



Research Article

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Resilience strategies of the Agricultural Sector in the face of Climate Change in Bumba (case of the Itimbiri Sector, Mongala province in DR CONGO)Mbula S¹, Ambena D^{2*}¹Assistant at the Higher Institute of Agronomic Studies of LOEKA (ISEA/LOEKA)^{2*}Master's degree at IKELA University**Article History**

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Abstract: The purpose of this study was to identify strategies for resilient agriculture in the face of climate change in the Itimbiri sector, Bumba territory, Mongala province in the DRC. To achieve this, a survey was carried out in 4 groups in the above-mentioned sector, namely: Bokombe, Yaligimba, Boonda and Yaliambi.

The investigation was based on the following observation parameters: (1) Farmers' perception of climate change; (2) The main causes of climate change; (3) The effects felt as a result of this change and (4) Resilience strategies developed by farmers.

In total, a sample of 30 people was interviewed per group. The compilation of the information received led to the following results: (1) 62.5% of people think that we can talk about climate change when dry seasons are shortened, in other words when rainy seasons are prolonged, (2) 500% of respondents maintain that slash-and-burn agriculture is the main cause of climate change., (3) Around 11 respondents out of 30 on average (i.e. 36.7%) specify that climatic disturbances are felt thanks to temperature inversions, (4) The strategy most developed by farmers to deal with these disturbances remains respect for the agricultural calendar adapted by the farmers in the groups surveyed.

Keywords: *Shifting agriculture, burned and resilient*

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INTRODUCTION

Since its establishment in 1998, as a specialized body by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO), the Intergovernmental Panel on Climate Change (IPCC) is increasingly convincing even the most skeptical among humans that change in climate change is a reality (IPCC1988)

The powerful and rapid rise of greenhouse gases and climate change throughout the world is becoming one of the most alarming critical problems in the world today (Anonymous 2001)

Furthermore, the world's cities are growing while solutions linked to the problem of climate change and especially resilience strategies in the agricultural sector must also be developed (Frank Sperling et al 2003).

Unfortunately, issues related to climate change and other factors remain a major concern for both crop production and the environment. Climate change and variability are certainly not new phenomena, but they have become particularly significant in recent decades.

All continents are affected by this phenomenon of climate change but to varying degrees. The diagnosis made on the effects of this change in the world and in Africa shows that drought, late and violent

rains, and floods are the three major climate risks (IPCC 2020).

The profound effects of climate change on agriculture coupled with the low resilience and high vulnerability of populations to things could considerably reduce their capacity to manage natural resources and also alter their livelihoods, their food security and their well-being. (Amadou 2005)

The fund to support local climate change adaptation strategies (FSSA) aims to significantly increase the capacity of African countries to adapt to climate change in ways that benefit the most vulnerable through strengthening abilities (<http://fr.wikipedia.org.wiki>)

Since June 1992, the Democratic Republic of Congo (DRC) has been among the more than 185 countries that are part of the United Nations Framework Convention on Climate Change (UNFCCC). It is in this capacity that it has since undertaken a series of scientific activities in accordance with the commitments to which it subscribed to have an inventory of its greenhouse gas (GHG) emissions for the year 1994. (<http://fr.wikipedia.community>, consulted on 08/03/2019 at 9:00 a.m.). The Itimbiri sector and its groups are an environment in which agricultural production is a result of climate change and as a result, no food is available in quantities that can meet the needs of the growing population.

Thus, in this perspective, we were interested in identifying and proposing some resilience strategies of the agricultural sector in the face of climate change with a view to enabling farmers to maintain or increase agricultural production despite climatic disturbances whose effects lead to a quantitative decline.

MATERIALS AND METHOD

Description of the survey site

Our study was carried out in the Itimbiri sector, more precisely in the Bokombe, Boonda, Yaligimba and Yaliambi groups, Bumba Territory, located at 2° 11' 30" latitude North, 2° 36' longitude East. The Itimbiri sector is mainly occupied by the Budja people. It is limited:

- To the East and South respectively by the territories of Aketi and Basoko.
- To the North and West, through the Loeka sector (anonymous 1990).

This sector enjoys an equatorial climate of the Af type according to Koppen. The annual temperature is around 25°C. Rainfall is abundant almost all year round. The population of this sector is 225,000 inhabitants, dominated by women and children (Anonymous 2011.).

The Itimbiri sector is made up of 8 groups, namely: Bokombe, Boonda, Yaligimba, Bomenge, Bopandu, Yawiango, Yamolota and Yaliambi.

Materials

In our study, we used the following materials:

- Questionnaire sheet with 4 main questions and sub-questions;
- Pen and timetable to encode data;
- Motorcycle for mobility;
- Calculator to perform different calculations.

Method

Our investigation took place over 90 days, from January 5 to April 5, 2021. The field survey method and the duly structured individual interview which were used to collect the data relating to:

- Farmers' perception of climate change;
- The main causes of climate change;
- The effects felt as a result of this change;
- Resilience strategies developed by farmers.

RESULTS

Perception of climate change by farmers

The data showing how climate change is perceived by farmers are shown in the following table (1):

Table (1): Farmers' perception of climate change

Perception	Group	B	Y	Bo	Ya	$\Sigma/120$	\bar{x}	s^d	cv(%)
Shortening of dry season		20	11	15	29	75	19	7,7	40
Decrease in water table level		2	6	7		15	4	2,3	57,5
Soil degradation		6	3	8	8	30	8	3,0	37,5

Source: field survey.

Legend: B=Bokombe; Y=Yalombo; Bo=Boonda; Ya= Yaliambi

Looking at the results in table (1), it generally appears that climate change is perceived differently from one group to another.

However, by comparing the scores of the groups with each other, the following was observed: All the groups surveyed affirm firstly that it is the shortening of the dry season which reflects climate change. The Yaliambi group occupies the top of the ranking with 29/30 people (or 96.6%). It is followed by the Bokombe groups (20/30 people or 66.6%), Boonda (15/30 or 50%).

The Yaligimba group (11/30 or 36.6%) occupies the last position.

Furthermore, soil degradation and the reduction in the water table are also considered signs of climate change, but at negligible rates, respectively 25% and 12.5%.

These low rates can be explained by the fact that, to cultivate the fields, farmers rely more on the climatic seasons than other parameters.

Cause of Climate Change

The data reflecting the causes of climate change are recorded in table (2) below:

Table (2): Main causes of climate change

Causes	Group	B	Y	Bo	Ya	$\Sigma/120$	\bar{x}	s^d	cv(%)
Anarchic logging		10	7	8	2	50	13	7,9	60,7
Shifting agriculture on slash and burn		13	8	19	20	60	15	5,5	36,6
Shifting agriculture on slash and burn		2	2	3	3	10	3	0,7	23,3

Source: field survey.

Analysis of the results in this table shows that the inhabitants of the 4 groups covered by our study believe that slash-and-burn agriculture constitutes the main cause of climate change.

Thus, out of 30 people interviewed per group, 20 (or 66.6%) considered slash-and-burn agriculture as the main cause of climate disruption in Yaliambi; 19 people (or 63.3%) in Boonda; 13 people (43.3%) in Bokombe and only 8 (26.6%) in Yaligimba.

These groups also considered that the anarchic exploitation of woods is one of the causes which disrupt the climate on a scale of 41.7% overall.

On the other hand, they unanimously rejected demographic concentration among the causes listed above. This is statistically attested by the calculation of the coefficient of variation (CV) which gives the value 23.3% 30, reflecting a homogeneous distribution.

However, considering all the scores, the practice of slash-and-burn agriculture is supported at 50% as an essential cause of climate change.

Effects of climate change on agriculture

Information relating to the effects of climate change on agriculture is recorded in the following table (3):

Table (3): Effects of climate change on agriculture

Group	B	Y	Bo	Ya	$\Sigma / 120$	\bar{x}	s^d	cv(%)
Effects								
Temperature inversion	18	10	8	9	45	11	4,5	40,9
Disruption of rainfall regime	3	10	5	12	30	8	4,2	52,5
Drying of rivers	7	4	6	5	22	6	1,4	23,3
Siltation of the hydrographic network	7	0	10	6	23	6	4,1	68,3

Source: Field survey.

We note from these results that each group feels the effects of climate change differently. For the Bokombe group, the temperature inversion is more felt (60%); the drying up of rivers and the siltation of the hydrographic network are felt to a large extent. As for the Yaliambi group; the most significant effect is the disruption of the rainfall regime (40%), the siltation of the hydrographic network and the drying up of rivers being negligible (20%) compared to (16.6%). This is also the case in Yaliambi where 33.33% of people affirm the presence of climatic disturbance as being the main effect. For this grouping the drying up of rivers is less remarkable (13.33%) while the siltation of the hydrographic network is zero.

The inhabitants of Boonda, unlike other groups, praised the siltation of the hydrographic level (33.33%) like the effects considered the most salient by other groups.

What could justify these differences depending on the groupings? Find scientifically acceptable arguments (reasons) here that can support this. The CV obtained in appendices 3 statistically proves that there is dispersion of effects felt from one group to another.

Furthermore, by comparing the ratings obtained by each parameter relating to the immediately felt effect of climate change in the 4 groupings, we find that the inversion of temperatures comes first with 37.5%.

Strategies for resilient agriculture

The data inherent to the resilience strategies are shown in table (4) below

Table (4): Resilience strategies.

Group	B	Y	BO	YA	$\Sigma / 120$	\bar{x}	s^d	cv(%)
Stratégies								
Respect of agricultural calendar	7	18	10	25	50	13	8,4	41,7
Suitable varieties	3	7	20	10	40	10	7,2	33,3
Adoption of new farming techniques	10	5	7	8	30	8	2,1	25

Source: Field survey.

From observing the results in table (4) it is noted that generally speaking, resilience strategies are not developed in the same way in all the study groups.

In Yaliambi people think that the best strategy must be based on respecting the agricultural calendar (83.33%), while in Boonda it is the use of varieties adapted to the conditions of climatic disturbance which must be essential (66.7%). Like the

Yaliambi group, the inhabitants of Yaligimba also maintain that respecting the agricultural calendar is the best resilience strategy.

Unlike the others, the Bokombe group underlines, against all expectations, that the adoption of new farming techniques remains a good strategy, despite the climatic disturbances which are rampant (27%). As a researcher, in accordance with the realities of the environment, the good resilience strategy to save this agricultural sector in this region is strict compliance with the agricultural calendar and the adaptation of farmers to this change.

Notwithstanding, this last strategy is the least cited by the people surveyed, or coefficient being 26.2% 30 proves that there is homogeneity of declarations about the latter. Which is still confirmed by the value of the standard deviation (Sd) which is 2.1, affirming a low dispersion around the average value. So, when we take into account the average ratings and the percentages awarded to all the strategies used, it is compliance with the agricultural calendar which presents the best rating.

CONCLUSION

This study sought to identify the resilience strategies of the agricultural sector in the face of climate change in Itimbiri in the Bumba territory. To achieve this, a previously established questionnaire was submitted to the respondents. This questionnaire contains 4 main questions and sub-questions, which are also considered as study variables. To obtain the results, the protocol retained 4 groups in each of which 3 villages were chosen at random, and in each village one sample per group.

The objective of this study was to examine the perception of the “climate change” phenomenon in each of the selected groups; the direct causes favoring this observed change; the effects felt as a result of climatic disturbances; resilience strategies for sustainable and adapted agriculture.

The study was supplemented by analyzes of variance with ungrouped distributions and percentage calculation, in order to detect the dispersion of values around the mean.

Based on the results obtained, the following conclusions were drawn.

- Regarding the perception of climate change in our study environment, the results showed that all groups support that the shortening of the dry season is a sign reflecting climate change, an opinion supported by 62.5%
- Concerning the causes of climate change, slash-and-burn cultivation is the main one (50%). Added to this is artisanal logging (41.7%).
- As for the effects linked to climate disturbances, temperature inversion remains the most dominant (37.5%), while siltation of the hydrographic network is the least considered (10%).
- Concerning resilience strategies, the study found that respecting the agricultural calendar imposed by climate change remains the strategy most considered by farmers (48%). This must be associated with the use of adapted varieties.

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