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Farming Households' Adaptation Strategies Against Climate Change in the Department of Mono (Southern Benin)

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Abstract:- This article assesses the coping strategies implemented by farming households in the Department of Mono based on a sample of 510 rural households. The article uses descriptive statistics to determine the coping strategies most developed by farming households. Strategies with percentages greater than or equal to 50% are considered to have been adopted by the majority. The results show that 81.96% of farming households in the study area change their agricultural calendar, 73.73% use dry ploughing for semi-early start-up, 80% use collective prayers, 64.71% adopt short-cycle variety crops, 77.65% engage in non-agricultural income-generating activities, 55.69% and 58.82% use modified sowing and mulching respectively. The late start and poor distribution of the rains, the increasing frequency of droughts and falling rainfall justify the use of these strategies. In view of these results, there is an urgent need to support rural households in choosing and implementing effective coping strategies against climate change.

Keywords:- *Strategies, Farming Households, Climate Change, Department, Mono And Rural Areas.*

I. INTRODUCTION

Climate change poses a threat to agriculture. By affecting agricultural yields, the availability of arable farmland and agro-climatic conditions, climate change negatively affects the agricultural production and exposes rural populations to the risk of food insecurity [1], [2]. Populations whose livelihoods are directly linked to agriculture are the most vulnerable to climate change [3],[2]. Smallholders in developing countries are more exposed [4], [5], [6]. To protect themselves against the consequences of climate change, farming households resort to adaptation strategies. These are precautions to reduce farmers' vulnerability to climate hazards [7], while making agricultural production systems and people's livelihoods resilient [8].

For adaptation strategies to be effective, they must incorporate innovation. Thanks to information systems, new ideas should enable the adoption of new technologies that boost agricultural production [8] and preserve soil quality. For example, sustainable intensification, agroecology, sustainable water, and carbon management are innovative. Sustainable intensification involves improving soil organic matter through nutrients such as external fertilizers, water, and the use of improved crop varieties [9], [10]. Agroecology makes the most of the interactions between animals, humans, and plants to ensure sustainable agriculture [11], [9]. Examples include biomass recycling and the use of natural pest predation. As biodiversity increases biomass recycling, enhances functional biodiversity (habitat creation for pests) and biological interactions, and provides organic matter to the soil, it represents a good measure of adaptation to climate change [12].

Apart from sustainable water management, sustainable intensification, and agroecology, which are aimed directly at improving farming systems, other adaptation measures are aimed at improving livelihoods. These include agricultural diversification, risk management, reducing gender inequalities and migration. In the last two cases, adaptation measures integrate gender disparities to ensure greater protection for women. Women's access to credit and insurance [13] and their access to weather information can boost their productivity [14]. Migration is seen as a coping strategy in its own. Rural populations use it to improve their livelihoods, i.e., their incomes. However, adaptation can involve reducing waves of migration so that rural populations stay in their homeland to increase agricultural production [15].

In developing countries, the adoption of adaptation strategies is hampered by the cost of adaptation [2]. However, as the cost of inaction is greater than that of action, investing in climate change adaptation strategies is important in developing countries [16]. For example, a study carried out in Vietnam estimates the annual cost of adaptation at $160 million, representing only a fraction of the cost of inaction. Small-scale farmers are limited in their

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adoption of technologies and improved, climate-smart practices. They have limited access to credit, information, and markets, and above all they are not covered by a social safety net that protects against the degradation of livelihoods [17].

Other social protection approaches are more geared to the occurrence of climate risk, including the provision of short-cycle cropspecies, reforestation and humanitarian aid in the event of climatic catastrophe. Index insurance, a form of social protection against climate change, is currently being tested in many developing countries. It involves making payments to farmers when they are affected by falling rainfall or rising temperatures [4].

Each country develops its own set of coping strategies based on the degree of exposure to climate shocks and the sensitivity of agro-ecological systems [4]. In Benin for instance, the National Adaptation Program (PANA) was designed to identify priority adaptation measures based on livelihood vulnerability. By way of illustration, a study carried out in Benin, on adaptation measures and technologies in nine (9) Beninese Communes, highlighted several adaptation techniques [18]. Faced with the horrors of climate change, Benin's farmers adopt endogenous and exogenous adaptation strategies [20], [21], [22], [23].

The current paper analyzes the coping strategies implemented by farming households in the face of climatic shocks to food production and determines the reasons for adaptation of each strategy in the Mono/Benin Department.

II. DATA AND METHOD

➢ *Data*

This article uses data collected from farming households on coping strategies and demographic data. The latter was drawn from the population census (RGPH 1, 2, 3 and 4) initiated in four rounds by the national institute of economic analysis (INSAEA). The demographic data were used to determine the sample size from equation 1 [24]. $\boldsymbol{\alpha}$ represents the risk threshold, **P** the percentage of agricultural households, **and** $\boldsymbol{Z}$ the standard deviation. Data on coping strategies were collected using an individual questionnaire from 510 farming households determined (see Equation 1).

$$X_i = \frac{Z_{1-\alpha/2}^2 * P(1-P)}{\alpha^2} \quad (1)$$

Figure 1 depicts the study area, that is the Department of Mono.

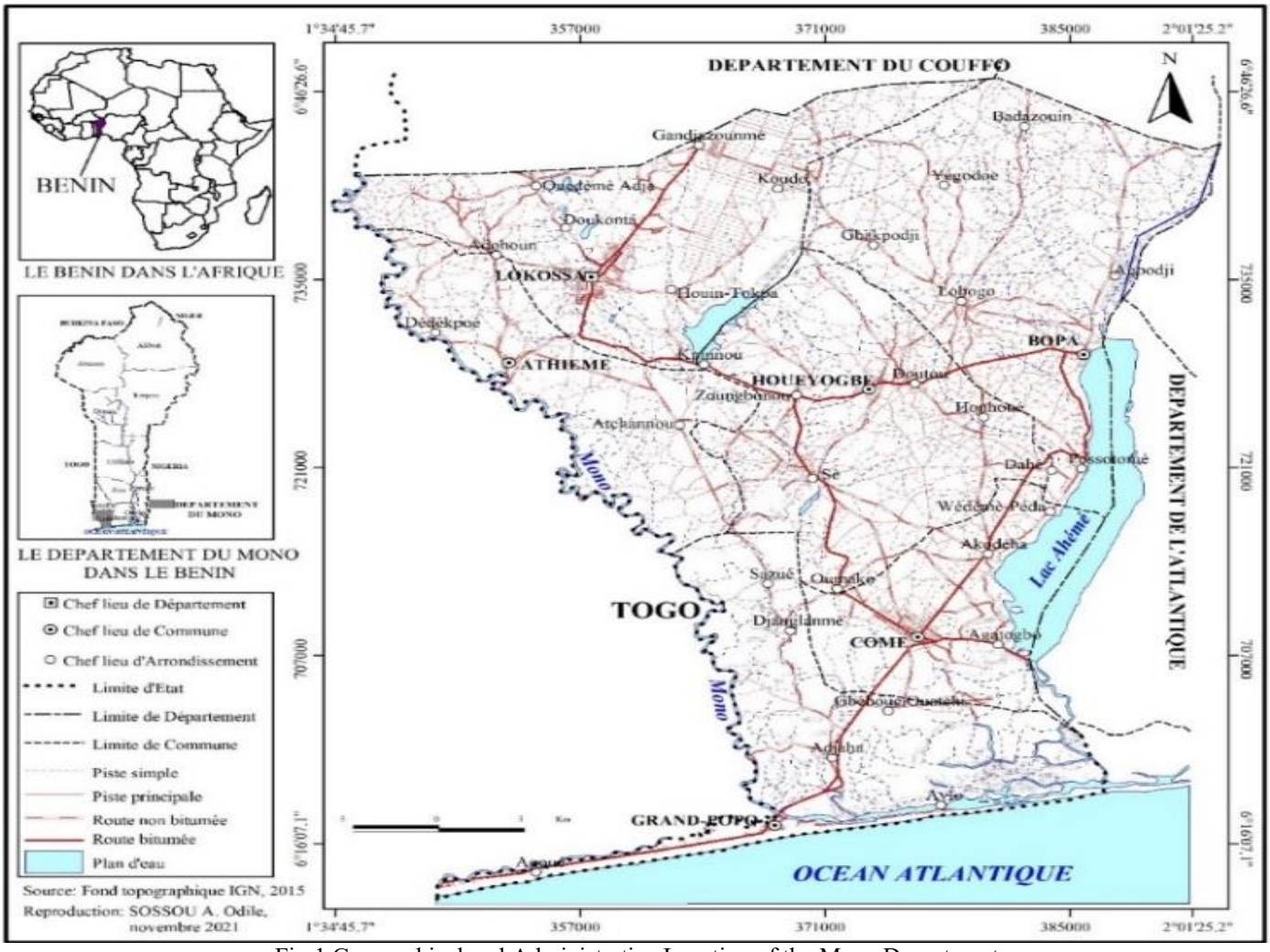

Fig 1 Geographical and Administrative Location of the Mono Department

The Department of Mono is located between 1°34'45.7" and 2°01'25.2" North latitude and between 6°16'0.7" and 6°46'36.6" East longitude. It includes the Communes of Athiémé, Bopa, Comè, Grand-Popo, Houéyogbé and Lokossa. The Department is bordered to the North by the Department of Couffo, to the South by a forty-kilometer (40 km) stretch of coastline on the Atlantic Ocean, to the East by a succession of bodies of water formed by the Couffo river valley, Lake Ahémé and the Aho river, which form its border with the Department of Atlantique, and to the West by the Republic of Togo, with a 90 km natural border formed by part of the Mono river (figure 1). According to the population census conducted recently in 2013 (RGPH4), the Department of Mono is home to 105,986 households, of which 37,639 are farming households, representing around 35.51% of all farming households. This statistic reflects the preponderance of the agricultural sector in the Department of Mono, a sector from which most households derive their livelihood. Therefore, rising temperatures and falling rainfall are threats to agriculture around study. This situation prompts farming households to develop coping strategies.

➢ *Method*

The analysis was carried out in two stages. First, the knowledge of the strategies has been analyzed. Then, the extent to which they were used was assessed. Descriptive statistics were used to select the adaptation strategies mostly used by farming households. For each strategy (***i***), the proportion (***f***) of positive responses (choice of the "yes" modality if the household adopts the indicated strategy) is calculated using Equation 2, with ***n*** the number of positive responses (the number of households using the adaptation strategy) and **N** the total number of households surveyed. Strategies with percentages greater than or equal to 50% are those adopted by most households.

$$f_i = \frac{n_i}{N_i} * 100 \quad (2)$$

III. RESULTS AND DISCUSSION

❖ *Climate Change Adaptation Strategies in the Mono Department in Southern Benin*

They bring together the various adaptation techniques implemented by farmers to cope with climate change.

A. Change of Agricultural Calendar and Dry Ploughing

An increasingly unpredictable climate, with rising temperatures and falling rainfall, has made agricultural production vulnerable and uncertain. Faced with repeated climatic variability, the agricultural calendar is disrupted and modified. Developing coping strategies, farmers are forced to gradually abandon the old (empirical) calendar and adapt to their own. Not only are sowing dates changed, but sowing is also repeated, resulting in seed losses. Changes in the agricultural calendar force farmers to practice dry ploughing and look for other non-agricultural sources of income. Figure 2 illustrates the extent to which households have adopted these strategies.

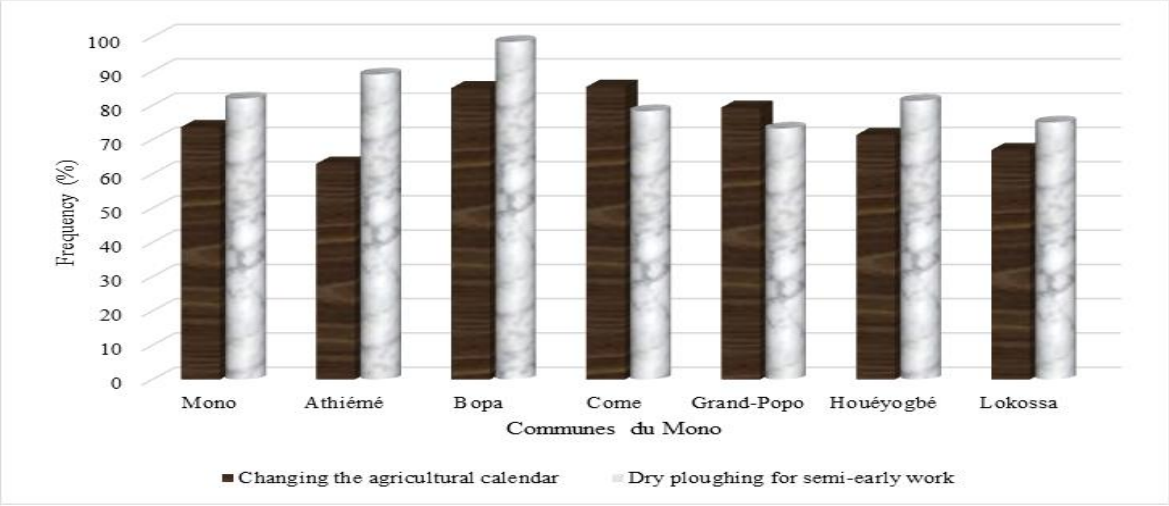

Fig 2 Change of Agricultural Calendar and Dry Ploughing
Source**:** Results of field surveys, Sossou A.O., September 2021

Figure 2 indicates that the empirical agricultural calendar is no longer functional in Department of Mono, as farming households have adopted their own calendars based on the occurrence of climatic phenomena in the area (droughts, late rains, floods). Farming households in Mono are changing their agricultural calendars to adapt to the effects of climate change, which are reflected in the disruption of traditional times devoted to agricultural activities including ploughing, sowing, weeding, and fertilizer spreading. The dates of fieldwork have been modified. For example, when fields are flooded during the short rainy season, sowing, which should start in early September, takes place in October after the flood waters have receded. To avoid late sowing, some farming households in Mono (81.96%) use dry ploughing, a method that involves ploughing the land early before the first rain. Dry plowing is used to gain time after a late rain. However, this practice is risky, as in most cases it leads to seed loss in the event of isolated and late rainfall [25].

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B. Collective Prayers and Recourse to Rainmakers

In regions where agriculture depends exclusively on rainfall, long droughts and torrential rains are detrimental to food production. In rural Benin, beliefs are sometimes intertwined with rainfall variations. A long drought can be interpreted as the wrath of the "gods" against incestuous practices or against mankind. To ward off fate and bring down the rain, the local populations engage in prayers and sacrifices. These practices are generally observed among rural populations whose survival depends on agricultural harvests. In the Department of Mono, farming households call on collective prayers and rainmakers to stop the incessant rains or to stimulate the arrival of rain. Figure 3 illustrates the frequency of adoption of collective prayers and the practice of rainmakers in Mono.

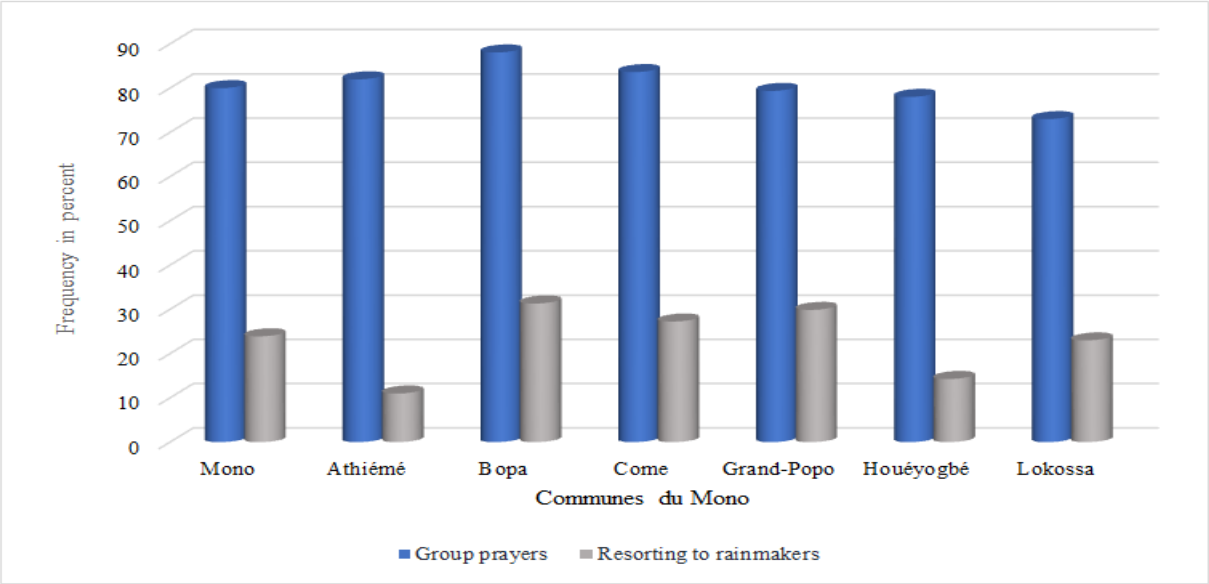

Fig 3 Collective Prayers and Recourse to Rainmakers
Source: Results of fieldwork, Sossou A.O., September 2021

Figure 3 shows that collective prayer is more popular (80%) than the use of rainmakers (28.92%). In the six Communes of Mono, collective prayers are commonly used to attract rainfall. Although these prayers come from populations whose beliefs are rooted in animism, they also come from Christians. These coping strategies are also practiced in other Departments in Benin [26].

C. Abandonment of Long-Cycle Crops, Adoption of New Crops or Short-Cycle Crops

The adoption of short-cycle crops is a strategy that makes up for the delay in the agricultural calendar. It's also a sustainable approach, as these crops are resistant to insects (pests), especially when they are improved types. Facilitating crop rotation in an environment characterized by a scarcity of arable land is another reason for adopting short-cycle varieties. In Mono, the adoption of new short-cycle crops is the general trend (figure 4).

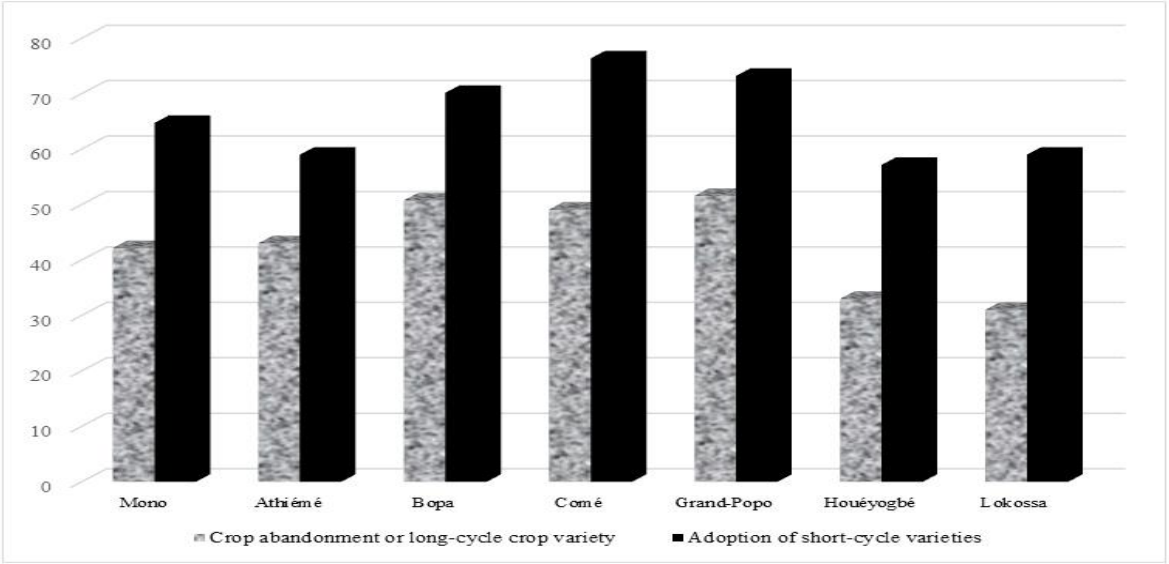

Fig 4 Abandonment of Long-Cycle Crops, Adoption of New Crops
Source**:** Results of fieldwork, Sossou A.O., September 2021

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Figure 4 demonstrates that long-cycle crops are increasingly being abandoned in Mono. Long-cycle crops no longer seem to respond to the climatic context. In the Department of Mono, 51.75% and 51.5% of farming households in the Communes of Bopa and Grand-Popo respectively opt to abandon long-cycle crops. Under these circumstances, the adoption of short-cycle crop varieties has become the general trend in the six (06) Communes of the Mono, with 76.36% adoption in Comé, 59% in Athiémé, 70.15% in Bopa, 59% in Lokossa, 73.2% in Grand-Popo and 57.14% in Houéyogbé. The adoption of new crops and the abandonment of long-cycle crops have also been documented in northern and central Benin [25], [27].

D. Change of the Production Techniques and use of Chemical Fertilizers

Climate change not only alters the agricultural calendar. It also reduces soil fertility. To this end, soil quality can be improved by cultural techniques such as crop rotation, crop combinations, fallowing and the choice of a particular type of ploughing, as well as by the administration of chemical fertilizers accompanied by organic manures. Figure 5 indicates the percentages of adoption of these strategies.

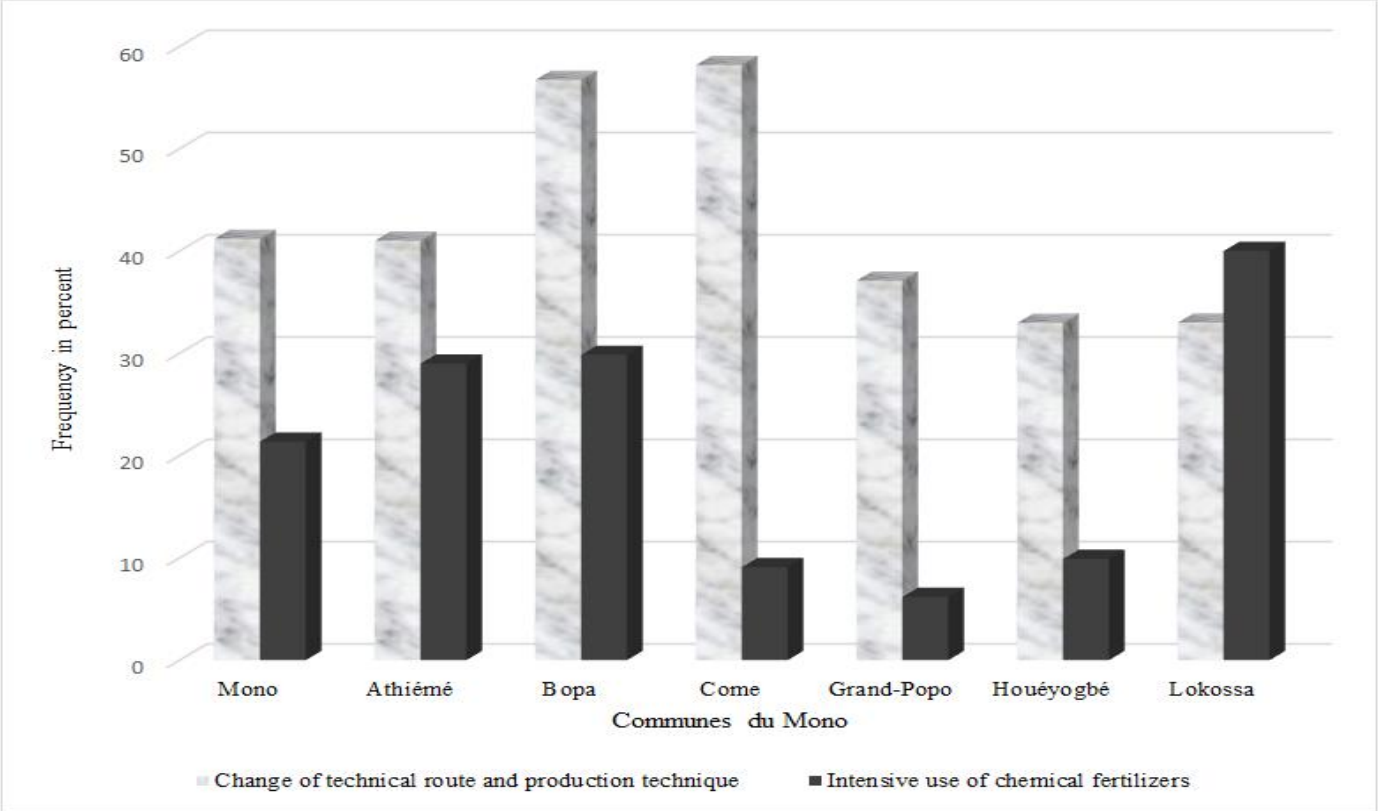

Fig 5 Change of Production Technique and use of Chemical Fertilizer
Source: Results of fieldwork, Sossou A.O., October 2021

To adapt to climate change, farming household change their production techniques. Findings show that 56.72% and 58.18% of farming households in the Communes of Bopa and Comé adopt this adaptation strategy respectively (Figure 5). Chemical fertilizers are rarely used throughout the Department. As chemical fertilizers are not produced locally, they can be prohibitively expensive for small-scale subsistence farmers. Unlike the Department of Mono, where the use of chemical fertilizers is low, chemical fertilizers are used in large proportions in northern and central Benin [27].

E. Agricole Credit And Other Non-Agricultural Activities

Non-agricultural livelihood is often developed to cope with the impacts of climate change in developing countries. To compensate for periods of prolonged drought or abundant rainfall that endanger crops in the fields, farming households diversify their sources of income through non-agricultural employment. Heads of household combine agricultural work with other occupations such as masonry, sewing, blacksmithing, the production and trading of local spirt (Sodabi), while women engage in small-scale processing and marketing of agricultural products. These different strategies are also practiced by smallholders in Kandi-Banikoara [19].

Figure 6 illustrates the extent to which farm households in the Department of Mono are diversifying their income-generating activities.

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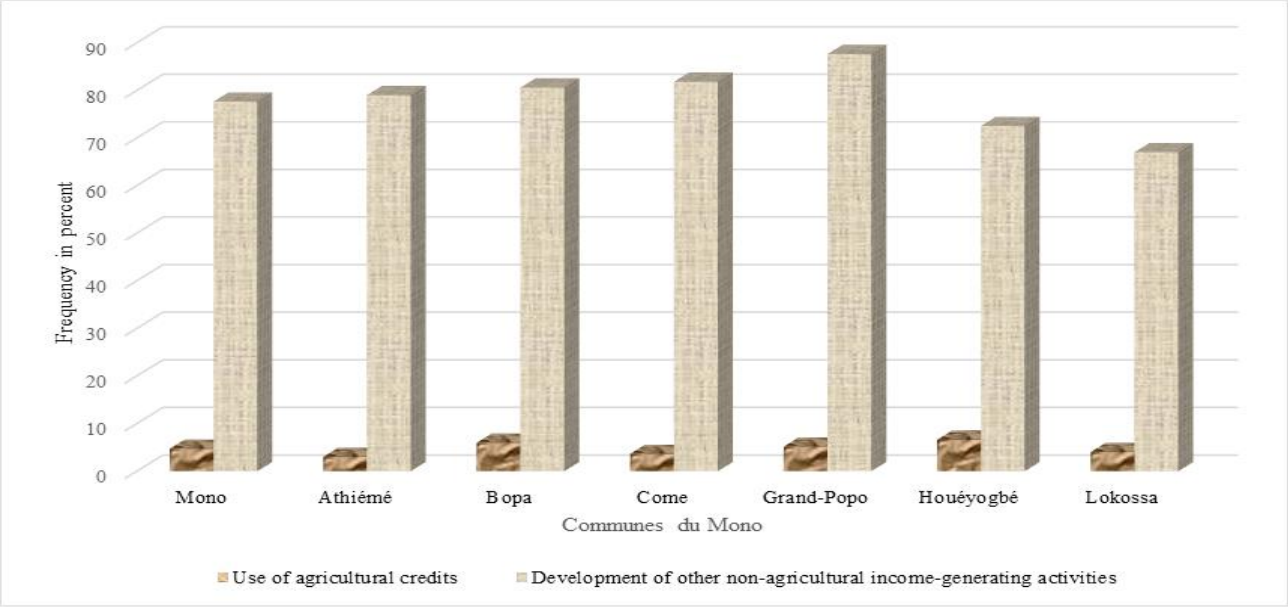

Fig 6 Agricultural Credit and the Development of Other Non-Agricultural Activities
Source: Results of fieldwork, Sossou A.O., October 2021

Figure 6 shows that 77.65% of farming households surveyed have developed non-agricultural activities to ensure food security for household members in the context of climate change. This percentage is almost identical in the six Communes of the Department of Mono. However, the success of these non-agricultural activities is hampered by limited access to credit. Because most of the farming households are poor and lack collateral, they are excluded from the traditional financial system (banks). The climatic risks to which agriculture is subject, including the risk of price volatility for agricultural goods, further accentuate the exclusion of farming households from agricultural credit.

F. Change of Production Sites

The search for moisture for plants and fertile arable land is driving small-scale farmers to change the location of their farms. Lowlands and fallow land are increasingly exploited to increase food production. Table 1 illustrates the results of changes in farming sites in the Department of Mono.

Table 1 Change of Operating Sites

Adoption frequency (%)	Mono	Athiémé	Bopa	Comé	Grand-Popo	Houéyogbé	Lokossa
Shifting cultivation to lower slopes	24,1	20	25,3	21,8	58,7	1,1	16
Use of several landscape units	38,8	24	50,7	41,8	54,6	31,8	35
Change of plot sites	39,6	25	46,2	40	58,7	41,7	29
Lowland farming	38,8	55	40,3	16,3	71,1	0	38

Source: Results of fieldwork, Sossou A.O., October 2021

Table 1 shows the frequency with which farm households exploit new production sites. The table shows that shifting cultivation to lower slopes (58.76%), exploiting several production sites at once (54.64%), changing plot sites (58.76%) and exploiting lowlands (71.13%) are more common among farming households in the Commune of Grand-Popo. The other Communes only marginally adopt these coping strategies, except for the Commune of Bopa, where 50.75% of farming households exploit several landscape sites for their crop production.

G. Water Management

Water management is critical to agricultural development. During dry periods, when plants lack water, irrigation appears to be the solution. Irrigation is the artificial delivery of water to plants to improve their productivity. Unlike irrigation, which is commonly practiced during dry periods, the construction of drainage channels and dykes enables water to be evacuated in the event of flooding. Table 2 shows the extent to which water management strategies are practiced in the Department of Mono.

Table 2 Water Management Strategies

Adoption frequency (%)	Mono	Athiémé	Bopa	Comé	Grand-Popo	Houéyogbé	Lokossa
Construction of drainage channels or dikes	4,7	6	0	1,8	13,4	0	4
Irrigation	6,6	13	1,4	1,8	13,4	0	6
Drinking water supply for livestock	14,3	22	14,9	21,8	11,3	10,9	8
Longitudinal trench to promote water infiltration	4,9	7	1,4	3,6	7,2	4,4	4

Source: Results of fieldwork, Sossou A.O., October 2021

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Table 2 indicate that very few farming households adopt water management strategies. Of those surveyed, 4.71% have built dykes, 6.67% practice irrigation and 4.9% have dug longitudinal trenches to promote water infiltration. In addition, only 14.31% of households supply their livestock with drinking water. These statistics are virtually the same in all six Communes of the Department (table 2).

H. Changes in Planting, Reforestation, Mulching, Connecting Log Ends

Other strategies are also deployed by farmers to preserve soil quality and conserve moisture. These include modifying planting patterns, reforestation, and mulching. Mulching is a farming technique that involves covering the soil around plants with straw or organic matter. Straw is often made from wilted plant leaves, which do not carry seeds that could be a source of weed invasion. The aim of mulching is protecting the soil from the sun's rays, maintaining biological life in the surface layer of the soil, fertilizing the soil by adding organic matter and limiting the mechanical effects of rain. These different strategies are listed in Table 3.

Table 3 Modification of Planting, Reforestation, Mulching and Ridge end Connection.

Adoption frequency (%)	Mono	Athiémé	Bopa	Comé	Grand-Popo	Houéyogbé	Lokossa
Change in sowing area	55,6	59	71,6	58,1	58,7	45	47
Reforestation/Agroforestry	38,4	40	52,2	29	46,3	30,7	32
Mulching	58,8	60	60,9	69	58,5	53,1	56
Connecting log ends	6,2	9	2,9	1,8	10,3	0	10

Source: Results of fieldwork, Sossou A.O., October 2021

The modification of sowing and mulching is the most widely adopted of the strategies listed in Table 3. In Mono Department, 55.6% and 58.8% of respondents respectively said they had modified their sowing and used straw to adapt to the adverse effects of climate change. Modification of sowing is more common in Bopa (71.6%), Comé (58.1%) and Grand-Popo (58.7%), while mulching is adopted by the majority in the six Communes of Mono. Table 3 also shows that only farming households in the Commune of Bopa (52.2%) adopt reforestation as their main climate change adaptation strategy, as previous studies have shown [28]. Changes in cropping patterns and the use of mulch were also identified in the Communes of Adjohoun and Dangbo as strategies for adapting to climate change [28], [20].

I. Reasons for Adapting Strategies

The coping strategies identified and predominantly developed by farming households in the Department of Mono are initiated for very specific reasons. Table 4 shows the reasons for using these strategies.

Table 4 Reasons for adopting climate change adaptation strategies

	Athiémé	Bopa	Comé	Grand-Popo	Houéyogbé	Lokossa
Collective prayers	More frequent droughts	More frequent droughts	Late start or poor rainfall distribution	More frequent droughts	Late start or poor rainfall distribution	More frequent droughts
Resorting to rainmakers						
Crop abandonment or variety of long-cycle crops		More frequent droughts		Fewer rainy days		
Adoption of short-cycle crop varieties	Fewer rainy days	Fewer rainy days	Late start or poor rainfall distribution	Fewer rainy days	Late start or poor rainfall distribution	Fewer rainy days
Connecting log ends						
Shifting cultivation to lower slopes				Fewer rainy days		
Changes to the agricultural calendar	Late start or poor rain distribution	Fewer rainy days More frequent droughts	More frequent droughts	Fewer rainy days	More frequent droughts Late start or poor rainfall distribution	Fewer rainy days
Change of technical itinerary and production technique		More frequent droughts	More frequent droughts			
Dry ploughing for semi-early work	Late start or poor rainfall distribution	Late start or poor rainfall distribution	Late start or poor rainfall distribution	Late start or poor rainfall distribution	Late start or poor rainfall distribution	Late start or poor rainfall distribution

Use of agricultural credits						
Use of several landscape units		Late start or poor rainfall distribution		Lower rainfall levels		
Change of plot sites				Persistent drought during the long dry season		
Change in sowing area	Fewer rainy days	Fewer rainy days	Fewer rainy days	Fewer rainy days		
Reforestation/Agroforestry		More frequent droughts				
Development of other non-agricultural income-generating activities	More frequent droughts	More frequent droughts	More frequent droughts	More frequent droughts	Late start or poor rainfall distribution	Late start or poor rainfall distribution
Construction of drainage channels or dikes						
Irrigation						
Lowland farming	More frequent droughts			More frequent droughts		

Source: Results of fieldwork, Sossou A.O., May 2021

Table 4 highlights two points. Firstly, certain adaptation strategies are used for reasons that vary from one Commune to another. These include collective prayers, abandonment of long-cycle crops, adoption of short-cycle crops, changes in the agricultural calendar, changes in cropping patterns, mulching and non-agricultural activities. For example, collective prayers are adopted in Athiémé, Bopa, Grand-Popo and Lokossa because of the increased frequency of drought, whereas they are requested in Comé and Houéyogbé by farming households because of the late start and poor distribution of the rains. The second observation stems from the fact that some reasons for adopting adaptation strategies are shared by the Communes. For example, farming households change their production techniques because of the increased frequency of drought, and dry ploughing is practiced when the rains start late. These results suggest that the reasons for the use of coping strategies by farm households in Mono are like those in the Communes of Adjohoun and Dangbo [20].

IV. CONCLUSION

This article analyzed the adaptation strategies implemented by farming households in the Department of Mono against the impacts of climate change on food production. Specifically, the article determined the mostly adopted coping strategies and the reasons behind their adoption. Based on a sample of 510 farming households, the article mainly used descriptive statistics to achieve the research objectives. The results showed that changing the agricultural calendar, dry ploughing, collective prayers, adoption of short-cycle crops species and income-generating activities are the most adopted coping strategies by farming households in the Department of Mono. Endogenous strategies (collective prayers and mulching) seem to be more developed than exogenous strategies (irrigation and intensive use of chemical fertilizers). Moreover, the technological content of these strategies is low, which could limit their effectiveness. Findings indicated further that increased drought, late onset of the rain, and poor rainfall distribution are the main reasons farming households adopt climate change strategies. In view of the findings, policy-makers need to adopt a plan to support small-scale farmers in implementing climate change adaptation strategies.

REFERENCES

[1]. Robert B. Zougmoré, Samuel T. Partey, Mathieu Ouédraogo, Emmanuel Torquebiau and Bruce M. Campbell (2018). Climate variability in sub-Saharan Africa: analysis of climate-smart agriculture opportunities for risk management, Cah. Agric. Volume 27, Issue 3, p. 9.

[2]. Nelson C. Gerald, Rosegrant W. Mark, Koo Jawoo, Robertson Richard, Sulser Timothy, Zhu Tingju, Ringler Claudia, Msangi Siwa, Palazzo Amanda, Batka Miroslav, Magalhaes Marilia, Valmonte-Santos Rowena, Ewing Mandy and Lee David (2009). Climate change: Impact on agriculture and costs of adaptation. Report of the International Food Policy Research Institute IFPRI Washington, D.C. pages 19.

[3]. Wheeler T. and Von Braun J. (2013). Climate change impacts on global food security. Science, 341(6145), pp. 508-513.

[4]. FAO (2016a). The State of Food and Agriculture climate change, agriculture and food security. *Food and Agriculture Organization of the United Nations,* Rome, 234 P.

[5]. DEKOUN Stanislas Eusebe Yao (2009). Perceptions, local knowledge and climate change adaptation strategies developed by producers in the Communes of Lokossa and Athiémé in the Department of Mono, Benin. PhD thesis in economics, socio-anthropology and communication for rural development.
[6]. Jost C., Kyazze F., Naab J., Neelormi S., Kinyangi J., Zougmore R., Aggarwal P., Bhatta G., Chaudhury M., Tapio-Bistrom M.L., Kristjanson P. And Nelson S. (2015). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. Climate and Development, 8(2), pp. 133-144.
[7]. Sultan Benjamin, Richard Lalou, Mouftaou Amadou Sanni, Amadou Oumarou, Mame Arame Soumaré (2015). Rural societies facing climate and environmental change in West Africa. IRD Éditions, p. 463.
[8]. Badolo M. (2008) Indications of the potential impact of climate change on food security in the Sahel. Bulletin mensuel d'information sur les changements climatiques de l'institut d'applications et de vulgarisation en sciences, Cahier des changements climatiques, N°6, p. 9.
[9]. CGAAER (2015). Food security and climate change in the Mediterranean and West Africa What action agenda for COP 21? Report, preparation for COP 21, the 3rd Edition, p. 6.
[10]. Lagandre D, Chetaille A. (2010)." L'assurance indicielle, une réponse face aux risques climatiques ". Grain de sel 49: 20-1.
[11]. HLPE. (2016). Sustainable agricultural development for food security and nutrition: what roles for livestock? A report of the High-Level Panel on Food Security and Nutrition of the Committee on World Food Security. Rome, FAO.
[12]. Nicholls C.I., Altieri M.A. and Vazquez L. (2016). Agroecology: Principles for the Conversion and Redesign of Farming Systems. Journal of Ecosystem and Ecography, S5: 010.
[13]. World Bank. (2010). Development and climate change - World development report. Washington.
[14]. Tall A., Kristjanson P., Chaudhury M., Mckune S. and Zougmoré R. (2014). Who gets the information? Gender, power and equity considerations in the design of climate services for farmers. CCAFS Working Paper No. 89. Copenhagen, CCAFS.
[15]. KNOMAD (2014). Environmental change and migration: state of the evidence, KNOMAD thematic working group on environmental change and migration. Washington.
[16]. OECD. (2015). The economic consequences of climate change. Paris.
[17]. Arslan A., Belotti F. and Lipper L. (2016). Smallholder productivity under climatic variability: Adoption and impact of widely promoted agricultural practices in Tanzania. ESA Working Paper 16-03. Rome, FAO.
[18]. UNDP. (2014). Choice of agricultural technologies for climate change adaptation in the NAPA1 intervention Commune. United Nations Development Programme.
[19]. Dimon R. (2018). Adaptation to climate change: perceptions, local knowledge and adaptation strategies developed by producers in the Communes of Kandi and Banikoara, northern Benin. PhD thesis, UAC, 209 p.
[20]. Vissoh V. Pierre, Tossou C. Rigobert, Dedehouanou Houinsou, Guibert Hervé, Codjia C. Olivier, Vodouhe D. Simplice and Agbossou K. Euloge (2012). " Perceptions et stratégies d'adaptation aux changements climatiques : le cas des communes d'Adjohoun et de Dangbo au Sud-Est Bénin ", Les Cahiers d'Outre-Mer [En ligne], online October 01, 2015, accessed December 04, 2018. URL: http://journals.openedition.org/com/6700; DOI: 10.4000/com.6700, p. 479-492.
[21]. Aho N. and Kouaro M. (2006). Identification et répertoire des mesures locales d'adaptation aux changements climatiques dans les Communes de Ouaké et de Tanguiéta. Rapport provisoire. Projet Pilote d'Adaptation aux changements climatiques dans l'exploitation durable des bassins versants du Nord-ouest du Bénin. Pp. 19-26.
[22]. Ogouwalé Euloge (2006). Climate change in southern and central Benin: indicators, scenarios and food security outlook. Thèse unique de doctorat de l'UAC, 302 p.
[23]. Agossou D.S.M., Tossou R., Vissoh P. Et Agbossou K. (2012). Perception of climatic disturbances, local knowledge and adaptation strategies of Beninese agricultural producers. African Crop Science Journal, 20 (s2), pp. 565 - 588.
[24]. Schwartz Daniel (1995). Le jeu de la science et du hasard. La statistique et le vivant, Paris, Flammarion, N° 1, Vol. 50, 228 p.
[25]. Vodounou J. B. AND Doubogan Y. O. (2016). Peasant agriculture and climate change adaptation strategies in North Benin. Environment, Nature et Paysage. https://doi.org/10.4000/cybergeo.27836, 27 p.
[26]. UNDP (2014). Choosing agricultural technologies for climate change adaptation in the NAPA1 Commune d'intervention. United Nations Development Programme, 87 p.
[27]. Lionel Ulrich Ayedegue typologie et déterminants des stratégies d'adaptation aux changements climatiques en riziculture au nord et center du bénin. European Scientific Journal, vol.16, no.6, ISSN: 1857-7881 (Print) e - ISSN 1857- 7431, february 2020 edition.
[28]. Thiéry. Codjo, Ogouwale Euloge, Boko Michel, Agbossou E. (2015). Stratégies paysannes d'adaptation aux changements climatiques dans la Commune d'Adjohoun. XXVIIIe colloque de l'association internationale de climatologie, Liège, pp. 313-318.