing. **Source:** Survey Results, January 2007

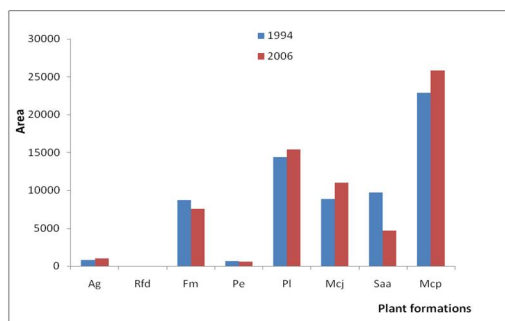


Figure 5: Evolution of the felling of palm wine in the municipality of ZE. **Source:** OVIGEPAF, January 2007

Legend (Figure 5 and 6)

- Ag= built-up area;
- Rfd= Relics of dense forest;
- Fm= Swamp training;
- Pe= Water;
- PI=Plantations;
- Mjc= Mosaic of cultures and fallow land;
- Saa= Tree and shrub savanna;
- Mcp= Mosaic of cultures palm

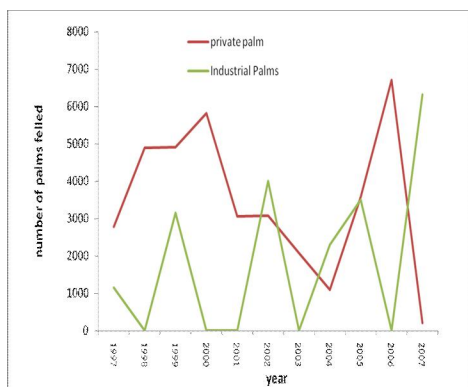


Figure 6: areas of environmental components. **Source:** CENATEL, May 2008

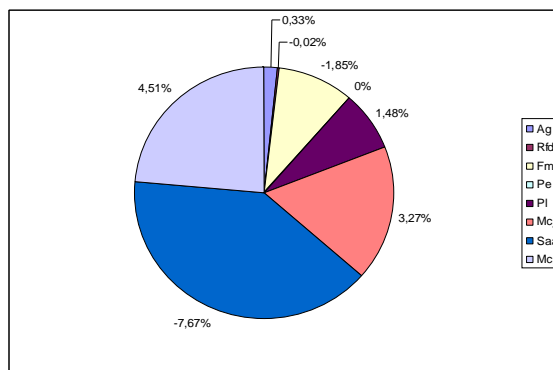


Figure 7: Evolution of environmental components. **Source:** CENATEL, May 2008

List of Abbreviations

- ASECNA- Agence pour la Sécurité de la Navigation Aérienne en Afrique et à Madagascar
- CAR- Coopérative d'Aménagement Rural
- CeCPA - Centre Communal de la Production Agricole
- CeRPA - Centre Régional de la Production Agricole
- INRAB - Institut National des Recherches Agricoles du Bénin
- INSAE - Institut National de la Statistique et de l'Analyse Economique
- MAEP - Ministère de l'Agriculture, de l'Elevage et de la Pêche
- MEPN - Ministère de l'Environnement et de la Protection de la Nature
- OVIGEPAF - Organisation Villageoise de la Gestion Participative de la Forêt.
- UR-CAR - Union Régionale des Coopératives d'Aménagement Rural

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