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Stakeholders' Signature to Climate Change Adaptation in the Agrarian Sector of Bui Plateau, Northwest Cameroon

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ABSTRACT

This study on stakeholders' signature to climate change adaptation in the agrarian sector of Bui Plateau, Northwest Cameroon aims at assessing the vulnerability of agricultural systems to climate variability as well as farmers' limitations to adaptation. The Bui Plateau is diverse and segmented into seven agrarian basins with diverse stakeholders involved in grappling with changing climatic and environmental problems affecting livelihoods. A total of 597 copies of questionnaire were administered, together with eight (8) focus group discussions and guided interviews with public services and community based organisations involved in climate change mitigation. Consequently, the findings reveal among others that there is no strategy on how to address adaptation in the long-term and that importance is given more 'misplaced priorities' like office functionality, communication, out of station allowances and other financial benefits, while, there are little or no budgetary allocations for pressing environmental problems distressing the masses. These leave poor rural farmers at the mercy of the whims and caprices of climate and environmental changes. Hence, there is need for concerted efforts and commitment at the local level to address the immediate needs of inhabitants by the local and national governments.

***Keywords**: climate change, stakeholders' signature, agrarian, farmers, adaptive capacity*

INTRODUCTION

A major challenge in planning for adaptation to climate change is to assess future development not only in relation to climate but also in relation to cultural, social, economic and political changes that affect the adaptive capacity (Oppenheimer *et al*, 2014). One approach is to use a methodology that combines top-down scenarios and bottom-up approaches to scenario building, with the aim of articulating local so-extended socio-economic pathways (Nilsson *et al*., 2017). There are shared socio-

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economic pathways (SSPs) of the *'glocal'* scenario framework as developed by the climate research community to present boundary conditions about potential changes with local and regional actors (Nilsson *et al*., 2017; Worldwide Fund for Nature, 2016). In the Bui Plateau, these challenges include more inclusive development, improved management of common property resources, rapid population growth, slow pace of the decentralisation and slower economic development (Tume and Fogwe, 2018). A range of biophysical, institutional, financial, social, and cultural factors constrain the planning and implementation of adaptation options and potentially reduce their effectiveness (Klein *et al*., 2014). Adaptation of both human and natural systems is influenced by the rate of climate change as well as rates of economic development, demographic change, ecosystem alteration and technological innovation (Organisation for Economic Co-operation and Development-OECD, 2009).

Adaptation planning and implementation may require significant inputs of knowledge as well as human, social, and financial capital. Real or perceived deficiencies in access to such resources can and do constrain adaptation efforts in both developing and developed nations (Antwi-Agyei *et al.*, 2013). Public and private institutions influence the distribution of such resources as well as the development of policies, legal instruments, and other measures that facilitate adaptation. Institutional weaknesses, lack of coordinated governance, and conflicting objectives among different actors can constrain adaptation (IPCC, 2014). Consequently, the need for proactive and promising approaches necessitate this study on stakeholders' signature to climate change adaptation in the agrarian sector of Bui Plateau, Northwest Cameroon. The aim is to assess the vulnerability of agricultural systems to climate variability as well as farmers' limitations to adaptation in the agrarian sector of Bui Plateau, Northwest Cameroon.

METHOD

Table 1: Agrarian basins of the Bui Plateau

Agrarian basins	**Crops cultivated**
Mbokam-Ngomrin-Mbaw Nso	Rice, maize, soya beans, groundnuts, oil palm, cassava
Oku-Vekovi-Tadu	Solanum potato, maize, beans, market gardening
Dzeng-Tatum-Banten	Market gardening, maize, beans, solanum potato
Nkuv-Ndzeen	Maize, cassava, beans, yams, cow pea, groundnuts
Djottin-Nkor-Lassin	Groundnuts, maize, beans
Nkar-Kumbo-Kikaikom	Maize, cassava, beans, yams, market gardening, solanum potato
Mbiame	Maize, cassava, beans, yams, cow pea, groundnuts, solanum potato, plantains

Source: Fieldwork, 2018.

The Bui Plateau of the Bamenda Highlands of Cameroon has seven micro

agro-ecological zones (Table 1). Bui is an orographic plateau within the Cameroon Volcanic Line (CVL) with spectacular landscapes like Mount Oku (3,011masl) and the Mbaw–Tikar Plains (Hd710masl) (Tume 2008). It provides a major watershed for the Niger and Sanaga river systems (Tume, 2008). Bui has a surface area of about 2,795 km^2 (Tume, 2008). Administratively, this area covers Bui Division, with headquarters in Kumbo, covering six sub-divisions: Kumbo (630km^2), Jakiri (675km^2), Nkum (375.3km^2), Nkor–Noni (307.7km^2), Mbiame (575km^2) and Oku (232km^2) (Fig. 1).

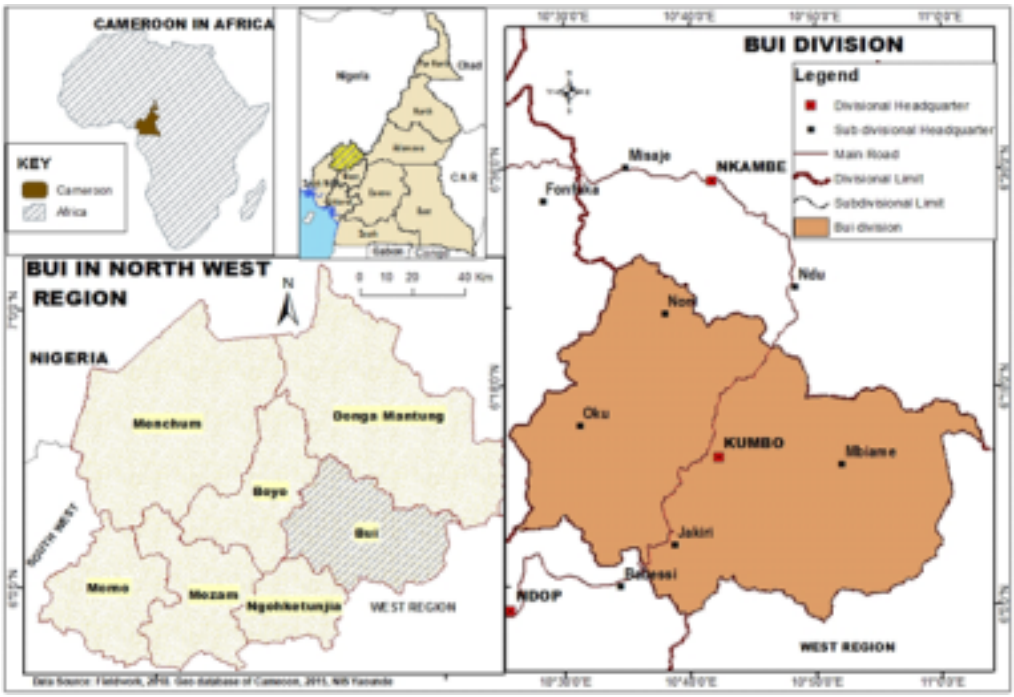

Figure 1: Location of Bui

Considering the Köppen's 1936 climatic classification, the Bui Plateau corresponds to the *'Aw'* climate type, with two seasons (dry and wet). The dry season lasts for four to five months (November to March) while the wet season lasts for eight months (March/April to October). There is a general decrease in rainfall during the dry season, during which water resources shrink due to the drying out of intermittent springs and a drop in the water table. This results to water scarcity. The dry season is characterised by dry harmattan winds, which lack moisture and rather facilitate the drying out of the environment. The Bui Plateau is diverse and segmented into seven agrarian basins (Tume and Fogwe, 2018).

Given that the research problem revolves on agrarian system, which is the life wire of the inhabitants of Bui, household questionnaire was administered in clusters.

The principle of cluster sampling solves the problem of data collection in a culturally and physically diverse area. A convenient way in which a sample can be taken is to divide the area into smaller non-overlapping areas and then to randomly select a number of these smaller areas (households located in the agrarian basins), with the ultimate sample consisting of perceptions from the agro basins, that are representative of the entire Bui Plateau. In cluster sampling over the Bui Plateau, the target population were farmers in rural areas. These were sub-divided into relatively smaller units relating to crops which are grown in specific areas. In cases where more than one crop dominates in an agro-basin, double or multiple levels of clustering were applied (multi-stage cluster sampling). Cluster sampling procedure was employed because the occurrence of agro basins does not respect administrative boundaries of sub-divisions. A total of 597 copies of questionnaire were administered (Table 2).

Table 2: Population of Bui Division and administration of questionnaire

Sub-Divisions	Population		Agrarian basins Questionnaire		
	Pop.	%		Freq.	%
Kumbo	127,919	22.35	Nkar-Kumbo-Kikaikom	94	15.7
Jakiri	59,951	10.47	Mbokam-Ngomrin-Mbaw Nso	68	11.4
Nkum	127,538	22.28	Dzeng-Tatum-Banten	91	15.2
Nkor	63,487	11.09	Djottin-Nkor-Lassin	81	13.6
Elak-Oku	144,800	25.30	Oku-Vekovi-Tadu	105	17.6
Mbiame	48,684	8.51	Mbiame	85	14.2
			Nkuv-Ndzeen	73	12.2
Total	572,379	100	Total 597	100	

Source: Fieldwork, 2018

The Nkar-Kumbo-Kikaikom agrarian basin covers most villages in Kumbo Central, Dzekwa area, the middle belt of Jakiri Sub-Division, extending down to Wainanmah. The Ngomrin-Mbokam-Mbaw Nso Plain covers the south-eastern part of Jakiri Sub-Division, extending north-east into Mbiame Sub-Division and thrusting eastwards into the Ndop and Tikar plains. Oku-Vekovi-Tadu basin covers the highland montane communities of Jakiri Sub-Division like Kinsenjam and Vekovi, extending across to Kaiy, Taashem and Vivwem in Kumbo Central Sub-Division. It extends westward to cover all of Oku Sub-Division. The Dzeng-Tatum-Banten basin covers much of Nkum Sub-Division. It extends north-westward into Noni Sub-Division. From the Dzeng Plateau, it shares boundaries with Mbiame and cover the rugged terrain of Yangkitari, which is a northern extension of the Kov Ndzeen range in Kumbo Central Sub-Division. Nkuv-Ndzeen basin covers the south-eastern part of Kumbo Central. It is a rugged frontier, which is reputed for massive deforestation, overgrazing, cultivator-grazier conflicts, landslides and fast flowing streams. The Djottin-Nkor-Lassin plain is located at the north-west edge of the Bui Plateau. It extends northwards into the

Donga plain. The Mbiame basin is situated between the Mbaw Nso plain and the Dzeng plateau. It is a transitional ecological zone because of a mixture of highland and lowland climatic characteristics. Eight (8) focus group discussions (FDGs) were used to substantiate the responses acquired using questionnaire (Table 3).

Table 3: Focus group discussions participants

Group	Location	Membership	Participants	Activities
Bongsiysi	Kishong	27 (women only)	10	Agriculture, weekly thrifts & loans
Kongadzem	Kishong	24 (women only)	10	Agriculture, weekly thrifts & loans
Bongatati	Shisong	14 (mixed)	8	Soybeans processing, monthly thrifts & loans
Men of Vision CIG	Shisong	11 (men only)	8	Livestock & Fisheries
Mbokam Mixed Farmers CIG	Mbokam	13 (mixed)	8	Cassava processing, weekly thrifts & loans
Loweh Rice Farmers CIG	Ber	16 (mixed)	9	Rice farming
Bongba Mixed Farming CIG	Manckock	13 (mixed)	8	Solanum potato production
Momeyen Mixed Farming CIG	Nkor	15 (mixed)	10	Maize production
Total	8	133	71	

Source: Fieldwork, 2018

The group discussion was conducted with farmers' groups, associations and cooperatives to get their responses to vulnerability, adaptation and limitations of adaptation to climate change. Other group of discussions were with community leaders and elders to explore local knowledge practices in climate adaptation. Community leaders who participated on discussions about indigenous environmental knowledge systems were staff of Green Care Association, a local NGO based in Shisong, Nature Care Cameroon, Fon to Taabah, Kingomen and Shufai Taansam, Takui.

Expert interviews were conducted with other stakeholders in the climate and environmental sectors in Bui as follows: Divisional Delegation of Agriculture and Rural Development; Divisional Delegation of Mines, Water and Energy; Divisional Delegation of Environment, Nature Protection and Sustainable Development; Delegation of Livestock and Fisheries and Delegation of Forestry and Wildlife. These mainstream public services were ask to assess the impacts and adaptation strategies to climate and environmental changes. Other key stakeholders interviewed were municipal councils. They were asked to provide information on the state of the environment in their municipalities with reference to percentage of their annual budgetary allocations for environmental protection and the fight against climate change. A questionnaire was

also directed to authorities of the Sub-Divisional Delegations of Agriculture and Rural Development to identify key vulnerabilities and adaptation measures in the agriculture sector.

RESULTS AND DISCUSSION

Dearth of inter/intra-sectorial stakeholders' collaboration: Climate change adaptation is currently dealt with only within a climate change unit in the Ministry of Environment, Nature Protection and Sustainable Development and through fragmented and small-scale projects implemented by various NGOs and research institutions, sometimes in collaboration with local partners. Although there are valuable initiatives, they remain scattered, uncoordinated and do not reach the level of magnitude required to address climate adaptation at the local level. Inter-institutional collaboration and coordination is extremely weak and joint planning or integrated outreach programmes being virtually absent (Table 4).

Table 4: Climate change and key environmental sectors in Bui Division

Sector	Staff strength	Effects of climate change	Remedial actions	Budgetary allocation for climate change
DDARD	07	Declining agricultural productivity	Supply of improved seeds to farmers	0%
S-DDARD	26	Declining agricultural productivity	Sensitisation on sustainable agricultural practices	0%
DDWE	05	Declining water resources	Community sensitisation on good watershed practices	0%
DDENPSD	02	Serious environmental degradation all over Bui	Synergy with some local NGOs to ameliorate local environmental conditions	0%
DDLF	04	Late onset of rains, delay of cattle at hollow frontiers, cultivator-grazier conflicts, invasive-unpalatable species on rangelands	Indigenous pasture improvement, allocation of rangelands to minimise transhumance	0%
DDFWL	06	No idea	No idea	0%

DDARD: Divisional Delegation of Agriculture and Rural Development
S-DDARD: Sub-Divisional Delegations of Agriculture and Rural Development
DDWE: Divisional Delegation of Water and Energy
DDENPSD: Divisional Delegation of Environment, Nature Protection and Sustainable Development
DDLF: Divisional Delegation of Livestock and Fisheries
DDFWL: Divisional Delegation of Forestry and Wildlife
Source: Fieldwork, 2018

Currently, there is no strategy on how to address adaptation in the long-term. Investments and financing in Bui are not available in any key environmental sector.

Ridiculously, the Divisional Delegation of Forestry and Wildlife could not provide the vulnerabilities and adaptation actions of that sector. There is no single government institution currently that convincingly convenes on the important issue and reaches out to all the relevant sectors and stakeholders in strategic partnerships. Overall, the institutional and individual capacities are weak and fragile. Infrastructure is poor, hampering the operations of the central government. Importance is given more to 'misplaced priorities' like office functionality, communication, out of station allowances and other financial benefits, while, there are little or no budgetary allocations for pressing environmental problems plaguing the masses. These problems are further exacerbated by limited operational budgets to implement policy action and outreach at local councils (Table 5).

Table 5: Municipal councils, environment and climate change in Bui Division

Council	Staff/ councilors	Vulnerability	Adaptation	Budget for climate change
Kumbo	41/65	Land degradation, Overgrazing, bush fires, water scarcity, increasing temperatures, farmer-grazier conflicts	Sensitisation in collaboration with MINEDEP	0.17% (700,000 FCFA)
Jakiri	33/58	Overgrazing, bush fires, water scarcity caused by drop in water table, increasing temperatures	Sensitisation of farmers on the dangers of climate change, Ngongbaa Community Forest, watershed protection	1.0% (2,000,000 FCFA)
Nkum	30/35	Land degradation, vanishing natural forest refugia, overgrazing, burning of soil organic matter in farms, bush fires outbreaks, unreliable and unpredicted rainfall pattern, increasing temperatures, soil erosion	Sensitisation of farmers against the use of fire to reduce farm residue, encouraging the planting of environmentally friendly trees in watersheds & construction sites	1.75% (11,000,000 FCFA)
Mbiame	37/32	Land degradation, vanishing natural forest, unpredicted rainfall pattern	Agro-forestry	0%
Elak-Oku	47/35	Land degradation, unpredictable climate	Sensitisation, capacity building of stakeholders in partnership with sub-delegation of MINADER, provision of resistant and improved planting materials, agro-pastoral shows, best farm competition	1.0% (5,300,000 FCFA)
Nkor	35/45	Land degradation, overgrazing, bush fires, water scarcity, increasing temperatures, farmer-grazier conflicts	Sensitisation on sustainable environmental practices	0%

Source: Fieldwork, 2018

The difficulties to organise outreach and campaigns meaningfully on the ground project interventions are manifold. Limited qualified staff, but also the limited skills and capacity levels of council staff seriously impair implementation of the necessary adaptation actions. Councils have employed unqualified staff to address pressing needs of the communities. Such recruitments are guided by nepotism and personal financial gains. In all the councils in Bui, there is no staff specialised in addressing climate and other environmental issues. The large number of councillors are mere hand clappers during annual council sessions. When questioned about pressing development needs of their respective villages, the responses were that development is lagging because of the lack of liquidity. Paradoxically, taxes are collected from petty traders on a daily and weekly basis. The question remains, where does the money go? The few young professionals are often ill-equipped when they graduate from higher learning institutions to perform in their professional fields and currently there are no trainings that would build such capacities. The worst-case scenario is the old and incompetent officials who have deliberately refused to relinquish power to the young. While they are clinging onto power, with an eye on how much is their take home package to swell private bank accounts, the climate and environment waxes and wanes.

Highly conservative and protected cultural and traditional practices: Cultural characteristics including age, gender and sense of place influence risk perception, entitlements to resources and choices about adaptation. Societal actors and natural systems may experience multiple constraints that interact. These practices include weekly traditional holidays during which farming activities are suspended and when death occur in communities. Each community in Bui Plateau has at least three days in a week during which any farming activity is not carried out (Tables 6 and 7).

Table 6: Duration of suspension of farming activities from death

Nature of death	**Duration of suspension (days/weeks)**
Fon	8 weeks
Shufai	7 days
Fai, Shey	7 days
Family elder	Woman (4 days), Man (3 days)
Family member	Woman (4 days), Man (3 days)
Child	3 days

Source: Fieldwork, 2018

Table 7: Weekly traditional holidays

Clan	Weekly traditional holidays	Other traditional holidays
Nso	*Kilovey, Ngoilum, (Reevey)*	Ngonso (cultural week)
Nkar	*Wailun, Nseeri*	Cultural week
Mbiame	*Wailun, Ntangrin, Kilovey*	Cultural week
Oku	*Nsamnen, Ngokse*	Ibam, Ndong Dance
Nkor-Noni	*Bvubun, Buukaa*	Cultural week

Source: Fieldwork, 2018

This has gone a long way to limit efforts to adapt to climate change. These traditional holidays play a negative role during critical phases of food crop production like sowing, weeding, application of fertilizers and harvesting. Taking an average of three traditional days in a week when agricultural activities are suspended, it gives a total of about 152 days in a year that farmers do not go to the farm. These, together with unforeseen circumstances like ill-health, bereavements and other celebrations increases the vulnerability of agrarian systems.

Communities around the Bui Plateau are facing multiple shocks and stresses from climate variability and change. These shocks and stresses are multiplied by the added pressures of unplanned development, leaving many residents without access to basic risk-reducing infrastructure and services, ranging from adequate potable water, housing and healthcare. This infrastructural deficit and the failures in local governance enhances the underlying vulnerability of local populations to the impacts of climate change in the context of the ongoing decentralisation process in Cameroon. Decentralisation is the transfer of powers from a central government to lower levels in a political–administrative and territorial hierarchy (Diep, Archer and Gueye, 2016). It is based on the principle of subsidiarity, that is, a central authority only performs the tasks that cannot be performed at local level. Aware that the decentralisation process in Cameroon is very slow, limited or no competencies and financial resources have been transferred to councils in Bui to manage climate change.

Rural farmers' challenges: Indigenous post-harvest crop preservation techniques portray limited knowledge of preservation practices. Some of these include hanging beans and corn around house, drying in the barn, using some herbs to treat dry maize and sunning crops before transfer to the barn. These techniques are not efficient because crops still get bad or are attacked by weevils and rats at home, thereby incurring huge losses, increasing vulnerable and even threatening food security. Farmers in Bui Plateau have not adapted completely for several reasons (Table 8, Fig. 2).

Table 8: Limitations of agricultural adaptation to climate variability

Limiting factors	Freq.	%	Anomaly
Inadequate finances to buy farm inputs	498	83.4	13.01
Inadequate fertilizers	440	73.7	3.31
Inadequate pesticides	405	67.8	-2.58
Inadequate farming land	314	52.6	-17.78
Stringent land laws	314	52.6	-17.78
Poor state of farm-to-market roads	483	80.9	10.51
Competing land use with graziers	474	79.4	9.01
Inadequate government assistance	481	80.6	10.21
Inadequate assistance from the council	413	69.2	-1.18
Gender inequality in land matters	241	69.8	-0.58
Poor land use planning	419	70.2	-0.18
High labour burdens	415	69.5	-0.88
Inadequate information and education	414	69.3	-1.08
Farming on steep slopes	337	56.4	-13.98
Farming in swampy land	333	55.8	-14.58
Disease vectors (mosquitoes/malaria)	376	63	-7.38
Infertile soils	449	75.2	4.81
Ineffectiveness of agricultural technicians and extension field workers	392	65.7	-4.68
Difficulty to understand science of climate variability and adaptation	486	81.4	11.01
Inadequate farm tools	448	75	4.61
Plant diseases, attack by wild birds and animals	476	79.7	9.31
Migration of youths to town	461	77.2	6.81

Source: Fieldwork, 2018

Climate may be perceived, rightly or wrongly depending on the context, to pose little risk relative to other hazards and therefore given low priority. Limiting factors to agrarian adaptation to climate variability has an increasing trend because of high exposure and sensitivity and a weak adaptive capacity for all the agro-basins.

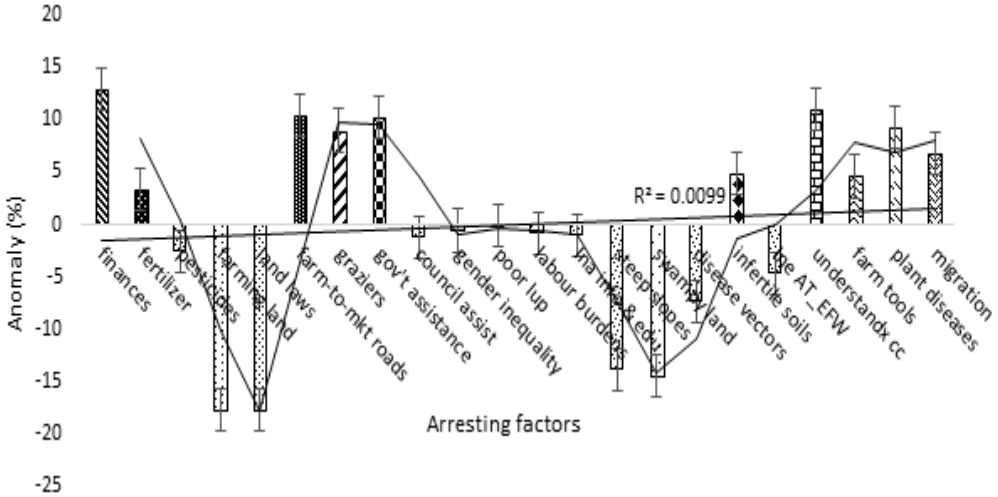

Figure 2: Trend of agrarian adaptation limiting factors
Source: Fieldwork, 2018

Respondents perceived that farm inputs like fertilizers, pesticides, competing land with graziers, inadequate assistance from central government and local councils, poor land use planning, soil erosion and declining fertility, crop diseases and the migration of youths to towns have weakened the productivity in the agricultural sector. Youth are a force to reckon with in the rural agricultural sector. With threats from climate change and other socio-environmental stressors, the agrarian enterprise is weakened (Tacoli, 2009). One of the outstanding limiting factors is the state of farm-to-market roads. Some farmers have resorted to the use of donkeys to transport their produce (Figure 3).

Figure 3: State of farm-to-market roads makes farmers use donkeys to transport their produce from Kov Ndzeen to Mbuluf in Kumbo
Source: Fieldwork, 2018

The problem of late rains and early rains has been lingering in Bui for the past 20 years. When the rains come early (usually in February to early March) and farmers sow seeds, the rainfall will not be consistent. Drought conditions will prevail, such that the tender crops wither and dry out. Farmers are compelled to wait for late rains to start (usually in April). Even when the rains begin in April, they support only germination of crops. After germination, droughts will prevail till May ending. It is during these phases of consistent droughts that pests like stem borers attack tender maize crops and blight destroys tender solanum potato and beans. As such, farmers adjust to these conditions by altering planting dates. This intensifies the vulnerability of subsistence households to climate change leading to drops in the main staple food crops (maize, solanum potato and beans). This goes to confirm the view that climate change is expected to lead to declining cereal production in developing countries, with risks of decreasing yields particularly high in Africa (Organisation for Economic Co-operation and Development-OECD, 2009; Patt and Winkler, 2007).

Gender dimensions of vulnerability arise from differential access to the social and environmental resources required for adaptation. In many rural economies and

resource-based livelihood systems, it is well established that women have poorer access than men to financial resources, land, education, health, and other basic rights (Vincent, Tschakert, Barnett, Rivera-Ferre and Woodward, 2014; Vincent and Colenbrander, 2018). Additional drivers of gender inequality stem from social exclusion from decision-making processes and labour markets, making women less able to cope with and adapt to climate change impacts. These gender inequalities manifest themselves in gendered livelihood impacts and feminisation of responsibilities: whereas both men and women experience increase in productive roles, only women experience increased reproductive roles. Weak integration of gender-sensitive planning and programming Cameroon is overall faring poorly in terms of gender considerations and below 14% of Parliamentarians are women (United Nations Development Programme, UNDP, 2009). Policies, especially those reaching out to the local implementation level lack a gender sensitive or balanced approach.

Stimulating adaptation is not only about empowering women to fill a good percentage of professional positions, but to recognise gender differences between men and women, as well as special needs of the youth, elderly, various cultures and religions and to address such needs in development planning and programming. Adaptation needs, and solutions need to be considered in a gender context. Bringing the perspectives of local women and men who have experienced climate impacts into relevant policy arenas is key to just decision-making and meeting local climate adaptation. There is a lack of robust evidences on how these experiences can increase the ambition, urgency and quality of climate responses at the community levels (Fisher and Shakya, 2018). Systematic inclusion of women and men with lived realities of climate change could strengthen climate action. This could be through grounding policy narratives with the realities of daily life, changing ideas of whose knowledge should be included, shifting power dynamics and increasing accountability.

Knowledge of options to reduce climate risks or the means to implement them is lacking. Their expected costs may exceed the expected benefits. The means or capacity to adapt is lacking. Uncertainty about the future makes it difficult to know what to do or when to do it. Irreversible consequences of some actions like failing to sow seeds at the onset of the first rains delay choices until some of the uncertainty is resolved. Incentives are distorted in ways that discourage choices that reduce risks, or even encourage riskier choices. Sometimes the action of others, or inaction of others, can be an obstacle. Some may believe that reducing their own risk is the responsibility of others. Limits to adaptation can emerge because of the interactions among climate change, biophysical environment and socio-economic constraints (IPCC, 2014). An adaptation limit occurs owing to the inability to avoid an intolerable risk to an actor's objectives and the sustainability of a natural system. Understanding of limits is informed

by historical and recent experience where limits to adaptation have been observed, as well as by limits that are anticipated to arise because of future global change (Klein *et al*., 2014). In an interview with Fon of Tabah-Kingomen (Kumbo Central), on 11 August 2018, it is affirmed that the climate has changed, impacting negatively on the agrarian systems. The Fon acknowledged that 30 years ago, the onset of the wet season was at mid-March. The behaviour of the rains confuses everyone. At times, the onset is in February and at times, it delays till April/May. As an adaptation measure, the sowing of crops officially opens in his land in January so that anyone who fails to plant on time have themselves to blame. Previously, sowing was normally in mid-March with the onset of first rains. The year 2018 has been particularly confusing. The onset of the rains in February could not convince indigenous farmers that it was already the beginning of the wet season. Many did not sow their crops and waited till mid-March, when weeds had overgrown the fields.

Climate change adaptation: The Divisional Delegation of Agriculture Rural Development for Bui provides improved seeds to local farmers to assist them adjust their agricultural practices to prevailing climatic conditions. These improved seeds are weather proof and serve as an option to adaptation to climate change. As much as 72.26% of farmers surveyed are adamant to change and prefer using local seeds which in most cases are not weather proof. As such, adaptation becomes difficult. An indigenous strategy of building resilience in managing climate change is through planting seeds from recently harvested crops, especially beans and solanum potato. Rural farmers in Bui perceive that seeds from recent harvests are more drought and blight proof than older seeds which were harvested at the end of the first farming season. Farmers across agrarian basins of the Bui Plateau adopt diverse strategies to grapple with climate variability and change. Key determinants to climate adaptation in the agricultural sector on the Bui Plateau are the types of planting materials used (improved and local seeds), application of chemical fertilizers, altering planting dates with the onset of first rains, application of organic manures and traditional farming techniques like slash and burn (Table 9).

Other strategies are mono-cropping, mixed cropping, concentration on cultivation of fewer plots at proximity, alternative income generating activities, livestock rearing, use of insecticides and pesticides, reliance on traditional weather forecasting systems and local irrigation techniques during periods of deficient rainfall. In all the agrarian basins combined, the most effective strategies are improved seeds, application of chemical fertilizers, altering planting dates, mono-cropping, mixed cropping, alternative income generating activities, use of herbicides and reliance on traditional weather forecasting.

Table 9: Agricultural adaptation to climate change on the Bui Plateau

Variables	**Agrarian basins (%)**						
	Nkar	Dzeng	Nkuv	Mbokam	Nkor	Oku	Mbiame
Improved seeds	81.7	84.4	53.4	86.8	49.4	81.9	68.2
Local seeds	55.9	87.8	56.2	51.5	33.3	87.6	72.9
Fertilizers	79.6	91.5	100	51.5	82.7	89.5	88.2
Alter planting dates	79.6	86.7	97.5	55.9	82.7	97.1	88.2
Organic manure	88.2	84.4	56.2	54.4	66.7	95.2	68.2
Ankara	34.4	41.1	57.5	44.1	49.4	29.5	48.2
Mono-cropping	53.8	47.8	95.9	33.8	95.1	76.2	45.9
Mixed cropping	41.9	46.7	90.4	42.6	100	86.7	34.1
Improved maize	86	87.8	17.8	52.9	67.9	88.6	75.3
Fewer plots	62.4	38.9	43.8	42.6	70.4	76.2	36.5
Drought-resistant crops	68.4	58.9	54.8	68.2	79	78.1	60
More crop varieties	68.8	57.8	43.8	39.7	98.8	73.3	50.6
Alternative income generating activities	54.8	50	82.2	35.3	97.5	86.7	45.9
Livestock rearing	90.3	76.7	53.4	58.8	70.4	58.1	68.2
Insecticides & pesticides	80.6	94.4	75.3	51.5	72.8	82.9	85.9
Traditional weather prediction	59.1	60	75.3	52.9	98.8	82.9	60
Irrigation	87.1	75.6	47.9	57.4	51.9	88.6	58.8

Source: Fieldwork, 2018

Leading local NGOs that have championed indigenous adaptation to climate change through alternative climate-smart agriculture (CSA) and other eco-friendly activities are Green Care Association (GCA), Nature-Care (N-Care) and Cameroon Gender and Environmental Watch (CAMGEW). They are involved in environmental education, poverty alleviation and sustainable use of local resources. Their mission is to empower local communities with techniques of sustainable use of local resources and building networking opportunities, with an overriding commitment to education, poverty alleviation and community development. Green Care Association's focal areas include apiculture, environmental education, community micro projects and biodiversity conservation. The GCA has successfully transferred to the local communities using education and demonstration farms, modern techniques of bee keeping, yam tubers multiplication, cane rat domestication, fish farming, analogue forestry and trees nursery.

CONCLUSION

Climate variability and change is happening in the Bui Plateau and are affecting agriculture and water resources negatively. Agriculture-dependent societies have been surviving within these changing environmental conditions over generations and have gained a considerable knowledge and understanding of their local environment. A significant portion of the respondents were knowledgeable about climate change and were able

to link the perceived environmental changes with the scientific understanding of climate change. Amongst those participants who did not have clear understanding of the knowledge of climate change they linked the causes of climate change with social, cultural and religious factors. Generally, respondents considered and perceived climate as an increase in dry spells, increase in temperature, decline in rainfall, water shortage, increase in pests, shortened growing period, weather variability increase, windy conditions, and increase in animal diseases and floods. Subsistent farmers have been adapting to these changes in environmental conditions over generations, thus increasing their resilience to the changes through coping and adapting. Understanding different local environmental knowledge and practices have helped farmers manage to cope with the impacts of the changing environmental conditions. Socio-cultural constraints, institutional rigidities and the farmers' perceptions that the local and central governments do not adequately assist them to adapt to variable climate and changing environmental conditions is clearly demonstrated in little or no budgetary allocations in the fight against climate change in key sectors of the Bui Plateau. Climate change adaptation is currently dealt with only within a climate change unit in the Ministry of Environment, Nature Protection and Sustainable Development and through fragmented and small-scale projects implemented by various NGOs and research institutions, sometimes in collaboration with local partners. Although there are valuable initiatives they remain scattered and do not reach the level of magnitude required to address climate adaptation at the local level. Inter-institutional collaboration and coordination is extremely weak and integrated outreach programmes are virtually absent. The causes, impacts and legacies of various strategies, decades of structural adjustment programs and market conditions on the Bui Plateau need to be understood in terms of poverty alleviation and adaptation to climate change. There are too many stakeholders involved in climate and environmental issues, yet none of them take responsibility for the pressing needs of rural farmers. This calls for concerted efforts to address the pressing needs of rural farmers in the 21st Century.

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