ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 07, Issue, 07, pp.13753-13759, July, 2017

ORIGINAL RESEARCH ARTICLE

Open Access

THE PERCEPTION OF CLIMATE CHANGE AND COPING STRATEGIES AMONG RURAL FARMING HOUSEHOLDS IN BOUAFLÉ AREA, COTE D'IVOIRE

[1]Nguessan C. Bodji, [2]Parfait F. Koutouan, [2]Kouakou B. Kouadio, [2]K. Traoré and *,[2]Eboua N. Wandan

[1]Department of Agriculture et Animal Ressources, Institut National Polytechnique – HB, BP 1093 Yamoussoukro, Côte d'Ivoire
[2]Department of Water, Forestry and Environment, Institut National Polytechnique – HB, BP 1093 Yamoussoukro, Côte d'Ivoire

ARTICLE INFO

Article History:
Received 05th April, 2017
Received in revised form
24th May, 2017
Accepted 06th June, 2017
Published online 22nd July, 2017

Key Words:

Climate Change, Perception,
Rural Farming Household, Bouaflé,
Côte D'ivoire.

Corresponding author:

ABSTRACT

The District of Bouafle is a major agricultural production areas in Côte d'Ivoire, but this production is entirely dependent on weather conditions. This study examines the perception of farmers about current climate variability and compare that perception with respect to climate data over the last 30 years. It also assesses the evolution of forest cover and adaptation measures. It is based on a survey of farmers, interviews with officials of the forest administration and agriculture, and focus group.

Citation: Nguessan C. Bodji, Parfait F. Koutouan, Kouakou B. Kouadio, K. Traoré and Eboua N. Wandan, 2017. "The perception of climate change and coping strategies among rural farming households in Bouaflé area, Cote D'ivoire", *International Journal of Development Research*, 7, (07), 13753-13759

INTRODUCTION

The economies of African countries, particularly those in sub-Saharan Africa are largelydependent on agriculture. In 2000, the FAO estimated that this sector employed 34-44% of the workforce which represents 51 to 77% of the population (http://apps.fao.org). Yet agricultural production is highly dependent on rainfall. Therefore intra and inter-annual fluctuations representthe major climatic changes for the concerned populations. Africa is vulnerable to climate change because of its dependence on rain-fed agriculture (Below *et al*, 2010; Boko *et al*, 2007; 2009; Kahiluoto *et al*, 2012). Small farmers are particularly vulnerable to climate change that negatively affect their livelihoods (Nhemachena and Hassan, 2007; Thornton *et al*., 2010). Because of their immediate and lasting impact on the natural environment and humans, climate change issues are of central concern for scientists and policy makers in the world. The variability of weather conditions in West and Central Africa in general and in the Ivory Coast in particular is well established (Paturel *et al*., 1997; Servat *et al*, 1997; Servat *et al*., 1999; Ardoin, 2004; Kouassi *et al*, 2008). Climate change has deregulated growing seasons and reduced water supply; whereas weather conditions - temperature, light and water - largely determine people's ability to grow enough food for themselves and their livestock. It is a real disaster for the African continent which agriculture depends almost

exclusively on rain and 70% of the population rely on their natural environment for food or medicine (Kaddour 2007). Several studies have been made to cope with the new climate patterns in order to minimize the vulnerability of populations and help them adapt to these new challenges. Thus, NICOLE (2008) assessed the knowledge of climate change and the perception of extreme risk areas of the Sahel, to strengthen the capacity of people to better coping strategies. Merie (2012) discussed in turn, the practicality of the concept of adaptation of Benin populations to climate change. These two major aspects; risk perception of climate change and adaptation are always treated all over the planet, given the constantly changing climates. In reality, after all, for their survival and that of their livestock, farmers have always developed agricultural strategies to address climate threats: drought, increase in temperature, strong winds, all factors unfavorable for agriculture in sub-Saharan Africa in general, and in the Ivory Coast in particular.

Cote d'Ivoire is not on the sidelines of the effects of climate change. Several studies conducted in the country, confirm this fact. BROU Y. (2007), has highlighted the uncertainty about the future of the Ivorian agriculture, confronted with the uncertain climatic conditions and partly to the shrinking of its production support, forest. Ochou (2012), addressed the impact of climate change on agricultural production in the Ivory Coast. Furthermore, Diomande (2007), oriented its investigation towards the study of the perception taking in account the disruption of rainfall patterns in relation to rainfed agriculture in Dimbokro region. Doumbia(2013), analyzed the understanding of peasant perception of climate change and strategies developed by the upland rice producers to adapt to this new context, in the Daloa region. This study aimed at identifying and document climate change in the department of Bouaflé, a major center of agricultural production in Côte d'Ivoire. The objectiveswere to describe (i) the socio-economic characteristics of farmers, (ii) examine their perceptions and knowledge on the theme of climate change, and (iii) evaluateweather and forest cover change in relation to climate change, and document the experiences of farmers regarding mitigation of the effects of climatechange.

MATERIALS AND METHODS

a. The area of study

The study was conducted in the Department ofBouaflé, in the central west part of the country. The climate of Baoulean type is characterized by one big dry season (December to February) followed by a by a big rainy season (March to June), then a small dry season (July to August) followed by a small rainy season (September to November). The average annual rainfall is between 1800 and 2000 mm and the annual average temperature varies between 25 and 28 °C (Eldin, 1971). Vegetation consists on a mosaic of forests and savanna (Adjanohoun et Guillaumet, 1971). This area is the site of a cultural melting pot between Gouro, Bété (indigenous peoples), the Baoule, the Sénoufo, the Tagbana and a large foreign community, came to settle in the area in search of forest land. The population of the study area increased from 332,561 to 440,259 between 1988 and 1998 is largely rural with traditional agriculture as the main activity (CI and MINEFOR 2001). Cash cropsgrown in the region are:coffee (3 659 tons per year), cocoa (26 622 tons/year), and sugarcane (2 682 tons per year). Coffee and cocoa are grown in the southern part of the region and some northern gallery forests and in some gallery forests while sugarcane is grown in northern part. The region of Bouaflé is renowned for the production of food crops: plantain (8338 tons per year), yam, maize, rice and cassava (27 456 tons per year), rice (53 320 tons per year). To these are added vegetable. Livestock is composed of chickens, cattle, goats, and pigs. Some fishing is done in the Marahoué River.

b. Sampling

The choice of villages where surveys were conducted was based first on the ecological zones. Thus two villages were chosen in the savanna and 2 in the forest zone. Secondly, taking into account the ethnic diversity, 4 villages were chosen: Tenkodogo, Pakouabo, Blanfla andSiétinfla. Tenkodois located at 5 km north of the city of Bouaflé in the savannah at7° 2' 39" North and -5° 45' 47"West. Its population is mostly the Mossi (Moré), originally from the Burkina Faso, deported in the region of Bouaflé during colonization by the French in 1934 (Meillassoux, 1999). The village of Pakouabo (7° 9' 20" North, 5° 47' 31" West) is located in the Savannah, at about 15 km of Bouaflé. Its population, the Ayaou, are from the originally from the center of the country who settled in this area after their lands were submerged by water from a hydroelectric dam. The two other villages, Blanfla (6°51′N 5°46′W) and Siétinfla (6° 59' 36" N, 5° 52' 30" W)are situated in the in the forest area,at is about 15 km and 22 km from Bouaflé respectively. They are populated by the Gouro, native of the Department. After a visit to the four selected villages, the total households were estimated to be 301 (Table 1) among which 244 were chosen for the surveys depending on their willing to answer the questions. First, 15 households were chosen to make a pre-survey in order to test the questionnaire especially regarding the interpretation of the words in local languages. After that, the questionnaire consisting of 3 modules: (1) the characteristics of respondents, (2) perception of climate change, and (3) the coping strategies were administratedwas administered individuallyat the house of each respondent. We were assisted, when it was necessary, by a translator to facilitate communication. These interviews were supplemented by discussion whenever necessary. For climate data analysis, the average annual precipitation and the index of Nicholson were calculated, to highlight the changes in rainfall patterns. The index which was calculated for each year determines seasonal variations (Nicholson *et al*. (1988) cited by Paturel *et al*. (1997 according to the following formula:

$$Ii = \frac{(Xi - \bar{X})}{\sigma}$$

With:

I_i: rainfall index
Xi: Rainfall for year i (mm)
X: Average Rainfall over the study period (mm)
σ: Standard deviation of the rain height over the study period.

According to the index of Nicholson, the inter-annual average of a series corresponds to a zero value (0). A normal period is a period during which the same fluctuation is observed on either side of the axis of the abscissa. In this case, the annual average is substantially equal to the average total rainfall. During the wet period, the annual average is greater than the average total rainfall[2], and during the dry season, it is the

opposite (PATUREL *et al*, 1997). The cartographic analysis of land coverwas done withimages from Landsat satellite obtained on the www.glovis.gov site. These images were processed with ENVI 4.7 software to obtain colored compositions. The information combined with field observations were used to map the land cover change using ArcGIS 10 software.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

The socioeconomic characteristics of the study population are shown in Table 2. The Baoulé ethnic group live in the village of Pakouabo (92.7%) and Sietinfla (35.7%) while the Mossi are mostly (98.5%) located in the village of Tenkodogo. Mostof the gouros live in the village of Blanfla (87%) and Sietinfla(45.2%). In Tenkodogo, agriculturethe principal activity of the population is quite diverse. Cash crop is cocoaandfood crops are dominated by maize which is the staple diet. Farm activities are dominated by cocoa, plantain and cassava as staple diet. Men represented 87.9 to 94.4% of head of households. The native of Cote d'Ivoire represented the majority (40-76%) of the households. Muslims accounted for 98.5% of household in Tenkodogo while animism is more important in the Baoulé (63.4%) and Gouro villages (69 to 81.5%). Christian religions are present in smaller proportions in the Baoulé (28%) and Gouro villages (11.9 to 16.8%). Adults represented 50.0 to 57.4% of the rural farmers. The educational level is secondary 32.9 to 53.7% primary level.

Perception of farmers on climate change: During the preliminary survey, change in rainfall and temperature were the concepts used by the household to express climate change that had an impact on their daily livehoods. Therefore the concept of change or climate variability was apprehended in this study by change in rainfall or in temperature. The vast majority of heads of household (95.5%) stated that they have observed a changing climate in their area. According to them, generally there were two rainy seasons and two dry seasons in the past. Currently, 49.6% of them admitted the difficult for them to recognize these patterns. Some of them, recognized two rainy seasons, others (54.1%) could no longer indicate rainy periods over the year. For example, 37% of them situated the rainy seasons in the period of March-June and September-October, while others (21%) argued that it is in March-July and September-November or in March-April and October-November. These observations reflect a change in the seasons in the region that may explain the observed climate change.
According to the heads of households; the disappearing of signs such as "the flowering of trees", "the rains of February 14 and July 14", and "the northern butterflies' migration to the south" that indicated the beginning of rain, showed that climate has changed. Besides that, farmers felt that rainy seasons are either early or late. Similarly, some of them (33.2%) had difficulty locating the end of the rainy season. Furthermore, 57% of them stated that rainfall has decreased compared to the past. Most of them (98%) also pointed out that there were one to two and a half months of drought during the rainy seasons.

The evaluation of variability of rainfall and temperature: The analysis of the degree of convergence between the perceptions of farmers and climate data using the index of Nicholson (Figure 1) indicated that the period from 1983 to 2013 can be divided into three periods: a wet period of 10 years (1983-1993), a dry period of 15 years (1994-2008) followed by a wet period (2009- 2013). The first wet period was characterized by an average rainfall of 816.77 mm, which was greater than the average rainfall of the last 30 years (680.68 mm), and represented an increase of 20%. The dry period has an average rainfall of 440.69 mm, which corresponded to a decrease of 35.26% compared to the average of the past 30 years. The third period corresponded to a wet period has an average of 1101.64 mm rainfall, an increase of 61.79% over the average of the past 30 years.

If we consider the index Nicholson, the 2009-2013 periods was rainy rather than dry with an increase in rainfall, which is totally contrary to the perception of the surveyed heads of household.

Figure 2 showed the monthly seasonal variations during the three time periods indicated earlier. The 4 seasons (two rainy seasons and two dry seasons) are well marked for the periods of 1983-1993 and 1994-2008. This is consistent with the transitional equatorial climate with four seasons encountered in the area of Bouaflé. However, some change was observed: an increase in the length of the long rainy season from 4 to 5 months (February-May to February-June) and a decrease in the length of the short rainy season, from 4 to 3 months (from July-October to August-October). This indicated that there has been a shift in the short dry season. This shift is complemented by a very sharp drop in the amount of rain in June, over the period 1994-2008 compared to the 1983-1993 period.

During the 2009-2013 period, 6 seasons instead were observed: a dry season of 4 months from November to February followed by a month of rain in March and a dry month in April. May to July (3 months) was arainy season followed by a dry season in August. The cycle ended with a rainy season of 2 months (September-October). This observed disorganization of seasons could explain why the surveyed households could no longer situate the periodicity of the seasons. In fact, what was actually observed in this area is a disruption in the rainy and dry seasons.

Figure 4 showed that temperature follows the same pattern as rainfall. The rainy seasons corresponded to the cooler period of the year. Although the 2009-2013 period was rainier, temperatures were higher during dry periods, which could explain the exacerbation of drought that was felt by population. Most the head of households (93%) believe that temperature is higher nowadays compared to the past. For them, the combination of the harmattan-high temperature, characterizing dry seasons contributes to the wilting of plants causing harvest loss.

Climate change and changes in land cover: The comparison of Landsat images of 1986, 2002, and 2013 (Figure 5) indicated that deforestation is continuing in this area. Indeed, forest lands lave decreased from 170.2 ha (1986) to 35.4 ha (2013), this represents a reduction of 79.3% over the last 11 years. This trend was also observed in a study on the risks of deforestation in Cote d'Ivoire (Brou *et al*, 2005). Besides that, three protected forest (Maraouhé, Bonon, and TOS) located in this area with a surface area of 82,310 ha and the National Park of the Maraouhé (over 101,000 ha) have lost more than 2/3 of their surface (Yeo, 2013).

Table 1. Sample rate of the households in the different villages

Villages	# Number of households	Number of households surveyed	Sampling Rate (%)
Pakouabo	105	82	78
Tenkodogo	84	66	79
Blanfla	64	54	84
Siétinfla	48	42	88
Total	301	244	81

The number of households were counted during a pre-survey

Table 2. Socio-economic characteristics pf the households

Characteristics		Blanfla		Pakouabo		Tenkodogo		Sietinfla	
		#Freq	%	Freq	%	Freq	%	Freq	%
Ethnic group	Gouro	47	87.0	0	0.0	0	0.0	19	45.2
	Baoulé	3	5.6	76	92.7	0	0.0	15	35.7
	Mossi	1	1.9	2	2.4	65	98.5	7	16.7
	Senoufo	1	1.9	0	0.0	0	0.0	1	2.4
	Bété	1	1.9	0	0.0	0	0.0	0	0.0
	Malinké	1	1.9	2	2.4	0	0.0	0	0.0
	Peuls	0	0.0	0	0.0	1	1.5	0	0.0
	Divers	0	0.0	2	2.4	0	0.0	0	0.0
	Total	54	100	82	100	66	100	42	100
Nationality	Ivoirien	53	98.1	76	92.7	64	97.0	40	95.2
	Burkinabé	1	1.9	4	4.9	1	1.5	2	4.8
	Malien	0	0.0	0	0.0	1	1.5	0	0.0
	Béninois	0	0.0	2	2.4	0	0.0	0	0.0
	Total	54	100	82	100	66	100	42	100
Religion	Musulman	2	3.7	7	8.5	65	98.5	8	19.0
	Chrétien	8	14.8	23	28.0	1	1.5	5	11.9
	Animiste	44	81.5	52	63.4	0	0.0	29	69.0
	Total	54	100	82	100.0	66	100	42	100
Sex	Homme	51	94.4	65	79.3	58	87.9	39	92.9
	Femme	3	5.6	17	20.7	8	12.1	3	7.1
	Total	54	100	82	100	66	100	42	100
Age	Jeune	14	25.9	22	26.8	17	25.8	10	23.8
	Adulte	31	57.4	42	51.2	34	51.5	21	50.0
	Vieux	9	16.7	18	22.0	15	22.7	11	26.2
	Total	54	100	82	100	66	100	42	100
Education	Analphabète	8	14.8	42	51.2	36	54.5	13	31.0
	Primaire	29	53.7	27	32.9	22	33.3	20	47.6
	Secondaire	15	27.8	11	13.4	8	12.1	8	19.0
	Supérieur	2	3.7	2	2.4	0	0.0	1	2.4
	Total	54	100	82	100	66	100	42	100

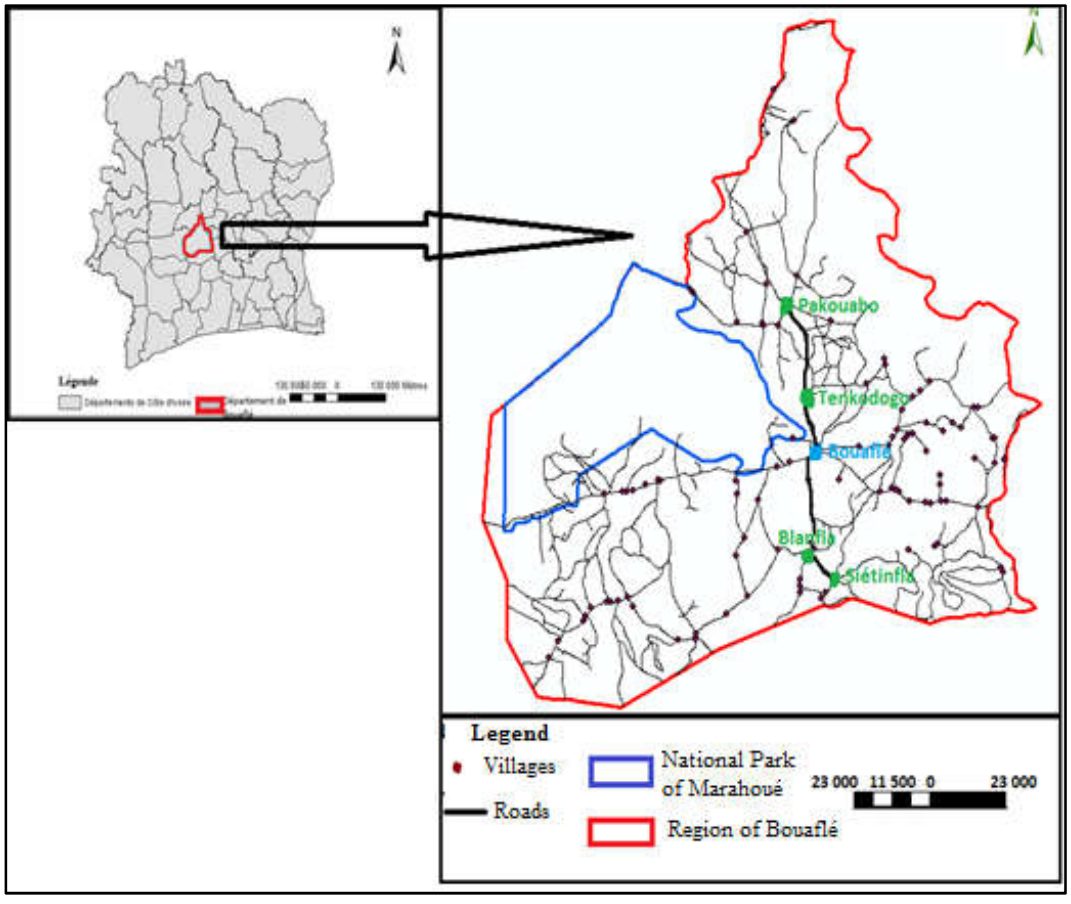

Figure 1. Map of the region of Bouaflé showing the village surveyed

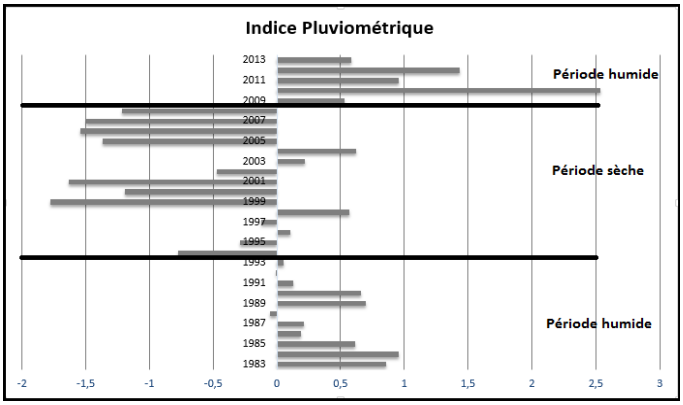

Figure 2. Distribution of the rainfall according to the index of Nicholson

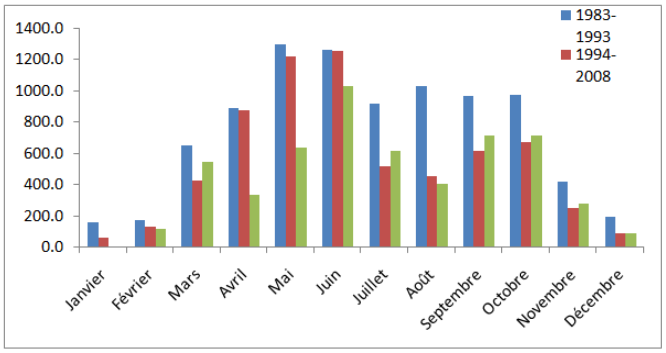

Figure 3. Mean temperature during the 2009-2013 period

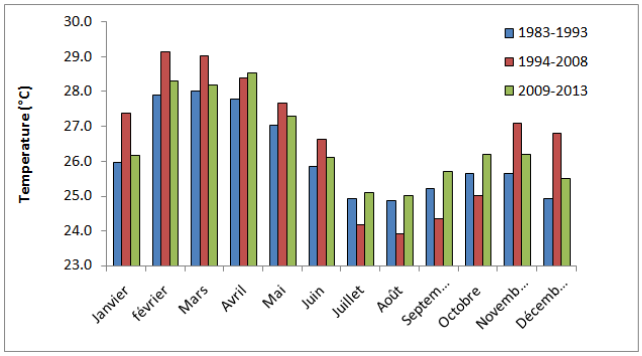

Figure 4. Mean rainfall during the 2009-2013 period

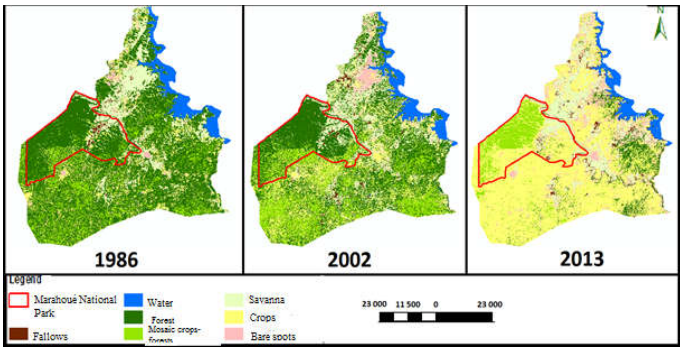

Figure 4. Land cover change between 1986 and 2013

Farmers indicated that 10-20 years ago, species such as iroko (*Miliciaexcelsa*, Moraceae), samba (*Triplochitonscleroxylon*, Sterculiaceae) and fraké (*Terminaliasuperba*Combretaceae) were abundant in Blanfla and Sietinfla. Even in this situation of scarcity, the remaining was logged mostly by illegal sawyers. Moreover, Farmers recognized that they also contributed to forest loss by the practice of bushfires and land clearing for farming. For farmers, the shortage of rain was due to the disappearance of forest. They argued that "forest calls the rain; therefore without forests, there is no rain". Unfortunately, legal and illegal logging of trees and agricultural practices such as slush and burning continue to impede in the remaining forest lands.

Coping strategies: Farmers stated, in 92% of the cases, that climate change had several effects on their crops such as the death of cocoa trees and corn stalks, the yellowing of leaves, the wilting of plants, the delayed seedling growth, the proliferation diseases. For 75% of them, this has led to drop of the production in this area. Faced with climate variability, producers have developed over time, a remarkable capacity to adapt to climate threats (KPADONOU *et al*., 2012). The most important adaptation measure concerns crop associations that take into account both cash crops and food crops. Associations such as cocoa-banana, cocoa-banana-eggplant-okra; cocoa-banana-cashew-cassava, yam-cassava were indicated by farmers. Cocoa-banana combination was the most practiced (61.5%). In this pair, banana was planted as cover plant to the young cocoa tree in order to protect them from the sun. Since banana does not disrupt the development of the cocoa tree it can remain in field for long time. This mixed farming system benefits the farmer because banana produced is used as stable food but can be sold providing substantial source of income to households. Cereal crops (5.7%) such as rice and maize, which are often in combination were farmed by the Mossi and non-indigenous populations. Part of the production was consumed; the remaining was sold and generated substantial income for households. Cassava-yams combined with peanuts were grown by women from the Baoulé ethnic group for self-consumption or sale. Peanuts were mostly sold to ensure the schooling of children.

Diversification of production was another strategy used by farmers to cope for climate change. It help farmers have multiple sources of income and food. For them if it doesn't work for one crop, the other may work. According to them, consumption account for 80.7% of this practice and 35.2% for income generation in order to face diseases, school enrollment charges. Diversification also helps cope with the reduction in cocoa production (6.2%) due to the "swollen shoot" which attacks the branches of the cacao causing their dieback leading yield reduction. To address land degradation, farmers said that they used techniques to maintain the fertility of soils. These practices include the use of herbicides (81.4% of the farmers). For them, the herbicides besides controlling weeds enrich the soil. In fact, using herbicides (no tillage) helps maintain soil moisture while killing weed. That's why farmers indicated that the use of herbicides would improve soil fertility. Weeds after being dried by the herbicides undergo a rapid decomposition and the returned nutrients enrich the soil. Fertilizers use cited by 13.1% of the farmers, as a practice to deal with the reduction of soil fertility. Fallow, once practiced by the farmers to restore soil fertility, was use by very few of them (3.6%). Another strategy used by 57% of the surveyed households to cope with climate change, the continuing adaptation of their calendar. According to them, it is only way for them to adapt to climate changes, as they stated: "we cannot do anything without the rain. So, we clear the land, we expect the rain and if it rains, we sow."

Conclusion

This study was done to highlight the similarities and differences between farmers' perceptions of climate change and climate observations. It appears that farmers were more marked by the deterioration of the quality of rainy seasons observed between 1994 and 2008, i.e. the change of the dates of the beginning and the end of the rainy season, the recrudescence of drought, and the lack of rainfall, than the relative recent regain of rainfall during this period (2009-2013). The perception of farmers may not always agree with climate data because the data use in this study were from the synoptic station of Yamoussoukro, located at about fifty kilometers from the study area. Farmers' perceptions deviate gradually from rainfall observations as one move away from the rainfall reference station due to the high spatial variability of rainfall in the Guinea region (Le Lay and Galle, 2005). The evolution of temperature remains almost the same during the considered period although an increase is observed in the period 2009-2013. Several hypotheses have been advanced to explain these differences, including the high cloud cover during rainy seasons that lowers solar radiation, the high deforestation rates, and population growth (Ozer *et al*., 2013). The evaluation of adaptation measures adopted by households showed that they are broadly relevant to their perception. Thus they used practices such as crop associations and diversification.

It seems urgent to propose alternatives to the use of firewood and charcoal and promote reforestation of the study area to reduce pressure on natural resources that exacerbate the impacts of climate variability. The use of chemical inputs (pesticides and fertilizers) can be counterproductive because of high their cost and the pollution they may cause. Finally, it would be desirable to promote reforestation in the area. This could take the form of agroforestry systems in which tree species would be introduced in crops. Success can only be guaranteed if these species find use among the population. These findings indicate the need for the political authorities to propose strategies that may help mitigate the changing climate.

REFERENCES

Adjanohoun, E. et J. L. Guillaumet, 1971. La végétation de la Côte d'Ivoire. In Avenard, J.M. *et al*. Le milieu naturel de Côte d'Ivoire, Mémoire ORSTOM N°50.

Ardoin, B.S., 2004. « Variabilité hydroclimatique et impact sur les ressources en eau de grands bassins hydrographiques en zones soudano-sahélienne ». Thèse de Doctorat de l'Université de Montpellier II, France. 330p.

Below T., A. Artner, R. Siebert, and S., Sieber, 2010."Micro-level practices to adapt to climate change for African small-scale farmers". International Food Policy Research Institute (IFPRI), Washington, DC; Discussion paper 00953.

Boko, M., I. Niang, A. Nyong, C. Vogel, A. Githeko, M. Medany, B. Osman-Elasha., R. Tabo, andP. Yandan, 2007."Changement climatique en Afrique: Impacts, adaptations et vulnérabilités". Contribution du groupe de travail II au 4e rapport d'évaluation du panel intergouvernemental sur le changement climatique, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden et C.E. Hanson, Eds., Cambridge UniversityPress, Cambridge, UK, 433-467.

Brou, Y, 2007. "Impacts des modifications bioclimatiques et dès l'amenuisement des terres forestières dans les paysanneries ivoiriennes : quelles solutions pour une agriculture durable en Côte d'Ivoire". Université d'Artois, UFR Histoire-Géographie, France. 28p.

Conservation Internationale) et Ministère des Eaux et Forêts 2001. "Ligne Directrices pour le Parc National de la Marahoué, République de Côte d'Ivoire", 91p.

Diomande, M., K. Dongo, K. B. Dje, K. K. H., Kouadio, D. Kone, J. Biemi, B. Bonfoh, 2007. Vers un changement du calendrier cultural dans l'écotone foret-savane de la côte d'ivoire". Agronomie Africaine, 25 (2) : 133 - 147

Doumbia, S. 2013. "Perception paysanne du changement climatique et stratégies d'adaptation en riziculture pluviale". CNRA 10p.

Eldin, M. 1971. Le climat. In Avenard J. M. "Le milieu naturel de la Côte d'Ivoire." Mémoire ORSTOM, n° 50. Paris. P. 73-108.

Kahiluoto H, Rimhanen K, Ro¨tter R, Tseganeh B (2012) "Mitigation of climate change to enhance food security: an analytical framework". Forum DevStud 39:51–73

Kendzi, K. 2009. L'environnement et l'Afrique. http://cuaab 33.blogvie.com/2009/12/21/lenvironnement-et-lafrique-par-dr-kendzi-kaddour-cuaab-universite-bordeaux-2/ (online décembre 21st, 2009)

Kouassi J.V., 2005. Climatiques besoins et priorités de la côte d'ivoire en matière de renforcement des capacités dans le domaine des capacités. Projet d'autoévaluation des capacités à renforcer pour la gestion de l'environnement mondial (ANCR-GEM), Côte d'ivoire. 42p.

Kpadonou, R.A.B., Adégbola, P.Y., et, Tovignan, S.D., 2012. Local knowledge and adaptation to climate change in Ouémé valley, Benin, African Crop Science Journal 20 (Suppl. 2), pp. 181-192.

Le Lay, M. et S., Galle, 2005, Variabilités interannuelle et intra-saisonnière des pluies aux échelles hydrologiques. La mousson ouest-africaine en climat soudanien, Hydrol. Sci. J., 50, 3, pp. 509-524.

Marie-ange B. 2012, Etude de l'adaptation au changement climatique des populations africaines : le cas de communautés agricoles au sud du Bénin. Thèse de doctorat, Université Libre de Bruxelles, Belgique, 327p.

Meillassoux, C.1999. "Anthropologie économique des Gouro de Côte d'Ivoire : de l'économie de subsistance à l'agriculture commerciale". Éditions de l'École des Hautes Etudes en Sciences Sociales, Les réimpressions (Coll.). Open Edition,: 382 p. ISBN: 9782713212970.

Nhemachena, C. and Hassan, R. 2007. "Micro-level analysis of farmers' adaption to climate change in southern Africa", IFPRI Discussion Paper 00714. International Food Policy Research Institute (IFPRI), Washington, DC.

Nicole, C. 2008. "Changement climatique au Mali". Intercorporation Sahel. 18p.

Ochou, E. 2012. "Analyse de l'impact des changements climatiques sur la production agricole en Côte d'Ivoire". Mémoire de DEA. Université Félix Houphouët Boigny, Abidjan, Côte d'Ivoire,.49p.

Ozer, P., Hountondji, Y. C., GASsANI, J., Djaby, B., De Longueville, F. 2014. "Évolution Récente des Extrêmes Pluviométriques en Mauritanie (1933-2010)". XXVIIe Colloque de l'Association Internationale de Climatologie 2-5 juillet 2014 – Dijon (France). 394-400.

Paturel, J. E., Servat, E., Kouame, B., Lubes-Nie, l H.,Oouedraogo, M., Masson, J. M. 1997. "Climatic variability in humid Africa along the Gulf of Guinea Part

II: an integrated regional approach". *Journal of hydrology*, vol.191, pp. 16-36

Thornton, P.K, Jones, P?G., Alagarswamy, G,, Andresen, J, Herrero, M 2010. "Adapting to climate change: agricultural system and household impacts in East Africa". *AgricSyst*., 103(2):73–82

Yeo, S. 2013. "Etat des lieux post-crise du parc national de la Maraouhé (Côte d'Ivoire)". Mémoire de fin d'étude pour l'obtention du diplôme d'Ingénieur agronome option Eaux, Forêts, EFCPC, INP-HB, Yamoussoukro, Côte d'Ivoire. 67p.

****