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"SOCIO-ANTHROPOLOGICAL ANALYSIS OF ENVIRONMENTAL INDICATORS OF CLIMATE DYNAMICS EXPERIENCED BY THE RIVERSIDE POPULATION AT THE YANGAMBI BIOSPHERE RESERVE: EXPERIENCE OF YASELIA VILLAGE IN ISANGI TERRITORY" (R.D.C.)

Madeleine LIKAKA ANGOWAKOLOLO
Head of Works and Researcher at Kisangani University

ABSTRACT

Socio-anthropological analysis of the environmental indicators of climate dynamics experienced by the population living along the Yangtze Biosphere Reserve in general, and that of Yaselia in particular, was the objective of this research.

To achieve this, an investigation was organized in Yaselia, a village located in PK 91 of Kisangani City on the Kisangani-Yangambi highway in the transition zone of the Yangambi Biosphere Reserve. 105 men and women were surveyed on the basis of a pre-developed questionnaire.

After analyzing the data, the results revealed that:

- ✓ At Yaselia, people perceive climate change through indicators such as early rains, early droughts and seasonal disturbances;
- ✓ The majority of the population attributes these climate changes to divine disapproval, saying that God is not happy with them. To this explanation is added others such as the environment is no longer favorable or the ancestors are angry;
- ✓ The most significant impact of these climate changes is seen at the agricultural level, where farmers report on the wilting of crops due to lack of water, the difficulty of burning for early rainfall and the proliferation of insect pests that result in a decline in agricultural production. But other sectors such as hunting, gathering and fishing are not spared;
- ✓ More than half of the population surveyed indicated that climate disturbances observed in the environment have negative impacts on the resources of the Yangambi Biosphere Reserve, such as the decrease in forest products other than wood (gibiers, caterpillars, snails, etc.).

This information is of paramount importance for the development of climate change adaptation strategies in the Democratic Republic of Congo.

KEYWORDS: Climate Change, Climate Dynamics Indicators, Yangambi Biosphere Reserve, Socio-Anthropological Perception.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

List of paintings

List of figures

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

1. INTRODUCTION

1.1. Background of the study

In recent years, climate change has become a major issue both locally and internationally. Its place at the centre of the concerns of scientific actors and policy makers at the global level is becoming increasingly important as it is one of the many obstacles to development (Brown and Crawford, 2008; Niang, 2009; Bambara ,2013). This is one of the biggest long-term challenges for global development (Yegbemey et al., 2014). Globally, as direct effects, climate change is leading to an increase in temperature and a new distribution of precipitation (Bergonzini, 2004).

Africa is projected to be the most affected region in terms of natural disasters (Kurukulasuriya et al., 2006; World Bank, 2013). The continent's high vulnerability to the negative impact of climate change is the result of Africa's heavy dependence on natural resources, poor infrastructure, widespread poverty and weak institutional capacity to respond effectively to environmental disasters (Daouda Hamani, 2007; Mohamoud. In addition, the continent's adaptive capacity is limited, exacerbated by widespread poverty and low levels of development (IPCC, 2007).

Gradually, several climatic disturbances are being felt across the African continent, although overall the situation is still good. Over the past few decades, Africa has experienced unprecedented reductions in annual rainfall in many regions (Mohamoud andal., 2014). In Benin, for example, Aho et al. (2006) show that climate change is already causing changes in the characteristics of rainy seasons. At the rural level, these climatic scourges result in disruptions in crop cycles, changes in traditional agricultural calendars, and changes in empirical cultural norms among farmers (Vissin and al., 2015).

There is therefore a risk and a sense of uncertainty, which arises at the producer level in terms of meeting crop schedules whose impact on crop yields is high. Supporting local populations in adapting to climate change requires a good understanding of perceptions, adaptation strategies and their consideration in the proposal of more effective strategies (Dossou-Yovo et al., 2017).

The Democratic Republic of Congo, one of the countries in Central Africa, is no exception to these climate changes and their socio-environmental effects. This negative change in climate appears to be much more detrimental to the well-being of rural populations, who rely heavily on agriculture. It is in this context that this study is carried out. It proposes to make a socio-anthropological analysis of environmental indicators

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

of climate dynamics as experienced by the populations bordering the Yangambi Biosphere Reserve, especially the village Yaselia.

1.2. State of the question

As climate change is a new issue, every day there are more and more scientific publications in this direction. However, with regard to socio-anthropological analyses of the impacts of climate change in rural areas, there is very little work available.

In Africa, most studies have focused on West Africa and Sahelian countries. These include:
The work of Bambara and his collaborators on thebenefits of climate change and their socio-environmental consequences in Tougou and Donsin, Sahelian and Sahelian climates in Burkina Faso in 2013. In this study, the authors linked climate change to socioeconomic population development.

For her part, Josephine Khaoma, in her study on the impact of climate change on agriculture in Africa in 2007, showed that current climate change can have a negative impact on agriculture by reducing the availability of arable land, particularly as a result of coastal flooding and drought that will affect the soil of potential agricultural highs.

In his thesis entitled: "Adaptation to Climate Change: Perceptions, local knowledge and adaptation strategies developed by producers in kandi and Banikoara municipalities in northern Benin," Rodrigue DIMON (2008) reported delays in the start of the rainy season, shortened rainy season, concentration of rains on short weather, decrease in the number of rainy days and excessive heat as indicators of climate change in the villages of Alfakoara and Kandèrou.

As far as the Democratic Republic of Congo is concerned, the few studies carried out have been in line with the REDD process. This is the case of Maurice Mukoie Dikaya who, in his study on the dual use of the REDD mechanism: Combating climate change and rural poverty in 2015, says that by tackling rural poverty, REDD is tackling one of the indirect causes of deforestation and the degradation of rural forests. In the Kisangani region of Tshopo Province, there are reportedly very few published studies on the socio-anthropological aspects of climate change. This includes Kimoni Kicha Alulea's (2014) study on climate change and its effects on humans, health and activities. Ethnoecological survey conducted in the Kumu and Turumbu of Kisangani Hinterland. In his study, the author emphasizes that climate change does not spare any sector of life, albeit to a different degree. However, the author continues, its impacts have a more negative impact on humans (through their health) as well as their activities (especially agriculture). As can be seen, the above study has similarities to ours in that it deals with the same purpose as climate change, but also and above all, the same target that represents the Turumbu people here. The only

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

difference is that this study is being conducted in Yaselia (a riverside village at the Yangambi Biosphere Reserve) in the Territoire of Isangi,whilethe previous study is conducted in Kisangani, the capital and/or capital of Tshopo province. Clearly, the two studies differ in their investigative areas, one in rural areas and the other in urban areas.

It was this lack of information on an area as important as this one that motivated the conduct of this study on the socio-anthropological analysis of environmental indicators of climate dynamics around the Yangambi Biosphere Reserve.

1.3. Problem

In the Democratic Republic of Congo, as in all of Africa, agriculture is still very much dependent on the annual distribution of rainfall. Since the effects of climate change can also be felt on the timing of precipitation that may no longer serve as seasonal benchmarks for seedlings and crops (UNDP, 2010); agriculture will then be greatly affected by temperature changes and the increase in CO2 (Bals et al., 2009) as well as the large intra-annual variability in rainfall distribution (Janin, 2010).

According to some forecasts, by 2020, crops from rain-fed crops may decrease by 50% in some countries (Lung'ahi etal., 2009). Others predictdeclining yields in the second half of the 21st century due to high temperatures (Janin, 2010; UNDP, 2010).

These forecasts highlight the need to develop adaptation strategies to address climate change. For example, today's needs to adapt people to climate change and their socio-environmental impacts are essential because people's survival depends on them (OECD, 2009).

But as Clark (2006) shows, the most effective and sustainable adaptation measures are often those taken at the local level directly involving the people involved. The adaptation practices developed by producers in response to the negative consequences of climate change depend on their perception and endogenous knowledge of these changes (Dimon, 2008).

People's adherence to local actions to adapt to climate change is effective if these actions incorporate their endogenous knowledge related to it (Kanté, 2011). Taking this knowledge into account, albeit empirical, in development policies helps to win the trust of farmers (Roncoli etal., 2001). But to date, the perception of peasant communities of the various environmental indicators of climate dynamics is not clearly defined. Views differ on perceptions of climate change indicators and their socio-environmental consequences in African peasant communities (ICSU, 2002; Lo and Kaeré, 2009; Mapfumo etal. Gnanglé et al. 2011).

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

Faced with this situation, it is very important to understand, in the Congolese context, what environmental indicators of climate dynamics are experienced by the population living along the Yangsil Biosphere Reserve. Based on the size of YaseliaVillage, the study answers the main question: "What are the environmental indicators of climate dynamics experienced by the population living along the Yangsil Biosphere Reserve in general, and that of Yaselia in particular? From this main question, the following specific questions emerge:

- ✓ What cultural significance does the population of Yaselia attach to ongoing climate change?
- ✓ How do these different changes affect food security in this village?
- ✓ Do these climate changes have a negative impact on the resources of the Yangambi Biosphere Reserve?

1.4. Assumptions

At the Yangambi Biosphere Reserve in general, and in Yaselia in particular, climate change is perceived through irregularities in the annual distribution of precipitation, including: early rains, droughts in rainy seasons and seasonal disturbances. Thus, in a specific way we start from the following hypotheses:

- ✓ For the people of Yaselia, the ongoing climate change is due to the divine will or disapproval of the ancestors;
- ✓ These different climate changes would lead to a decline in agricultural, fish and cynegetic production in the village, leading to famine and poverty at the population level;
- ✓ The resources of the Yangambi Biosphere Reserve would be negatively affected by ongoing climate change.

1.5. Goals

1.5.1. General objective

The overall objective of this study is to identify environmental indicators of climate dynamics as experienced by the population living near the Yangambi Biosphere Reserve and their impacts on food security in the village and on reserve resources.

1.5.2. Specific goals

Specifically, this study pursues the following objectives:

- ✓ To capture and analyze the cultural (socio-anthropological) meanings granted by the population of Yaselia to the current climate problem;
- ✓ Determine the impact of these changes on food security in the village;
- ✓ To determine the negative impacts of climate change on the resources of the Yangambi Biosphere Reserve.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

1.6. Interest in work

Today, there is a growing recognition that strategies for adapting to climate change cannot be considered without taking into account endogenous knowledge. Thus, a good socio-anthropological analysis of environmental indicators of climate dynamics as experienced by the population of Yaselia is very important. This is for two reasons: first, it will inform opinions on the issue of climate change in rural areas, and then it will propose adaptation strategies that take into account farmers' knowledge. This will help to gain the confidence of rural people in the implementation of adaptation mechanisms.

Chapter II: Medium, Materials and Method

2.1. Study medium

The village of Yaselia on which this study is based is located in the territory of Isangi, secteur Turumbu, Yelongo grouping in Tshopo Province (DRC). It is located at Pk 91 on the Kisangani-Yangambi highway, in the transition zone of the Yangambi Biosphere Reserve. Figure 1 gives its location in the vicinity of the Yangambi Biosphere Reserve.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

Figure 1. Location of the study medium (Adapted from WWF, 2011).

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

2.1.1. Climate

Because of its proximity to the city of Yangambi, Yaselia enjoys the same climatic conditions as those described for the Yangtze Biosphere Reserve by Kombozi (2009), a climate of type of the Koppen classification.

a. Temperature

The temperature is clearly high in February-March, considered a dry season, with relatively low temperatures in July-August. Temperatures vary very little during the year with an annual average of between 24.4 and 26.3 degrees Celsius (Kombozi, 2009; Kearsley et al.

b. Precipitation

The average rainfall pattern reproduces the double periodicity characteristic of equatorial regions. This regime is characterized here by a clear dissymmetric between each of two minimums or two maxima (Kombozi, 2009). The highest is reached in October with an average of 210 mm and the small maximum with an annual average of 184.6 mm in April. The January-February period is distinctly dry of the year (93 mm), the small rainy season takes place in the April-May period, while the great rainy season occurs from October to November. Annual rainfall easily reaches 1835 mm according to this regime, the rains seem to have recovered well during the year (Kombele, 2004).

2.1.2. Natural Resources and Socioeconomic Activities

The village benefits from the proximity with on one side the Congo River, and on the other, the Yangambi Biosphere Reserve. This offers several possibilities, in terms of fishing, hunting, agriculture, gathering and collection of NLFPs. As a result, the population engages in several activities, with agriculture being the main one. There are also fishermen, hunters and herders. Crafts, including the manufacture of mortars, drumsticks and chairs, are part of the subsistence activities of the people of Yaselia. Occasionally the collection of NFPs in the Yangambi Biosphere Reserve provides a financial supplement to household savings, but also contributes to the self-consumption of families.

2.2. Materials

As this work is socio-anthropological in nature, survey questionnaires have been of great use to us in collecting data. This questionnaire consisted of questions oriented to allow an understanding of the perception of environmental indicators of climate dynamics by the Yaselia population and the various impacts that result from it.

In addition, we were equipped with a questionnaire, a notebook, a pen and a pencil to carry out interviews with the local population. The notebook was used to take additional notes on other details raised by the

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

public.

The mobile phone (smart phone) was also useful for us to take pictures during interviews. It should be noted that these images were taken after prior authorization from the respondent was received.

2.3. Method

2.3.1. Data collection

We used the inductive method as described by Omar Aktouf in 1987 in his book Methods of Social Sciences. This method is more common in the social sciences, it consists of attempting generalizations from particular cases. This is done in practice by observing specific characteristics on one or more individuals (objects) in a class and in order to demonstrate the possibility of generalizing these characteristics to the whole class. This is the succession observation - analysis - interpretation - generalization. This is the same approach we took in our research.

Apart from the inductive method, two techniques helped us to carry out this work, namely: documentation and investigative technique.

2.3.1.1. Survey techniques

Our survey was conducted in the form of an interview with a previously designed questionnaire. There are two types of questionnaire: the written questionnaire and the interview questionnaire. However, the exact meaning of a questionnaire, whether written or by interview, is limited to the list of questions.

Since we conducted our study in an area where the majority have a low level of education, our survey was conducted in the form of an interview (interview) with the population of Yaselia. The questions in French have been carefully translated into Lingala or Turumbu to allow the population to express themselves well during the various interviews. Their answers were faithfully transcribed into the questionnaires for later analysts.

Thus, the sample size was 105 individuals, due to one male or female representative per household. Figure 2 presents the investigation in Yaselia.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

Figure 1. Socio-anthropological survey in Yaselia

2.3.1.2. Documentation

To refine knowledge on environmental indicators of climate dynamics, a review of the scientific literature was conducted. This allowed us to report on the issue but also to compare Yaselia's information with that of other parts of the country, even Africa.

2.3.2. Data processing

After encoding the collected data, we used the 2013 Microsoft Excel software and the R statistics software under its R Studio interface version 1.1.453 for processing and statistical operations.

2.4. Difficulties encountered

Like any human work, the realization of this work has encountered a number of difficulties. But the biggest thing was the fact that the people living along the Yangtze Biosphere Reserve are very used to receiving investigators. As a result, they tend to charge investigators tips before agreeing to the discussion.

On the other hand, language was a great difficulty because the majority of respondentsdo not master the

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

lingala well, whichseems to be wellco-equipped by us means investigator.

Chapter III: Results

In this chapter are presented the different results obtained in terms of the profile of the respondents (3.1), climatic disturbances experienced by the population (3.2) and impacts of these disturbances in the socio-economic life of the population under study and on the resources of the Yanglambi Biosphere Reserve (3.3).

3.1. Profile of respondents

3.1.1. Breakdown of respondents by gender

The following figure gives the distribution of the individuals making up the study sample by gender.

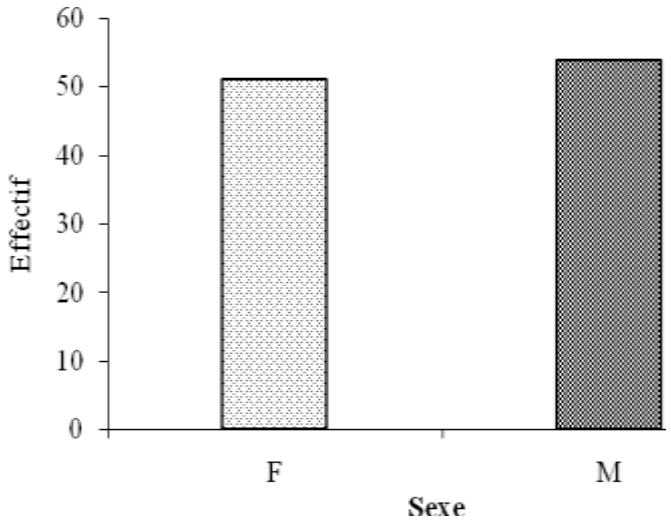

Figure 3. Breakdown of respondents by gender

After analyzing Figure 3, we note that the sample of this study is composed of men and women of varying proportions. 54 men and 51 women, 51.43% and 48.57%, respectively.

3.1.2. Breakdown of respondents by seniority in the study environment

Figure 4 shows the distribution of respondents based on their seniority in the locality of Yaselia.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

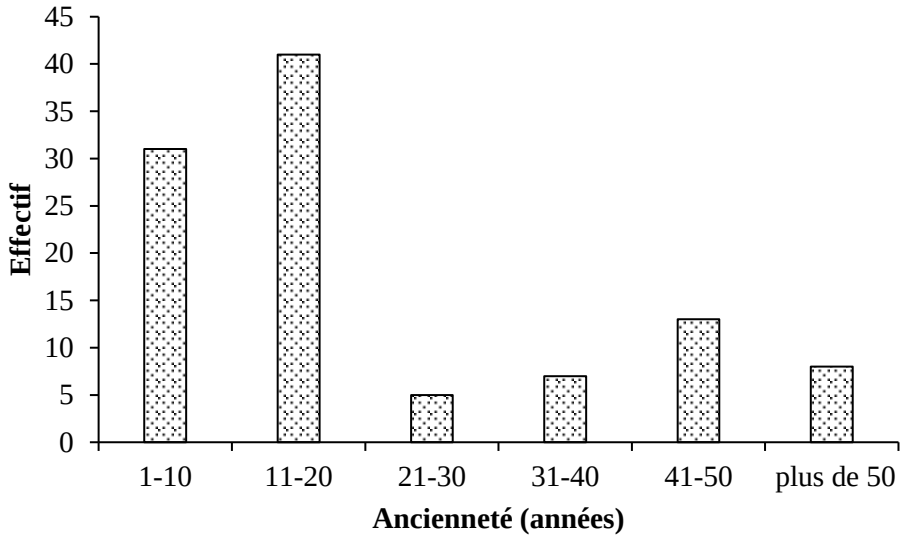

Figure 4. Breakdown of respondents based on their seniority in the study environment

In Figure 4, we note for this sample that people who have spent 11 to 20 years (class 11-20) in the village are the majority, followed by those who spent between 1 to 10 years in Yaselia (class of 1-10). The least represented class is 21-30 for those who lived in the study environment between the 21 and 30 years of age. In all, more than half of this sample is made up of people who lived in this village between the 1 and 30 years. Only 28 respondents spent more than 30 years in the village under study.

The result in terms of sex, however, indicates that the time lived in the village varies according to gender. This variation is evidenced by the Student test which shows a significant difference (t-3.8009; df 102.92; p-value - 0.0002445) between the period of residence in men and women. The average time for men is 29.2 years and 17.6 years for women. Classes 1-10 and 11-20 alone are full of 82% of the women surveyed.

3.1.3. Size of households surveyed

Figure 5 shows the distribution of the number of people per household that makes up our study sample.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

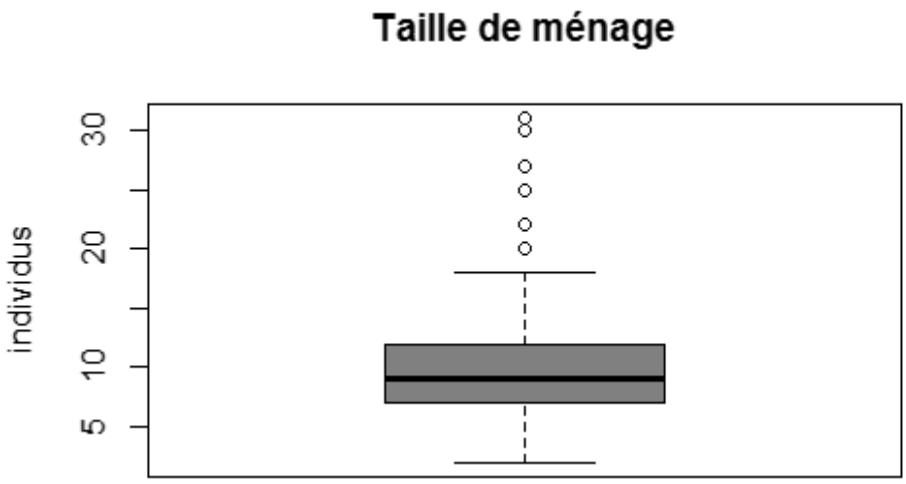

Figure 5. Distribution of the sizes of the households surveyed

Figure 5 indicates that household size is highly variable in the study environment. The number of individuals varies from 2 to 31 people per household. The average household size is 10 people, with more than half (50%) households made up of 7 to 12 individuals. Only 25% of the households surveyed have fewer than 7 members.

3.1.4. Household economic activities

Figure 6 presents the various revenue-generating activities carried out by the heads of households surveyed to provide for their families.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

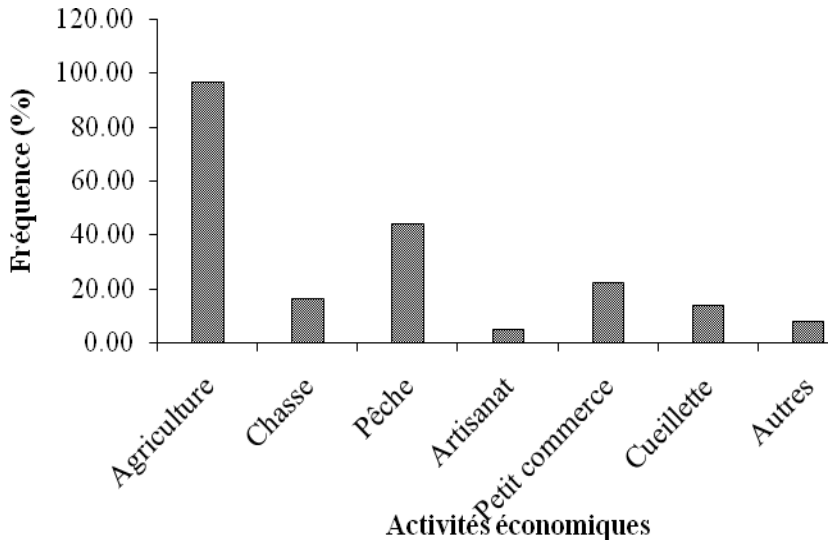

Figure 6. Yaselia's main economic activities

In this village, the majority of respondents practice agriculture. According to the opinions expressed, this activity constitutes the livelihood of 96.19% (101 out of 105 individuals) of respondents. In second place, 43.81 per cent of the population fished. Small-trade is also increasingly practiced, as reported by 21.9% of respondents, or 23 out of 105 individuals in our study sample.

Apart from these three activities, there is also hunting among the activities of this population, practiced by 16.19% of respondents, gathering (13.33%) (4.76%).

But it is also interesting to note that these respondents generally engage in two or more activities at a time in order to support their families because, the main one (agriculture), is currently threatened by the negative impact of climate change. As a result, productivity declines. Figure 5 illustrates this situation. Figure 7 shows the numbers of economic acts provided by respondents to support their families.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

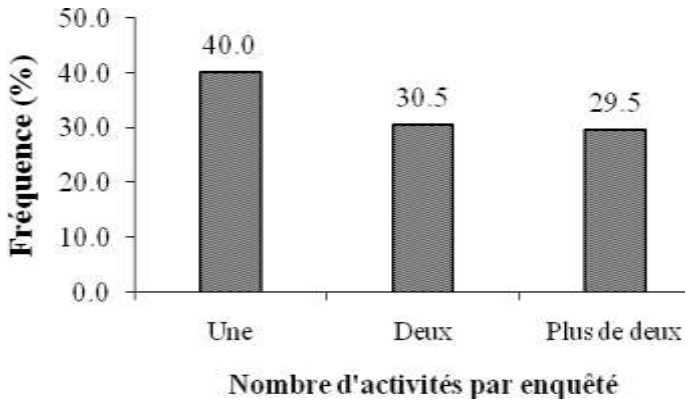

Figure 7. Number of economic activities carried out by respondents.

In view of the figure above, it appears that in this village only 40% of respondents, or 42 out of 105, practice a single activity. Of the 42 surveyed, 41 are in agriculture. For the 30.5% who combine two activities, 30 out of 32 practice agriculture in association with another activity. Finally, 29.5% do more than two activities, or 31 out of 105 surveyed. Of these 31, 30 combine agriculture with other activities. In general, the two figures (Figures 4 and 5 above) show that agriculture is the main activity of the Turumbu population of Yaselia.

3.2. Climate disturbances

3.2.1. Climate Disturbance Indicators in Yaselia

Figure 8 presents the indicators of climatic disturbances experienced by the population along the Yangsil Biosphere Reserve in general, and that of Yaselia in particular.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

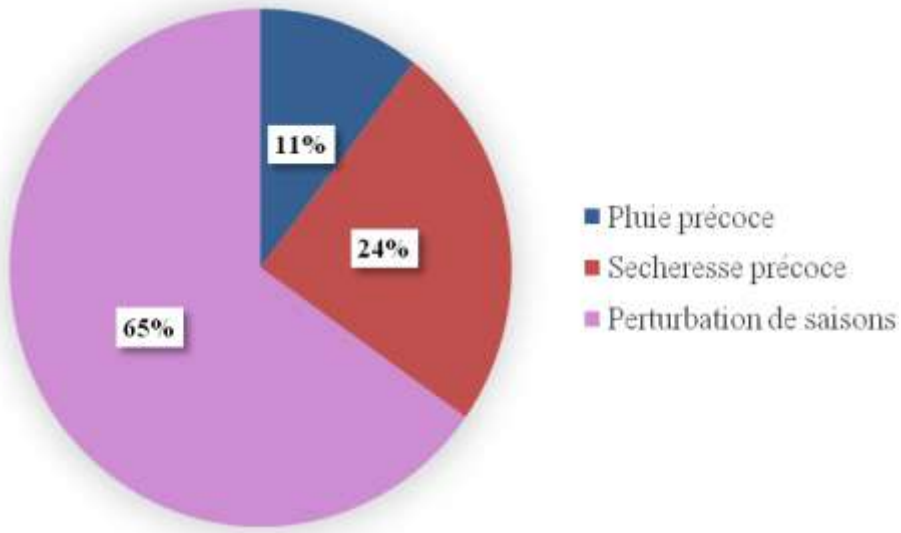

Figure 8. Indicators of climatic disturbances observed by the Yaselia population.

According to this study, three main indicators of climate disturbance are raised by the Yaselia population. First, the majority of respondents cite seasonal disturbance as an indicator of climatic disturbance. In second place, 24% of respondents report early droughts in the region. According to the latter, the once rainy months are becoming more and more dry. The last group (11% of respondents) talk about early rains. For them, the rains begin to occur even during the months deemed dry. In short, it is clear from all these statements that there is a disturbance of seasons around the Yangambi Biosphere Reserve. The so-called dry season begins to become rainy and the rainy season begins to become dry. The distribution of rains during the year no longer follows the seasons as it once did.

3.2.2. Cultural significance of observed climate disturbances

Figure 9 presents the views of the Yaselia population on the cultural significance of the climatic disturbances observed around the Yangambi Biosphere Reserve.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

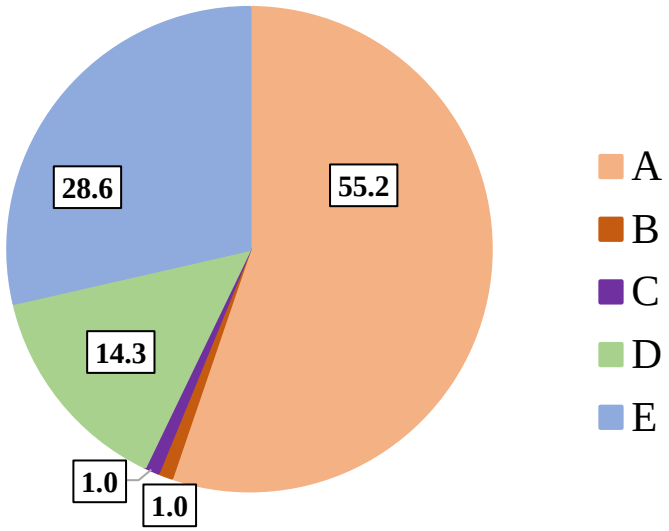

Figure 9. Respondents' views on the cultural significance of observed changes

(A: God is not happy with us; B: Our ancestors are angry; C: we have sinned against our forefathers; D: the environment is no longer favourable to us; E: Others).

In Yaselia, 55% of the individuals surveyed explain the climatic disturbances observed by divine disapproval. For the latter, all these evils happen to them because God is not happy with them. 14% say the environment is no longer favourable for them. However, only 2% associate these disturbances with the anger of their ancestors. But 29% still have no explanation for these different climate disturbances. The khi-two test indicates that the opinion of the respondents is not conditioned by their gender (x-squared - 3.5907, df - 4, p-value - 0.4642). Similarly, seniority in the environment does not influence the opinion of respondents as to the cultural significance of the observed climatic disturbances (X-squared - 26.853, df - 24, p-value - 0.3113).

3.3. Impacts of climate disturbances in Yaselia

3.3.1. Impacts on the day-to-day activities of households

Figure 10 shows the perception of the impacts of climate disturbances on the daily activities of the population under study.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

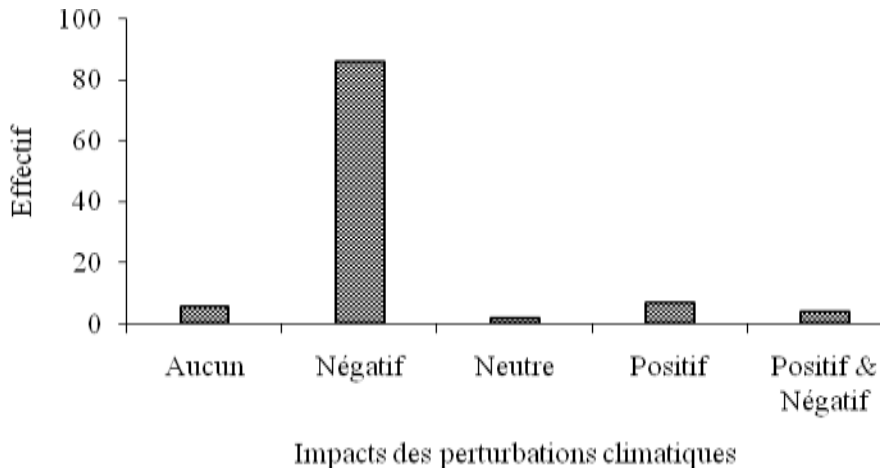

Figure 10. Perception of the impacts of climate disturbances by respondents

Figure8 shows that 86 of 105 respondents report negative impacts of climate disturbances on their socio-economic activities of populations. But some (7 respondents) say that these climate disturbances have a positive impact on their activities. Others report both positive and negative impacts, as is the case of 4 respondents. There are, however, those who argue that these various disturbances do not influence their activities in any way. The positive and negative impacts of these disturbances per activité are included in the table below:

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

Table 1. Impacts of climate disruption on the socio-economic activities of the Yaselia population

Activity	Positive impacts	Negative impacts
Agriculture	- Opportunity to grow crops during previously uncultivated periods	- Crop shrinking due to lack of water - Difficulty of burning if early rains; - Production decline - Proliferation of insect pests
Crafts	RAS	RAS
Hunting	- Animals are congested more and more around streams as there are less and less stagnant water points	- Rare game; - Dry leaves complicate hunting by warning animals of hunter presence
Picking	RAS	- Scarcity of non-wood forest products and non-timber (Chenilles, snails, mushrooms, etc.) - Long distance for caterpillar collection
Fishing	- Lower water levels make fishing easier, especially at the skies - page	- Decline in fishing production; - No fishing on the banks once facilitated by floods
Small business	- Makes it easier to trade and sometimes conserve agricultural products	RAS

According to Table 1, of all the activities cited by the population of Yaselia, only handicrafts and small trade are still unaffected by climate disturbances. All other activities are, in one way or another, influenced by these disturbances.

Regarding the strategies adopted to deal with these changes, opinions are divided: Some go back to God (no strategy), others diversify crops or adopt alternative activities (breeding, small trade), others advocate regular weeding, monitoring and adaptation of the agricultural calendar according to the vagaries of the climate or sowing of short-cycle crops (3 months) such as rice, cowpea, peanut and soy.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

Not understanding what is happening to them, a part of the population has so far adopted no strategy leaving the success of their activities at the stroke of chance.

3.3.2. Impacts on food security

Figure 11 presents the perception of the impact of climate disruptions on food security by the population of Yaselia.

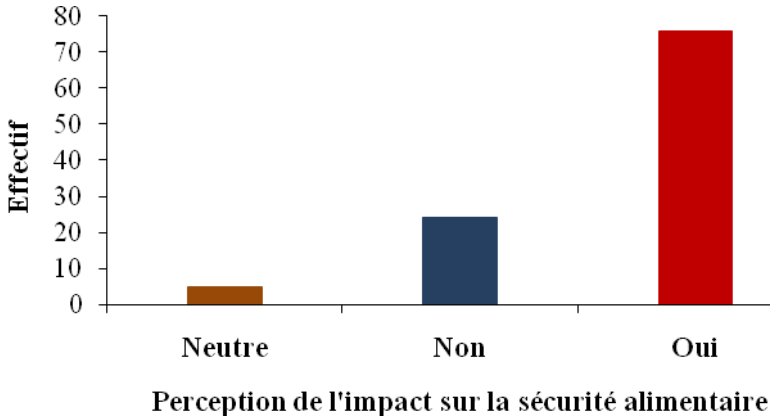

Figure 11. Perception of the impact of climate disruption on food security in Yaselia

Figure 11 shows that the majority of Yaselia residents recognize the impact of climate disruptions on the food security of their households. Of those surveyed, 72.4% said that climate disruptions negatively impact food security in their families. However, there are 24 others, or 22.9%, who say that climate disruptions have so far had no impact on food security. Finally, 4.8% have no opinion on the potential impacts of climate disruptions on household food security.

For those who report negative impacts on food security, they cite, among other things: the decline in agricultural production as a result of the wilting of crops due to lack of water, which leads to a decrease in the availability of food for households; the scarcity of game that reduces the consumption of meat products at the household level and the less productive fishing that forces the population to fetch smoked fish in Yangambi, or even salty fish from Kisangani.

3.3.3. Impacts on the resources of the Yangambi Biosphere Reserve

Figure 12 presents the views of the Yaselia population on the potential negative impacts of climate disturbances on the resources of the Yangambi Biosphere Reserve.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

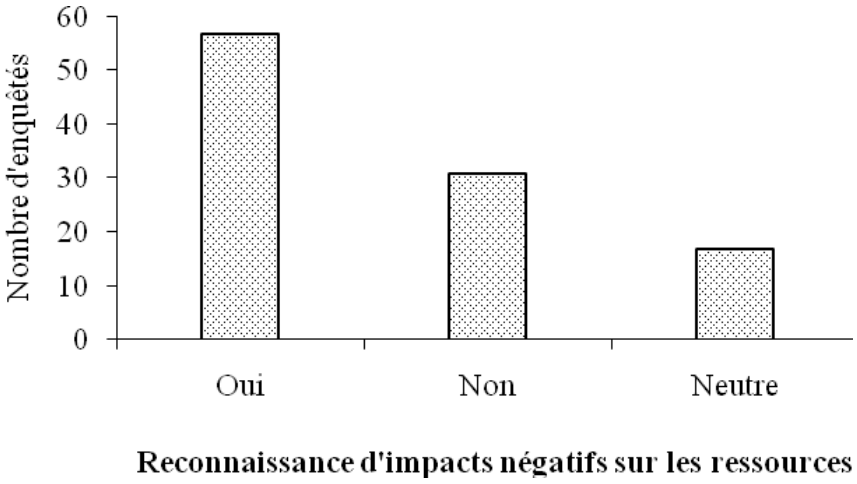

Figure 12. Opinion of respondents on the existence of negative impacts of climate disturbances on the resources of the Yangambi Biosphere Reserve

In the village of Yaselia, more than half of the population (54.3%) acknowledges the existence of negative impacts of climate disturbances on the resources of the Yangambi Biosphere Reserve. The latter (57 out of the 105 individuals format our study sample) evoke several impacts already visible. Among the impacts cited, we can see the decline in non-wood forest products. For example, snails are becoming increasingly rare and game is becoming increasingly difficult to hunt because dried leaves throughout the forest warn animals of the presence of hunters. Butbasically, the population surveyed reports a decrease in NFP resources within the Yangambi Biosphere Reserve.

On the other hand, 29.5% of respondents suggest that the observed climatic disturbances still have no visible impact on the resources of the Yangambi Biosphere Reserve. In the end, 17 have no ideas about the situation in this area.

Chapter IV: Discussions

In this part we propose a confrontation of the results obtained first with local information, then with the existing scientific literature.

4.1. Household economic activity

In the village of Yaselia, the results show that agriculture is the main activity of the populations although it is associated with other types of activities such as fishing, hunting, gathering, small trade, etc.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

This confirms the opinion put forward by Dixon etal., (2001) which indicates that agriculture contributes about 20% of the African continent's GDP, employs 67% of the workforce and is the main source of subsistence. Another study indicates that in this continent, more than 90% of farmers are smallholders (grow less than 5 ha). They account for more than 80% of agricultural production and provide food to about 600 million people (Molua et al., 2010).

In the Kisangani region, several studies report the same activities as those obtained in this research. For example, Maindo and Likwandjandja (2016) report agriculture as the main household activity on the Kisangani-Ituri and Kisangani-Lubutu axes. Similarly, the authors also point to combinations of agriculture with hunting, fishing, small trade, etc.

4.2. Climate Disturbance Indicators

In Yaselia village (study site), respondents identified three main indicators of climatic disturbances (early rains, early drought, seasonal disturbance). 65% of respondents raised the disruption of the seasons, 24% decryed early droughts and 11% spoke of early rains.

The work of Ouédraogo et al. (2010), related to a study on perceptions and strategies for adapting to changes in rainfall in the Sahelian, Sudanese-Sahelian and Sudanese areas of Burkina Faso, found similar indicators: decreased rainfall, seasonal disruption, irregularity of rains, pockets of drought, heavy rains, etc.

In a study conducted in northern Benin (Dimon, 2008), 90% of respondents indicated that there had been a change in the course of the agricultural season. The rains arrive late, which means fewer rainy days.

Villagers raise the manifestation of certain pockets of drought during the rainy season but also the persistence of the drought. Guibert et al. (2010) found similar peasant perceptions in responses to a survey conducted in the cotton-growing area of northern Benin.

In Yaselia, some indicators have not yet been observed in other studies (Bambara et al.,2013; Ouédraogo et al., 2010). These include the violence of thunder throughout the rainy season, the disappearance of rains accompanied by hail, the frequency of rainbows at the beginning of the rainy season, the decrease in dew.

The results obtained in this study compared to all these studies show that the Yaselia population is aware of the ongoing climate change and clearly perceives the different environmental indicators of climate dynamics in their environment.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

4.3. Cultural Meanings

In Yaselia, more than half (55.2%) respondents mentioned that the observed changes are the result of divine disapproval (God is not happy with them). In addition, a group constituting 13% indicates that the environment is no longer favourable for them; another group representing 2% explains that these disturbances are related to the anger of ancestors. Finally, 28.6% of respondents have no explanation for the changes observed in their environment.

The high rate of people citing divine disapproval as a cultural significance of climate change is certainly due to the dominance of Christianity in the Democratic Republic of Congo in general, and in the Kisangani region in particular. But it could also be explained by the low enrolment rate of the population under study. The explanation of climate change through divine disapproval leaves a large part of the population in a state of inaction. Considering that climate change is of divine origin, this frankness of the population does not adopt any strategy to deal with it. Thus, the majority of respondents said they had nothing else to do but go back to God to solve the problem.

This situation is common to other parts of Africa. In a study similar to Benin, Sabai et al. (2014) associate this way of thinking with the poverty of the population. According to these authors, while rich and moderately rich populations are developing new strategies to deal with climate change, the poorest are returning to God through prayer.

4.4. Impact of climate disturbances

The results show that of the 105 surveyed, 86 reported that climate disturbances have negative impacts on their socio-economic activities. On the other hand, a small number (7 surveyed) show that these changes have a positive impact on their day-to-day activities. Others (4 respondents) said they see both positive and negative impacts related to the changes that have occurred.

Among the negative impacts raised, the population mentions the wilting of crops due to lack of water, the difficulties of bruising so early rains, the proliferation of insect pests and the decline in agricultural production. Outside of agriculture, other activities such as hunting, gathering and fishing are also affected by these negative impacts.

The impacts on agriculture in Yaselia are consistent with the findings of several studies (Agossou etal., 2012. Doussou-Yovo et al... 2017). These authors indicate that current climate change is having a negative impact on agriculture, resulting in a decrease in agricultural productivity.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

The studies of Boko (1988), Afouda (1990) and Ogouwalé (2004) confirm the perception of the population of Yaselia by showing that even in Benin, rainfall pejoration induces a reduction in the length of the agricultural season, resulting in a decrease in production. With regard to agriculture, previous studies in other parts of Africa have shown, as has this study, that the negative impacts generally come from the annual change in precipitation distribution. In Benin, Agossou et al. (2012) suggest the formal revision of the agricultural calendar by the relevant agricultural frameworks, including the sought-afters to adapt to current climate changes. Brou et al (2005) in Côte d'Ivoire had resulted in this change in the timetable according to producers' perceptions.

According to Besada and Sewankambo (2009), many regions in Africa have responded to the impacts of climate change. For example, efforts by people in the Lake Olbollosat region of central Kenya by reducing deforestation on slopes, which was exacerbated by irregular rainfall due to climate change, through reforestation. Similarly, in Benin, Agossou et al. (2012) report that farmers adopt various strategies: the combination of crops, the adoption of crops adapted to new climatic constraints, etc.

This is more or less the case in Yaselia where the population advocates weeding and hoeing crops, changing crops. But at the same time many of the pay-free, because of their poverty have only prayer as a coping strategy. This confirms the view of Sabai et al. (2014) which have shown that financial constraints are the main barriers to how rural populations adapt to climate change.

4.5. Impact on natural resources

In the study site, some respondents (54.3%) revealed that climate disturbances observed in the environment have negative impacts on the resources of the Yangambi Biosphere Reserve, such as the decrease in forest products other than wood (gibiers, caterpillars, snails, etc.). Others (29.5%) said they can't find any tangible impacts and finally 16.2% have no idea.

This echoes the assertion of Gregory et al. (2005) who claim that in some parts of Africa climate change is already raging, which is altering the dynamics of drought, precipitation and heat. It also induces other secondary constraints such as the dispersal of plagues, increased competition for resources leading to the loss of biodiversity (Gregory et al., 2005).

CONCLUSION AND SUGGESTIONS

This study aimed to conduct a socio-anthropological analysis of environmental indicators of climate dynamics as experienced by the population living along the Yangsambi Biosphere Reserve in general, and that of Yaselia in particular.

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

To do this, an investigation was organized in the Yaselia village located at PK 91 in Kisangani City on the Kisangani-Yangambi highway, a village located in the transition zone of the Yangambi Biosphere Reserve. During this survey, 105 households were surveyed on the basis of a pre-developed questionnaire. The information collected was encoded and processed using Excel 2013 software and R. their interpretation was facilitated by content analysis.

After analyzing the data, the results revealed that:

- ✓ Yaselia's population, made up mostly of farmers, perceives climate change through indicators such as early rains, early droughts and seasonal disturbances;
- ✓ The majority of the population attributes these climate changes to divine disapproval, arguing that God is not happy with them. But other explanations such as the environment is no longer favorable or the ancestors are angry were raised by a minority. This confirms the first specific hypothesis. On the other hand, there remains a group no less important that has no cultural significance to all these changes;
- ✓ The most significant impact of these climate changes is seen at the agricultural level, where farmers report on the wilting of crops due to lack of water, the difficulty of burning for early rainfall and the proliferation of insect pests that result in a decline in agricultural production. But other sectors, such as hunting, gathering, fishing, are also affected, thus confirming the second specific hypothesis.
- ✓ More than half of the respondents 54.3% revealed that the climatic disturbances observed in the environment have negative impacts on the resources of the Yangambi Biosphere Reserve such as the decrease in forest products other than wood (gibiers, caterpillars, snails, etc.) although 29.5% said they did not find any palpable impacts at the Yanglh Biophere Reserve. This partly confirms the third specific hypothesis.

These different results show that the population of Yaselia is already beginning to experience the impacts of climate change in their daily lives. The information provided by the population during this study indicates that an awareness-raising effort must be made to enable the population of this village to understand that current climate change has nothing to do with the divine will or anger of the ancestors. This could lead them to take responsibility for themselves to combat the negative impacts of climate change.

Based on these different results and the constraints inherent in this study, we suggest:

- ✓ That peasant perceptions of climate change be coupled with weather data from the region to refine the understanding of the evolution of the phenomenon in the context of the Yangambi Biosphere Reserve;

ISSN: 2582-6271

Vol.2 No.2; Mar-Apr 2021

- ✓ To better define the population's perception of environmental indicators of climate change, certain socio-anthropological parameters such as age, population financial resources and educational attainment can be taken into account in future studies.
- ✓ Based on the constraints on agriculture, we suggest that a redefinition of the agrarian calendar be carried out taking into account the current annual distribution of precipitation.

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Vol.2 No.2; Mar-Apr 2021

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Vol.2 No.2; Mar-Apr 2021

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