

## CLIMATE CHANGE AND FARMER'S PERCEPTION OF CLIMATIC EVOLUTION IN ALIBORI DEPARTMENT IN BENIN

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### ABSTRACT

*The climate changes constitute nowadays a potentially major threat for the environment and the sustainable development. Their impacts especially affect the agriculture that essentially depends on rainfall in the poor countries as Benin. In this context, identification and understanding of manifestations of the climate change that are perceptible by the farming population and their impact on different crops are proved to be essential so that to take urgent measures to reinforce the adaptation capacities of populations to face climate changes harmful effects. So this research tries to analyze the farmers' perceptions of the climate changes.*

*It was conducted in communes of Banikoara and Malanville. 80 heads of household serve as sample. The data are collected through non direct and semi direct interviews, focus groups and participant observation.*

*The analysis of farmers' perception of climate changes with the discourse analysis and descriptive statistics reveals that the local populations perceive the climate changes through the climatic risks such as the delay in the starting of rains, the pockets of drought in rainy season, the bad spatial distribution of rains, the precocious stop of rains, the reduced rainfall, the violent winds and the excessive heat. But according to this farmers' perception, globally Malanville is more exposed to the climatic risks than Banikoara.*

**KEYWORDS: CLIMATE CHANGES, PERCEPTIONS, CLIMATIC RISKS, FARMERS, BENIN.**

### INTRODUCTION

Today the climate changes potentially constitute a major threat to the environment and the human sustainable development. Their manifestations are expressed by the impacts affecting the natural resources and the whole of life sectors (9). It is useless to show that agriculture, main source of subsistence for the majority of poor rural populations, is the human activity most directly affected. (8) signals that in the developing countries, the climate changes already constitute the cause of the bad harvests and losses of livestock provoking major financial losses and reinforcement of foodstuffs. It is a great proof that the climate changes will harm the African continent and become one of the major challenges that must be taken up for her future development, particularly in the arid regions. (1, 12, 14, 15)

So, these regions and in general the poor regions of Africa will be confronted with the most serious problems caused by the stoppage the offer of the services of the ecosystems whose the populations depend on to satisfy their basic needs and also because of the precariousness of their life conditions and their weak financial and institutional capacities. Some very worrying perspectives indicated by (8) report a fall of 50% of the outputs of the pluvial cultures from now to 2020. Benin, a poor country of West Africa is not secured against the threats bound to the climate changes. According (19) the climate change has had and would have huge impacts on the sectors of the water resources, energy, coastal regions, health, agriculture and forestry. So, one remarks that agriculture, bedrock of its economy with a contribution to 36% to the GNP and 88% to the revenue of the exportation (11) and employing more than 70% of the population (19), is already victim of the negative impacts of the climate change. This phenomenon threatens the development of agriculture that remains largely pluvial and so compromising food

security. In this context, it is imperative to undertake studies that can permit to understand the manifestations of the climate changes in the regions most exposed and their possible impacts on the different produces cultivated so that urgent precautions must be taken to reinforce the adaptation capacities of the populations to the negative impacts of the climate changes. It is in this framework that this current research work has been initiated in the department of Alibori and specifically in the administrative districts of Banikoara and Malanville. It aims at analyzing farmers perceptions of the climate change.

## 2. MATERIAL AND METHODS

### 2.1. Presentation of the study area

The department of Alibori is limited in the North by the Republic of Niger, in the North-west by Burkina Faso, in the South by the department of Borgou, in the East by the Federal Republic of Nigeria and in the West by the department of Atacora. It includes six administrative districts subdivided into two agro ecological zones: Karimama and Malanville. Karimama and Malanville comprising zone 1 (the extreme north Benin), which one is the most open to the climatic risks; Banikoara, Kandi, Ségbana and Gogounou are included in the Zone 2 (cotton Zone of the north) less open to (19). In the view of having a representativeness of these two zones Malanville and Banikoara have been selected as areas of study.

The administrative district of Banikoara, having a surface of 4383 km<sup>2</sup>, is located in the northwest of the department. It comprises at latitude between 10°50' and 11°30' north and at longitude 2° and 2°40' East Its climate is of a Sudanese type evolving towards the sahelian with one rainy season from May to October. According to the data of ASECNA (2008), the annual average of rain falls varies from 723, 8 mm to 1280, 7 mm. As for the temperature the annual averages of the minima vary between 19,77°C and 22,6°C and those of maxima between 33,35° and 35,85° (synoptic station of Kandi). Banikoara profits from the effluents of the river Niger such as Mékrou (410 km) in the Northwest and Alibori (338 km) in the South-east. The vegetation is composed of woody, shrubby and herbaceous savannah with beaches prickly shrubs to some places submitted to a high anthropic influence but along the river, one remark the presence of well woody vegetation. The grounds are ferruginous, clayey and silty in the depressions favourable to rice- growing and market gardening. The natural resources (grounds, vegetation, river, etc. are submitted to a high anthropic pressure characterised

by rapid rhythm of deterioration of the environment. The continuous fall of pluviometric is the signal of an advanced sahelian consecutive to the vulgarised monoculture of cotton.

The population is in majority agricultural and chiefly cultivate cotton, maize, sorghum, rice and groundnut. As for the administrative district of Malanville, it has a surface of 3.016 km<sup>2</sup>, be 2,63% of Beninese territory and is situated in the extreme North-east of Benin in the department of Alibori between latitude 11,50° and 12° North and 2°45' and 3°40' East. Its climate is of the Sudano-Sahelian type marked by a dry season from November to April with the harmattan from November to April and rainy season from May to October. According the data of l'ASECNA (2008) the annual average rain falls varies between 472, 2 mm and 1449.6 mm. As for the temperature, the annual average of the minima vary between 19,77°C and 22,6°C and those of maxima are between 33,35° and 35,85° (synoptic station of Kandi). The administrative district of Malanville is limited in the direction East-west the river Niger with its affluent (Alibori, Mékrou and Sota). The Niger valley which goes from Guinea to the minor bed of the river is plentiful of exploitable depressions.

The vegetation of the administrative district of Malanville is characterised by wooded savannah with predominance of the herbaceous formations. In the constituency are the forests of Gougoun, Boïffo which is a secured area and the cynegenetic zone of the Djonta. The grounds of Malanville are for the majority of gneissic type except the Niger valley and its affluent where one has sandy-clayey and ferruginous grounds. According to the statistics given by CeRPA Borgou- Alibori about agricultural campaign 2008-2009, the basic cultures of the administrative district of Malanville are rice, millet maize, sorghum and cotton.

### 2.2. Collected data

The data used chiefly concern the climatic risks and their manifestations. They have been collected from 80 chief peasants of agricultural exploitation chosen at random after individual interviews (semi-structured and non structured), targeted groups, participant observations.

### 2.3. Approach by perception

Perception is the process by which we receive information and stimuli of our environment and transformations in conscience psychological acts (Lewin, 1996, quoted by 16). Perception is neither

a passive reception nor a mechanic recording (6). It is selective, varies in the time and space and regarding the individuals. So, we do not perceive all that happens around us. We select in function of our selective concentration. What has been selected is directly arranged and actively modified during the perception (6). This gives birth to an obvious difference the physical environment and the subjective one, as we have perceived it that is to say psychic environment. The pattern of human perception bring out two types of perception: the psychic perception linked to psychic situation of the individual and the sensorial perception that is linked to the sense. The psychic perception is function of functional factors and we can consider the elements below as including functional factors (6): the experiences, the notions of value, the expectations, the needs, the opinions and the socio-cultural norms. The sensorial perception depends on the structural factors that are nothing else than our five senses (sight, hearing, smelling touch, and taste).

Furthermore, Prieto (1975 quoted by 22) assert that the identity under which a subject knows a material object is only the manner who is conceives it. This means that face to a given situation, perception can vary from an individual to the other. This pattern of processing of perception is very important in the comprehension of the perceptions that the local populations have about climate changes.

#### 2.4. Methods and tools of processing.

We have proceeded to analyzing the speeches of the chiefs of exploitation related to the climate changes. For this relation, a calculation of related and absolute frequencies has permitted to know the number and percentage of the chiefs of exploitation having perceived the different types of risks to which they themselves have alluded. This has permitted to identify the great climatic trends perceived in the zone.

### 3. RESULTS AND DEBATES

#### 3.1. Peasant perception of the pluviometric trends

The different risks related to the pluviometric and that trouble the execution and efficient development of the agricultural activities are summarized in the table1. It appears that in the administrative district of Malanville, all the producers contacted assert that the pluviometric trend is expressed by the delay in the start of the rain whereas in the administrative district of Banikoara 15% of the producers contacted at Komon to 45% at Kokey have given

this trend. This shows that at Malanville this risk is effective at Kokey in the two villages while at Banikoara it is more effective at Kokey than Komon. When one compare the two administrative districts, all the producers remark this risk at Malanville whereas 30% of the producers contacted assert that this trend at Banikoara. So, the administrative district of Malanville is much more exposed to the delay in the start of the rain in the second decade of May even at sometimes at the end of May. The pockets of drought constitute a risk identified by all the producers in the zone of study. In effect, the interruptions of the rain during the season are more and more increasing those last years. The periods in which these pockets of drought are often observed are May, June, end of September and October according to the peasants' sayings. These breaks are manifested by an absence of the rains for about one or two weeks and even sometimes more according to the statement of the contacted producers. Concerning the bad spatial distribution of the rains in the administrative of Malanville 55% of the contacted producers at Boïffo and 100% at Tombouctou assert the effectiveness of this risk in their environment. This shows that at Malanville, the village Tombouctou is more exposed to bad distribution of the rains than Boïffo. On the other hand, at Banikoara 65% of contacted producers at Komon to 80% at Kokey remark this climatic risk in their environment. So, the village of Kokey is more exposed to this risk than Komon. When we compare the two administrative districts, we notice 77, 5% of contacted producers at Malanville and 72, 5% the contacted producers at Banikoara assert the effectiveness of the risk. So, the two administrative districts are plagued by the phenomenon of ill spatial distribution of the rains but Malanville is more exposed than Banikoara. The local indicator linked to the ill spatial distribution of the rains is the withering of the cultures and the losses provoked by the lack of water or yellowing of the plants, after an abundance of water in a short time

Concerning the pluviometric recession in the administrative district of Malanville, 45% of the contacted producers at Boïffo to 100% at Tombouctou notice that the trend is to the pluviometric recession whereas at Banikoara, 90% of the contacted producers in the two villages assert this trend. So, at Malanville, Tombouctou is much more exposed to the pluviometric recession than Boïffo. But at Banikoara, the pluviometric recession is identically perceived in the two villages. Furthermore, the fall of the outputs of the cultures, the premature drying up of the depressions pongs and the rivers with the passing years

constitute for the peasants, local indicators of the pluviometric recession.

As for the premature break of the rains all the contacted producers have identified did in the two villages of Malanville whereas at Banikoara, 80% of contacted at Komon to 65% at Kokey assert that the trend is to premature break of the rains, for the rains stop in the end of September-beginning of October instead of traditionally mid-October. So, the two villages of Malanville are more submitted to the influence of the premature stoppage of the rains than the two villages of Banikoara.

Above all and under the approach perception one can say that all the risks cited above exist in the two administrative districts but globally Malanville is more under the influence of these risks than Banikoara. These different trends perceived by the producers confirm the results by (4) that have concluded that the climate changes are manifested in the North of Benin by the delay of the rains (the rains start presently in May instead of April); the continuous stoppage of the rains during the agricultural campaign; the persistence of the drought. Moreover, the climatic obligations achieved by (17) certified that these two administrative districts are under the influence of drought, what the producers of the two administrative districts have confirmed. The peasant perception is equally in accordance with those by Le Barbé et al. (1993 quoted by 3), (7), (2), (13), (20 and 21), (18) and (19) which lead to a reduction of amplitude of the annual average of the total heights of the rains since the end of the 1960s, chiefly in the 1970s and 1980s. The fact that the area of Malanville is more exposed to climatic risks than Banikoara confirmed the results of the research works by (19) that stipulates that agro ecologic the zone I (Extreme North Benin) to which belongs Malanville is one of the zone the most exposed to the climatic risks mainly drought whereas Banikoara is in the coastal zone of the north less exposed to the climatic risks.

### 3.2. Peasant perception of the thermometric trends

The rural communities equally perceive temperature changes in the territory. The synthesis of their perception of the thermometric trends is recorded in the table N°2. From this table it appears that the quasi-totality stakeholders of the two villages (95% at Boïffo and 90% at Tombouctou) from Malanville assert that the trend to heat is high these last years and mainly during the rainy seasons. On the other hand, at Banikoara, 75% of the contacted producers at Komon and 70% at

Kokey certify that the heat has become higher and higher; in the same time 20% of the contacted stakeholders in each of the villages assert that the level of the heat has not varied considering the past. But furthermore, 5% of the contacted stakeholders at Komon and 10% at Kokey signal that the heat is weaker and weaker in accordance to the past. On the basis of peasant declarations, one can say that the two administrative districts through their villages are subjected to climatic warming but that Malanville is warmer than Banikoara. In effect, here are some speeches of the contacted producers that justify this thermometric trend: « These past fifteen years (15 years), the heat is excessively lasted from March to June whereas before it is only in April that it was really very warm. The sun heats more the planet these last years and even under shadow one feels the heat. In the past if it was very hot at most two days (2 days) after it must have rained but now it no more the case»

The farmer's statements confirm the results by (4) that had recorded "the increasing of the heat all the year" among the risks characterizing the climate changes in the North of Benin. These statements equally corroborate the research works conducted by (19) in the framework of PANA-BENIN (2008) that specifically the excessive heat among the climatic risks characterizing this parts of Benin and more specifically the administrative districts of Malanville and Tanguieta. Moreover, the same trend to the warming had been addressed by (10) in his third report of assessment.

### 3.3. Peasant perception of anemometric trends

The anemometric dynamics as perceived by the contacted producers with the passing of years is recorded in the table N° 3. The processing of this table shows that all the contacted producers at Malanville perceive the violent winds on their environment whereas at Banikoara 80% and 85% of contacted stakeholders, respectively at Komon and Kokey perceive this climatic risk. So, relying on the farmer's perception, one can assert that the zone of study is under the influence of violent winds. According to these producers the violent winds are more frequent and more violent these last years. These peasants add that the violent winds are manifested by these last years during the rainy season, mainly at the beginning and towards the end of that season whereas there is about thirty years, it only two or three violent winds on average that there was at start rainy season. Some facts could subtend this perception. The stay in the environment has permitted to observe some havoc provoked by the winds. In effect, the houses are uncapped, the branches of the trees are broken and

in some cases the trees are uprooted themselves. Finally, the phenomena of pouring down of cultures are more and more frequent, according to the peasants. One must remark that the winds are more violent at Malanville according to the statements of the peasants and our own observations, for the havocs are more important there than at Banikoara.

The anemometric indicated by the producers is in accordance with the results of the research works by (4) which have observed that the climate changes are manifested by a certain number of risks among which there is the increasing of violence of winds. Altogether, (19) equally underlines that in this part of Benin and more specifically in the administrative districts of Malanville and Tanguieta, that the violent winds are part of the climatic risks.

## CONCLUSION

The results from the perceptions of the agricultural producers of the zone, one can say that the delay in the start of the rains, the pockets of drought during the rainy season, the ill spatial distributions of the rains, the pluviometric recession, the violent winds, the excessive heat, are the risks that characterize the climate these past years. It would be interesting in undertaking the study of effects of these changes on the agricultural activities of peasants so that the conditions of efficient adaptation must be taken into account to reinforce the capacities of adaptation of the populations to these effects

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Climatic Risks	Administrative district of Malanville				Administrative district of Banikoara				Whole of the zone of study	
	Boïffo		Tomboutou		Komon		Kokey			
	Absolute frequency	Related frequency	Absolute frequency	Related frequency	Absolute frequency	Related frequency	Absolute frequency	Related frequency	Absolute frequency	Related frequency
Delay of the start of the rains	20	100%	20	100%	3	15%	9	45%	52	65%
Pocket of drought during the rainy season	20	100%	20	100%	20	100%	20	100%	80	100%
Premature stoppage of the rains	20	100%	20	100%	16	80%	13	65%	69	85,25%
Ill spatial distribution of the rains	11	55%	20	100%	13	65%	16	80%	60	75%
Pluviometric recession	9	45%	20	100%	18	90%	18	90%	65	81,25%

*Table n°1: Synthesis of the peasant perceptions of the progression of the pluviometric*

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<u>Climatic Risks</u>	<u>Administrative district of Malanville</u>				<u>Administrative district of Banikoara</u>				<u>Whole of the zone of study</u>	
	<u>Boiffo</u>		<u>Tomboutou</u>		<u>Komon</u>		<u>Kokey</u>			
	<u>Absolute frequency</u>	<u>Related frequency</u>	<u>Absolute frequency</u>	<u>Related frequency</u>	<u>Absolute frequency</u>	<u>Related frequency</u>	<u>Absolute frequency</u>	<u>Related frequency</u>	<u>Absolute frequency</u>	<u>Related frequency</u>
<u>Heat more and more increasing (excessive heat)</u>	<u>19</u>	<u>95%</u>	<u>18</u>	<u>90%</u>	<u>15</u>	<u>75%</u>	<u>14</u>	<u>70%</u>	<u>52</u>	<u>82,5%</u>
<u>Heat less and less increasing</u>	<u>0</u>	<u>0%</u>	<u>0</u>	<u>0%</u>	<u>1</u>	<u>5%</u>	<u>2</u>	<u>10%</u>	<u>80</u>	<u>3,75%</u>
<u>No change</u>	<u>1</u>	<u>5%</u>	<u>2</u>	<u>10%</u>	<u>4</u>	<u>20%</u>	<u>4</u>	<u>20%</u>	<u>69</u>	<u>13,75%</u>

Table N°2: Synthesis of peasant perceptions of the progression of temperature

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Climatic risks	Administrative district of Malanville				Administrative district of Banikoara				Whole of the zone of study	
	Boiffo		Tomboutou		Komon		Kokey			
	Absolute frequency	Related frequency	Absolute frequency	Related frequency	Absolute frequency	Related frequency	Absolute frequency	Related frequency	Absolute frequency	Related frequency
Violent winds	20	100%	20	100%	16	80%	17	85%	73	91,25%
No change	0	0%	0	0%	4	20%	3	15%	69	8,75%

*Table N°3: Synthesis of peasant perceptions of the progression of the wind.*