


## Article

# Diagnosing Climate Adaptation Constraints in Rural Subsistence Farming Systems in Cameroon: Gender and Institutional Perspectives

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**Abstract:** Climate adaptation efforts are recurrent in the science and policy spheres, especially in the context of the adaptation of community-driven, small-scale farming systems. One such is subsistence farming, which constitutes the backbone of most rural sub-Saharan African (SSA) economies, including Cameroon. Significant research and policy efforts have been directed towards overcoming barriers to climate adaptation. Such efforts have tackled a range of socio-economic and exogenous institutional constraints. However, knowledge gaps exist in the climate adaptation literature, particularly with regards to the extent to which endogenous cultural institutions (customary rules) in SSA shape gender (in)equality in access to productive resources like land. Based on a representative survey of 87 female-headed households in rural Cameroon, we contribute to bridge this gap by determining endogenous cultural institutional constraints to rural women's climate adaptation, specifically with regards to their access to land for subsistence farming. Results were obtained with logistic regression analysis and a chi-square test of independence, showing that: (i) an inverse relationship exists between discriminatory cultural practices and women farmers' capacity to adapt to climate change, and that (ii) tenure insecurity and inequality amplifies farmer's vulnerability to long- and short-term climatic change. While this paper contributes to existing theoretical frameworks on climate adaptation from an institutional perspective, it equally makes a succinct request for further studies to be undertaken to ground this theoretical assertion.

**Keywords:** climate adaptation; culture; gender; poverty; subsistence farming; vulnerability

## 1. Introduction

Globally, climate change variation is no longer an abstract issue; its impacts are felt across the globe, especially in sub-Saharan Africa (SSA) [1], where it imposes new pressures that are profoundly shaping ecological and socio-economic interactions. One of the key sectors extremely vulnerable to such changes is subsistence farming (SF) which underpins rural development, and employs over 60% of the labour force in SSA. Under mild scenarios where the world will warm by only 2 °C, SSA already stands to endure substantial losses in SF as a result of climate change [1,2]. By 2050, the region (SSA) is expected to witness a decline in certain crops (maize, millet, and sorghum) by 15–20%, if warming exceeds 3 °C [3]. Changes in the climate system have created huge biophysical impacts (e.g., ecosystem instability, plant growth depression, and soil degradation) including a reduction in the range of livelihood opportunities, increasing rural poverty and inequality in SSA, including Cameroon [4], where the livelihoods of about 93% of her rural population is linked to land and natural resource exploitation [5].

As part of the global system, Cameroon is witnessing the effects of climate change which is mirrored through increasing temperatures (average increase of 0.95 °C between 1930 and 1995), and

a drop in rainfall by over 2% per decade since 1960 [6]. This is affecting rural agrarian economies. Current trends indicate an increasing feminization of subsistence farming due to the significant male out-migration [7]. It is, however, still unclear how socio-cultural factors influence adaptation from a gendered perspective in access to land resources. In the context of climate adaptation, gender inequality amplifies the vulnerability of women with regards to limited access to and control over resources upon which livelihood depends [8–12]. Women equally need different assets, including an enabling environment to tackle these effects [12,13].

Recent emphasis on climate-smart agriculture (CSA) demonstrates potentials to increase and sustain farming production and productivity under changing climate. However, the upscaling of this practice is marred by insecure and unequal tenure, especially for female farmers [14–17]. While empirical studies have shown a correlation between secure rights to farmland and rural women's livelihoods, current patterns suggest a decline in the access and use of land, exacerbated by degradation and institutional drivers [18–20]. Tenure insecurity represents a serious obstacle to increase farm productivity and income for rural women [21], including their investment [22,23]. Tenure is shaped by a set of institutions and policies that determine the conditions under which land and its resulting resources are accessed, and the benefits derived from these resources [24]. Customary tenure which is usually administered in accordance with the customary law (native customs) defines access and use of land resources [25] with a high tendency to favour male ownership [26–28]; this has direct impacts on agriculture and livelihoods [29,30].

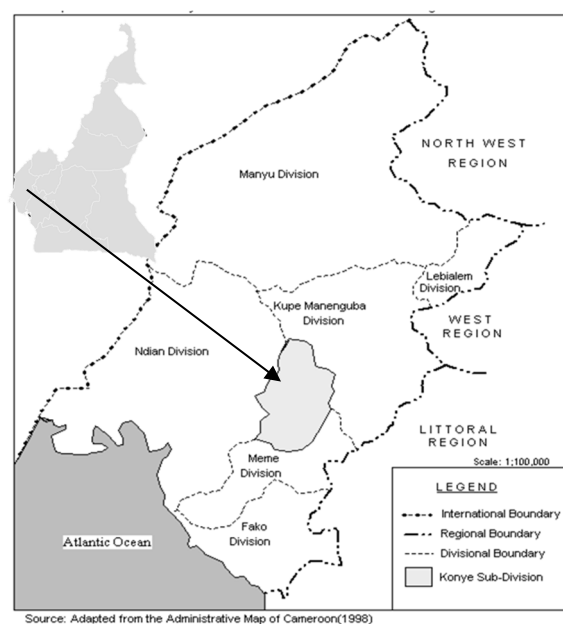
Empirical studies equally hold that tenure insecurity is one of the major factors behind the accelerated land degradation through its negative effects on long-term investments in sustainable land management practices [31]. It is also one of the most critical factors associated with unsustainable farming practices [32–34]. Literature contends that subsistence farming is the main cause of deforestation [35], making reference to slash-and-burn or shifting cultivation around forest communities [36,37], while neglecting land tenure issues [38]. While secure and equitable tenure has the potential to simultaneously promote local economic development, reduce vulnerability, and strengthen the adaptive capacity of local communities, the lack of clarity that characterize insecure tenure, reinforces the negative effects of subsistence farming. Therefore, pro-women land reforms which create avenues that consider women's strategic interest of secure and equitable access to and control over agricultural land and related resource will increase land productivity [31]. This is pertinent in the Cameroonian context where rural poverty persists, with women being the most significantly affected.

Cameroon's land tenure system considers the state as the "custodian" of land and guarantor of rights to possess and dispose of it. This law classifies land into (i) private property which includes: private property of individuals and of other legal persons who acquire the land for developmental purposes which are beneficial to the public; (ii) national lands: all lands that have not been subjected to private appropriation; and (iii) public property: all real property that by nature or purpose is allocated for public use [26]. The focus of this paper is on (i) private property under the customary tenure system in rural Cameroon. Customary tenure system is not static and has evolved slowly over time in response to institutional, economic, environmental, and political changes, thus offering a window of opportunity for inclusive customary reforms at the local level [39,40]. However, knowledge gaps exist with respect to the extent to which customary rules shape rural women's adaptation in the context of climate change. This paper seeks to address two objectives: (i) to characterize gender inequality with regards to customary land tenure in rural Cameroon, and (ii) to analyse land access as an endogenous institutional constraint to rural women's climate adaptation. It is based on a study conducted within the framework of the Alexander von Humboldt Foundation International Climate Protection Fellowship on "Land tenure, gender and climate change adaptation in sub-Saharan Africa, using Participatory Action Research approaches". The knowledge generated will contribute not only to (re)define customary practices, but will identify pathways to reduce gender inequality, while building community resilience to climate change in the context of subsistence farming.

## 2. Materials and Methods

### 2.1. Study Area

The study site, Konye Sub-Division (Figure 1), is found in the South West Region of Cameroon, between Latitude  $5^{\circ} 9' 26.46''\text{N}$  and Longitude  $9^{\circ} 22' 2.31''\text{E}$ . The climate falls within the equatorial climate with an annual rainfall of 3000–4000 mm. It is characterized by two distinct seasons: the wet and dry seasons. The dry season lasts from November to February while the wet season extends from March to October. The average annual temperature is  $27^{\circ}\text{C}$  and favours agriculture. The area has an estimated population of 749 people [41], with a density of 57 persons/km<sup>2</sup>. Of this population, 51% are women. More than 85% of the population are dependent on farming for their livelihood. Perennial and seasonal crops (cocoa, plantain/banana, oil palm, fruit trees and rubber, and cassava, cocoyam, maize, and vegetables) together with livestock, constitute the principal sources of household income and subsistence [41].



**Figure 1.** Location of Konye in Cameroon.

### 2.2. Data Collection and Analysis

Three key research instruments were employed: (i) an interview guide, (ii) a focus group discussion (FGD) guide, and (iii) a semi-structured questionnaire. We interviewed 10 key informants (clan leaders, NGO workers, women group leaders, and government officials) to generate information on contextual issues with regards to land tenure, gender inequality and the resilience of sustainable farming systems in the face of climate change. Two FGDs were conducted involving a total of 29 participants. The participants were 1 traditional ruler, 2 village council members, 6 municipal councillors extended to sector-based ministries, 3 community-based organization members, and 17 male and female farmers. The first and second FGDs were made up of 14 and 15 participants, respectively. Although the study focused on women's access to resources and the inherent constraints, we judged that mixed groups, involving men and women, drawn from all key sectors of the community, were relevant for the study. The mixed groups gave room for heated discussions on the cultural practices that shape access to land and other natural resources. Participants were selected based on their role as actors (active or passive) in the community. Issues discussed were traditional/cultural practices and their changes over time, and their impact on land access for women. The interviews and FGDs further shaped the design of a semi-structured questionnaire (30 items) which was administered to 87 female farmers. Apart from

the socio-demographic characteristics (age, level of education, family size and marital status), the questionnaire also captured questions on rural women's awareness of climate change, climate change effects on farming, crop production and their uses, knowledge of the traditional institutional setting in Konye and women's access to and use constraints to land. Questions were structured to capture either categorical or coded response options. For instance, participants were asked if they were aware of climate change, with "yes" and "no" response options. A follow-up question on the perceived climate change manifestations were posed to generate categorical response options as follows: (i) "Are temperatures increasing (are places getting warmer)?" and (ii) "Does rainfall come earlier or later than expected?" The effects of climate change on subsistence farming were also obtained by proposing coded response options (Table 1).

**Table 1.** Key questions on respondents' perceptions of climate change and its effects on subsistence farming.

Question	Responses
Which crops do you grow on your farm?	List of crops mentioned: (1) Kolanut, (2) Maize, (3) Yam, (4) Cocoyam, (5) Vegetable, (6) Plantain, (7) Cocoa, (8) Oil palm, (9) Pepper, (10) Cassava, (11) Bean, (12) Banana, (13) Groundnut, (14) Egusi
For the crops identified, explain how you use the produce.	Coded into the following categories: (1) Household use, (2) Household use and sales, (3) Sales only
Are you aware of any change in climate (temperature and rainfall)?	(1) Yes, (0) No
If yes, please answer questions (a) and (b) to indicate the manifestations of these changes:	
(a) Are temperatures increasing (are places getting warmer)?	(1) Yes, (0) No
(b) Does rainfall come earlier or later than expected?	(1) Yes, (0) No
From the options below indicate the applicable effects of climate change on subsistence farming:	Coded into the following categories: (1) Crop failure, (2) Reduction/loss of income, (3) Decline in productivity, (4) Loss of plants species, (5) Pest and disease attack, (6) Food insecurity and hunger, (7) Reduction in soil fertility
Do you have access to land?	(1) Yes, (0) No
Do you have a secured tenure over farmland?	(1) Yes, (0) No
From the list below, indicate the various sources of land access:	Coded into the following categories: (1) Inheritance, (2) Marriage, (3) Groups, (4) Lease/rent, (5) Church, (6) Purchase, (7) Gift
Identify the land access constraints faced by women:	Coded into the following categories: (1) Tradition, (2) Men are natural household heads, (3) Women can remarry, (4) Land title acquisition bottle necks, (5) Women are not aware of their rights
Does the way you access land affects the way you adapt to climate change?	(1) Yes, (0) No
What are your access constraints to adopt sustainable farming?	Coded into the following categories: (1) Insecure and unequal tenure, (2) Land disputes, (3) Lack of access to credit facilities, (4) Inadequate information, (5) Fear of the unknown
What do you do to increase yields with limited land access/control?	Coded into the following categories: (1) Proper seed/seedling preservation, (2) Change land preparation/planting dates, (3) Change of harvesting dates, (4) Use of weather resistant varieties, (5) Grow short cycle crops (early maturity), (6) Introduce pest and disease resistant crops, (7) Grow crops on wetlands
Do you have any off-farm coping strategy?	(1) Yes, (0) No
If, yes, indicate from the list below:	Coded into the following categories: (1) Migration, (2) Reduction in household food consumption, (3) Incorporation of other non-farm sources of income, (4) Adoption of non-farm income sources

Twenty-nine out of the 36 villages that make up Konye were purposively selected for the study. The villages were judged to focus on subsistence farming as against the other 9 villages where farming activities were oriented towards smallholder plantations. In each of the 29 villages, 3 households were randomly selected. This process was largely facilitated by the lead author (Nchu), who had lived and worked in this area, within the framework of a government funded climate change programme.

Therefore, the already established trust was relevant in this process. Random sampling was employed, involving 87 female farmers to capture a variety of issues about land ownership, access to land and use, agricultural production, poverty and vulnerability to climate change.

The sample size for the study was determined using the Kothari Equation (1) [42].

$$n = \frac{Z^2 pqN}{e^2(N-1) + Z^2 pq} \quad (1)$$

where;  $n$  = sample size for a finite population,  $N$  = size of the total population which is the number of households,  $p$  = population or frequency estimated for the sample size ( $n$ ) and is 0.5 which is taken for all developing countries' population and  $p + q = 1$ ,  $e$  is the margin of error considered as 10% for this study. At 0.05 level of significance,  $Z$  is 1.96. The above sampling Equation (1) yielded a sample size of 85, but the actual sample was slightly increased to 87 targeting women farmers from Konye. All the sampled women were involved in subsistence farming. The language used was the local dialect and Pidgin English, both of which are spoken and well understood by the respondents.

Qualitative and quantitative data were summarized, coded and analysed using Microsoft Excel spreadsheets and the Statistical Packages for Social Science (SPSS) version 20. Data collected through FGD and interviews were manually transcribed and used as narratives to further support the results. The linear regression equation, the chi-square test and the frequency distribution were employed with the aid of the SPSS. The linear regression was used to model the impacts of climate change as perceived by the respondents, at the 10% level of significance. A chi-square ( $\chi^2$ ) test for independence was used to determine the reliability of the information concerning the constraints to climate adaptation for women farmers. A 5% significance level was adopted. The binary logistic regression was employed to determine the likelihood of crop failure and the loss of plant species linked to respondents' perceived manifestation of climate change. In this regard, the analysis was geared towards explaining the extent to which women who perceived temperature increase and changes in rainfall timing were more likely to report crop failure and the loss of plant species. We used dummy variables to present both outcome variables. The first dependent variable, namely, "crop failure", received a 1 if the interviewed woman witnessed crop failure and 0 otherwise. The equation is expressed as follows:

$$Y_i = \alpha + E_1\beta_1 + E_2\beta_2$$

where  $Y_i$  = probability that there is crop failure,  $E_1$  and  $E_2$  are climatic variables (perceived temperature increase and perceived change in rainfall timing), respectively,  $\alpha$  is a constant, and  $\beta_1$  and  $\beta_2$  are regression parameters to be estimated.

The second dependent variable, namely, "loss of plant species", received a 1 if the interviewed woman witnessed a loss in plant species and 0 otherwise. The expression follows a similar approach as Equation (1) above where:

$$X_i = \alpha + E_1\beta_1 + E_2\beta_2$$

Such that  $X_i$  = probability that there is a loss in plant species,  $E_1$  and  $E_2$ , are climatic variables (perceived temperature increase and perceived change in rainfall timing), respectively,  $\alpha$  is a constant, and  $\beta_1$  and  $\beta_2$  are regression parameters to be estimated.

### 3. Results and Discussion

#### 3.1. General Characteristics of Respondents

The socio-economic aspects studied were age, civil status, education and household size (Table 2). Of the sampled women, the majority (71%) fell within the age group 16–49 years, those above 50 years represented 28%, while 1% fell below 16 years. The results also indicated that 79% of the women were married, while most (69%) belonged to households with sizes between 4–6 persons. As concerns literacy and education, 44% attended primary school, 20% attended secondary school, 3% were

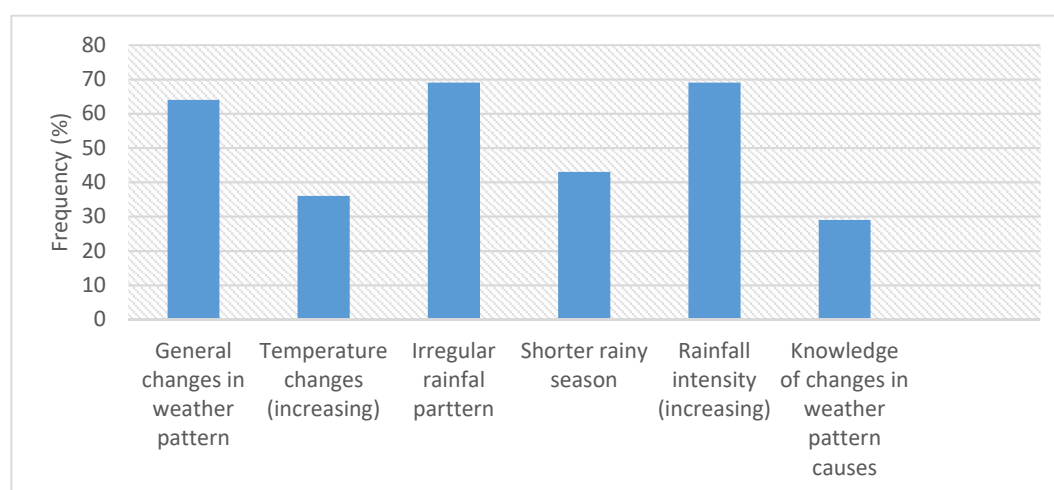
university graduates, 16% went through non-formal education (adult literacy centres), and 17% had no formal education.

**Table 2.** Socio-demographic characteristics of respondents.

Variables	Variable Definition	Percentage of Sample
Age of respondent	1 = Less than 16	1
	2 = 16–49	71
	3 = 50+ years	28
Family size	1 = 1–3 members	32
	2 = 4–6 members	60
	3 = 6+ members	8
Level of education	1 = Primary	44
	2 = Secondary	20
	3 = University	3
	4 = Non formal education	16
	No formal education	17
Marital status	1 = Married	79
	2 = Unmarried	21

### 3.2. Perception of Climate Change

With respect to the climate change awareness of rural women, expressed through temperature and rainfall (Figure 2), 75% of the women were aware of the changing climatic conditions. Even though some women (25%) acknowledged not being aware of climate change, 98% of them agreed that farm productivity was falling. This falling productivity, based on interviews, was linked to the confusing nature of rainfall and temperature which negatively affected crop cultivation dates, maintenance periods and harvesting dates. With regards to rainfall irregularity and intensity, 69% of the respondents indicated a change compared to the past situation and testified to have experienced brief periods of rainfall with high intensity (heavy downpour), 43% of the respondents acknowledged that the rainy season did not last as long as it did in the past. Considering that 99% of the respondents fell within the age group of 16 to 50 years, it is possible to rely on their opinion which is based on their experience. Thirty-six percent perceived an increase in temperature. With just 29% being aware of the causes of climate change, 64% agreed that there is a general change in the weather pattern.



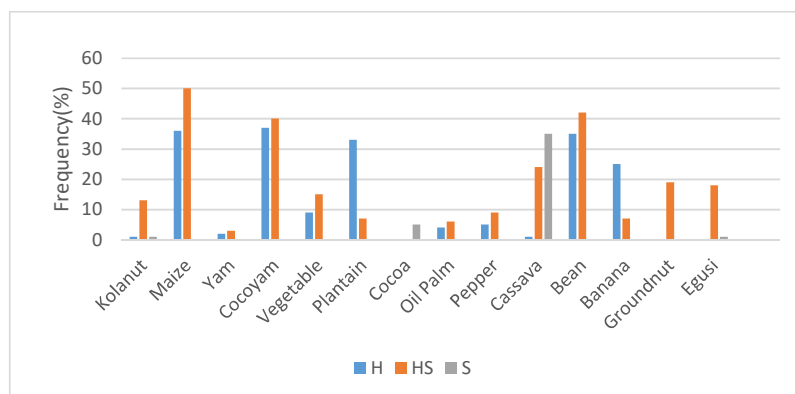
**Figure 2.** Indicators of women's climate change awareness in Konya.



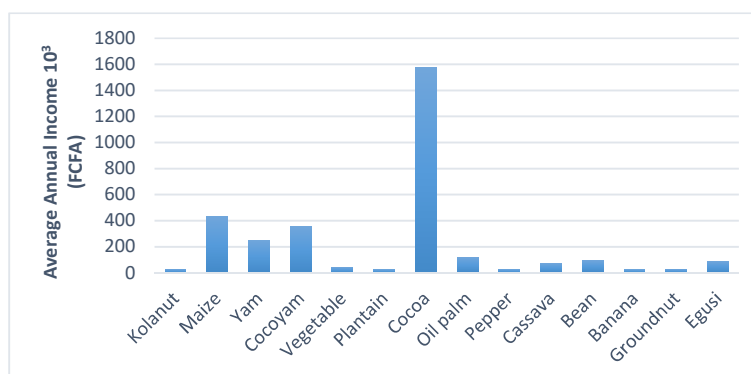
The results are consistent with Kimengsi and Tosam [43] who contend that the coefficient of variation for rainfall and temperature in the South West Region of Cameroon all exceed the 10% threshold, suggesting increasing climatic variability. The results are equally in line with Molua [44], and Molua and Lambi [6] who noted an increase in average temperatures, and an irregular rainfall pattern in the Southwestern Region of Cameroon. As concerns sources of climate information, 44% of the respondents obtain climate-related information from their local support groups, 34%, 15% and 7% obtain climate information through community radio (broadcasting in the local dialect), agriculture extension workers and workshops, respectively.

### 3.3. Gender and Land Tenure Implications on Livelihoods in Konye

In Konye, women extensively use the land for subsistence farming (slash and burn) with food crops (cassava, plantain, cocoyam, maize and vegetable) and cash crops (mainly cocoa) accounting for 64% and 36%, respectively, of all agricultural land use. This constitutes 85% of rural income (Figure 3; Figure 4). Cocoa brings by far the highest income, but it is a significant driver of deforestation in most cocoa producing areas of Cameroon [45]. Recent trends [40] show an increase in the number of women involved in cocoa production, although this is highly constrained by insecure and inequitable access to and control over land. As concerns decision making on what and where to plant, 15% of women make the decisions solely and 85% make decisions jointly with their husbands. Women also have other non-farm sources of income such as non-timber forest products (NTFPs) (mushrooms, snail gathering, fuel wood collection) and small-scale business activities such as palm wine sales. These results are consistent with Gaymard et al. [46] who contend that subsistence farming employs more than 90% of Cameroon's rural population.



**Figure 3.** Main crops grown by women in Konye. H: Household use only. HS: Household and sales. S: Sales only.



**Figure 4.** Average annual income (FCFA) from crops grown.

One hundred percent of women use their income to support the family and over 80% for children's education, while 6% and 5% use it to purchase farm inputs and to re-invest in small businesses, respectively (Figure 5). These results are in line with Fombe et al. [47] who reported that proceeds from the land women cultivate contributes to the wellbeing of the family.

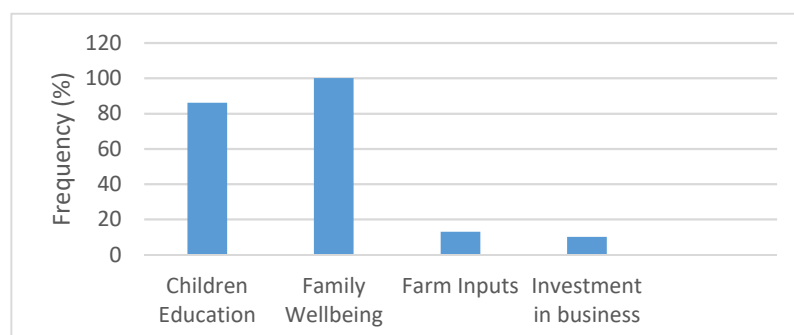


Figure 5. Expenditure from farm revenue.

While women are engaged in subsistence farming, their activities are perceived to be constrained by climate change effects (Figure 6). These impacts include a fall in income (70%), a decline in crop productivity (67%), food insecurity (28%), crop failure (70%), the loss of plant species (60%), pest and disease attack (60%) and a reduction in soil fertility (20%). Women who perceived the effects of climate change (temperature increase, change in rainfall timing, or both) were more likely to report crop failure and the loss of plant species (Table 3).

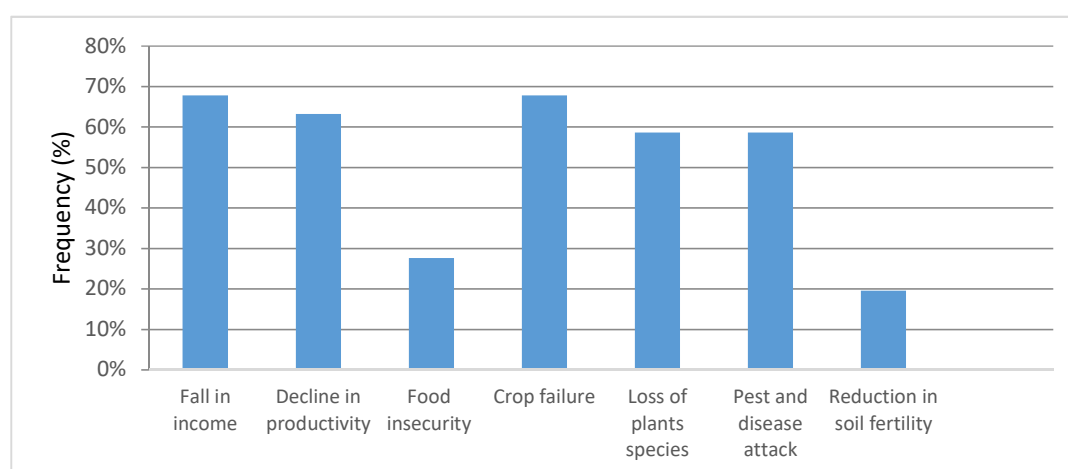


Figure 6. Perception of climate change impact on subsistence farming.

This result agrees with Orock et. al [48] who stated that the loss of cocoyam (*Colocasia esculenta*), previously cultivated by more than 90% of female subsistence farmers [49] in the Southwestern Region of Cameroon is attributed to climate-induced pests and diseases. It is equally supported by Molua and Lambi [6] who upheld that net revenues fall as a consequence of the increasing unpredictability of rainfall and temperature increase. Eighty-nine percent of Konye women believe that they are more affected and burdened with the cost of coping and recovering from the impacts of climate change. This is in line with Defang et al. [50] who held that women are more affected than men because of their heavy involvement in natural-resource-dependent activities including farming when compared with other paid occupations. Equally, women have a low migration potential when compared to men [1].



**Table 3.** Logistic regression results with perceived temperature and precipitation changes as independent variable.

	Coefficients	Significance ( <i>p</i> -Value)
Crop failure	0.131	0.002 **
Loss of plant species	0.094	0.015 *
Reduction/loss of income	0.048	0.535
Reduction in soil fertility	0.021	0.671
Decline in productivity	0.003	0.952
Pest and disease attack	0.009	0.865
Food insecurity and hunger	0.606	0.177
Multiple R	0.37973817	
R Square	0.144201078	
Adjusted R Square	0.123824913	
Standard Error	0.171785645	
Observations	87	

Note: \*\* Significant at 0.01, \* significant at 0.05.

### 3.4. Customary Institutions and Gender Constraints in Subsistence Farming

Although traditions and customs regarding tenure have evolved over time, the allocation of land in terms of inheritance is still discriminatory in favour of males. In Konye, women own only about 7% of all registered lands [41]. This consists of women with legal marriage documentation (marriage certificates) and where both spouses accept joint property as a clause in the above document. As few as 9% of women have equal access rights, but not control rights, and even in such cases, these rights are restricted. The men can restrict their wives from farming a piece of land because they plan to use the land for another purpose (most often for the cultivation of cocoa). The institutional set up in Konye (Figure 7) is largely controlled by the chief and the Village Council (VC), and therefore male-dominated. These institutions play a pivotal role in regulating access and control rights to private and communal property. The chief is the custodian of the land at the village level and together with the VC (exclusively men), they decide who uses the land, and when it should be used. Resources become private property when owned by families (most often household heads) and are governed by the customary law under a patriarchal system. Generally, customary rules shape gender relations in the context of natural resource access and use. Hence, women are generally deprived of land ownership, and in taking major decisions over land use. The same scenario acts as a constraint to youth engagement in community development [47].

Traditional practices (57%) within a patriarchal system, which specifically views men as the natural head of the household (49%), are part of the customary system that discriminate against women (Figure 8). The belief that women could always remarry (18%) accounts for why men will prefer their male children to inherit the land. Furthermore, the procedure for acquiring a land title is lengthy, costly and highly corrupt (12%). At the heart of it is the fact that a significant proportion of women (49%) are not aware of their rights to access and own land.

In this discriminating patriarchal system, only 23% of women received land for farming from their parents. However, their husbands still control the land. This happens mostly in cases where the women married somebody who is not a native of the area. A majority of rural women (82%) access farmlands through their spouses (Figure 9) and most often lose such rights when they divorce or become widows. A male respondent corroborates this in the following words:

“My wives decided on what to farm, but I prefer to plant more of cocoa because of the growing market demand. For that reason, I have asked my 3 wives not to farm on the piece of land they used because I intend to expand my cocoa plantation” (Chief Ngoue, 50, Married to 3 wives with no Legal Documentation).

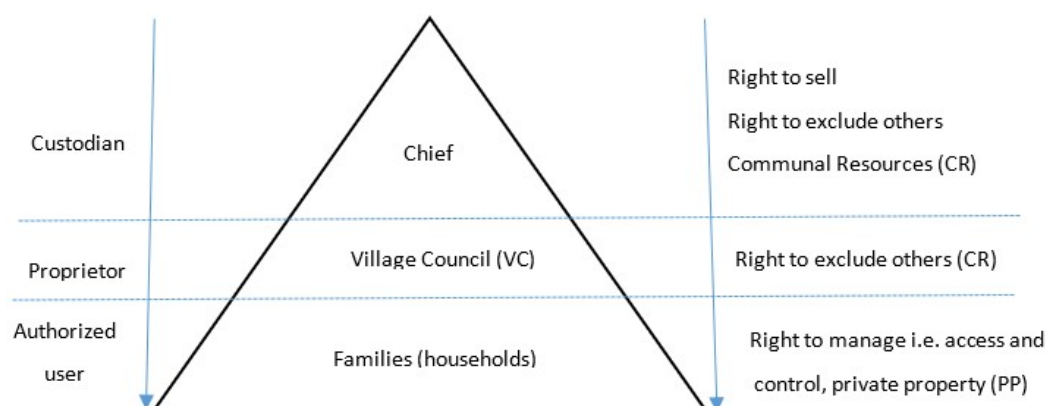


Figure 7. Konye village traditional institutions.

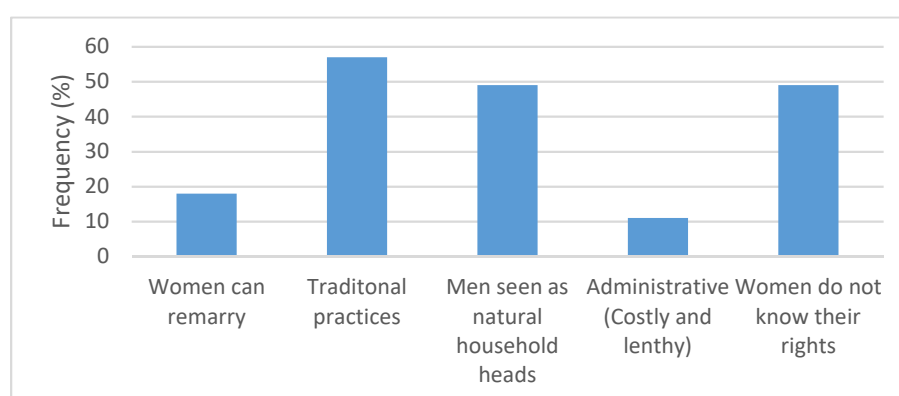


Figure 8. Women's access to and control over farmland in Konye.

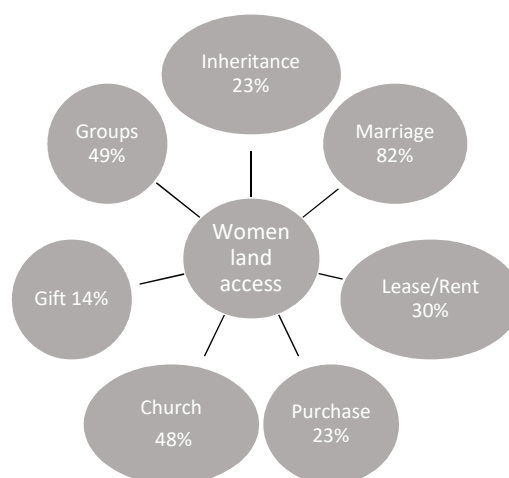
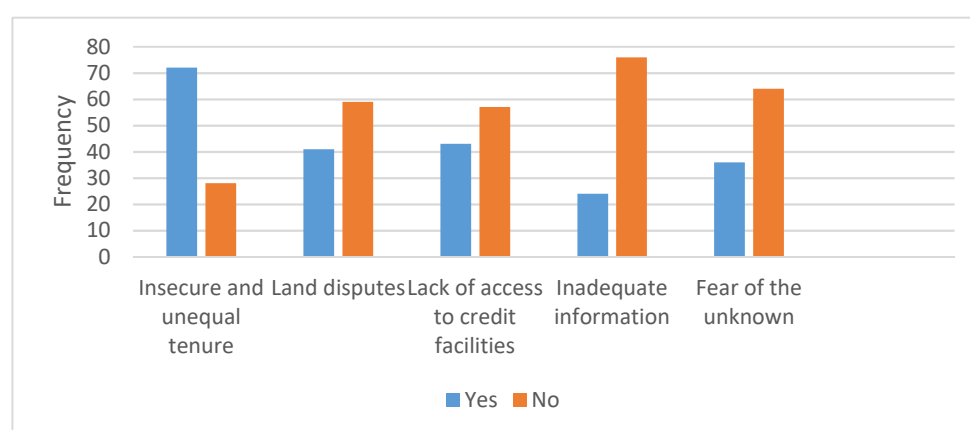


Figure 9. Ways in which women access farmland in Konye.

Since women cannot access land in their own right, they are, however, seeking other access channels such as groups (49%), the church (48%), lease/rent (30%), purchase (23%) and gifts (14%).

Women tend to have only small land sizes and are uncertain about the period of use. Consequently, they mostly cultivate short-cycle crops—the income from which is unsustainable [51].

The survey data further revealed that unsecured and unequal tenure (72%) was the most significant constraint towards adopting farming practices to reduce vulnerability and enhance climate change adaptation (Figure 10). Unsecure and unequitable tenure is often characterized by land disputes (41%). Without a secured tenure, it is difficult to access credit facilities (43%), especially where land could be used as a collateral for obtaining a loan to either buy farm inputs or move to other non-farm sources of livelihood. Women are not ready to invest in land or property that is not theirs. Hence, there is a lack of motivation to invest in long-term farming practices. This limits their ability to build resilience to climate impacts, which in this case is linked to enhancing agricultural productivity.



**Figure 10.** Constraints to the adoption of farming practices to reduce vulnerability.

Based on the interviews, access to farmland is perceived to affect women’s adaptation practices in subsistence farming in the face of climate change. As one of the respondents succinctly puts it:

“We grew up in the community to learn that it was a taboo for women to be involved in discussions concerning land issues. Land issues are reserved only for the men who determine when and where we have to farm. Although we do not complain [out of respect for our husbands or family heads], we feel that it would have been good for us to at least take part in deciding what happens to land and how it can be managed, since we are principally the ones who grow food crops for our households.” (Anna, 45 years).

We can deduce from these remarks that women are increasingly recognizing the need to be fully integrated into land decision-making arrangements. This result is consistent with Salami et al. [52] who state that the lack of tenure security (especially for women) is one of the most important “socio-cultural” (non-technical) factors constraining small-holder farming, thus undermining the sector’s adaptive capacity to climate change. The finding is in line with Bruce et al. [38], Cotula [39], and IFAD [53] who hold that insecure and unequal access to and control over agricultural land affect the way rural women build their resilience to climate change impacts. However, some women expressed fear of being sanctioned by the traditional council (which is composed entirely of men). This view was further expressed as such:

“The traditional council is the decision-making body of the community. It is sacred and has [spiritual] powers. Only men are members of this council. Most of us cannot challenge any land access arrangements because we are scared of our husbands reporting us to the traditional council.” (Sonia, 49 years).

The chi-square test of independence (Table 4) suggests that insecure and unequal tenure as perceived by women engaged in subsistence farming undermines women’s adaptive capacity to climate change impacts ( $p$ -value = 0.003; 0.05 level of significance).

**Table 4.** Chi square test on the relationship between insecure land tenure, as perceived by women engaged in subsistence farming, and vulnerability to the effects of climate change.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.646 <sup>a</sup>	1	0.003		
Continuity Correction <sup>b</sup>	5.172	1	0.023		
Likelihood Ratio	8.287	1	0.004		
Fisher's Exact Test				0.017	0.017
Linear-by-Linear Association	8.547	1	0.003		
N of Valid Cases	87				

<sup>a</sup> Two cells (50.0%) had expected counts less than 5. The minimum expected count is 0.79. <sup>b</sup> Computed only for a 2 × 2 table.

One of the respondents recounted in her own words:

*"It is difficult for us to organize [plan] our farming activities in the long term; today we are told we can farm here, and in a few years to come, we are told that the land has been sold or will be used for other purposes [small-scale palm or cocoa farms]. That is why we generally grow short-cycle crops."* (Hannah, 39 years).

These results conform with Gyua et al. [54], Salami et al. [52], and IFAD [53] who report that uncertainties attributed to land tenure insecurity together with inadequate land access have been identified as a critical challenge to smallholder farmers in SSA. Building resilience to climate change requires long-term farm planning approaches which can mitigate losses and maximize productivity. This scenario does not hold for the women in rural Cameroon; with an insecure tenure, long-term farm investment decisions cannot be made by them. However, other respondents held a contrary opinion, maintaining that times were changing and men were gradually integrating women in land decision making. Quoting this (male) respondent:

*"Times are changing; I guess so too is tradition. Women now own land and can farm wherever they want to. When it comes to cash crops such as oil palm, men are responsible for clearing, planting, harvesting and processing, while women assist in fruit picking and processing. However, the men make decisions about what to plant and when, what to buy or sell and at what price, and they [jointly] control the income obtained from the sale of farm produce. Alternatively, women cultivate vegetables on plots of land assigned to them by the men."* (Traditional Ruler of Konye, more than 1 wife).

#### 4. Proposals for Building Resilience to Climate Change

In this paper, we sought to (i) characterize gender inequalities with regards to customary land tenure in rural Cameroon and (ii) analyse land access as an endogenous institutional constraint to rural women's climate adaptation. We randomly drew a representative sample of 87 female subsistence farmers in Konye, South West Cameroon. We employed the logistic regression and the chi-square analysis and established a relationship between women's insecure tenure and the vulnerability of subsistence farming systems to climate change. Our results concur with the notion that climate change as perceived through increasing temperatures and irregular rainfall patterns, affects subsistence farming, especially through crop failure and crop species loss. Intense rains result in soil compaction, soil erosion and high run-off, which accelerates the physical and chemical degradation of soils. Also, higher temperatures cause food crops to die before they mature. Insecure and unequal land tenure systems interact with climate change impacts to amplify climate vulnerability by constraining subsistence farming activities that could buffer rural farmers' especially women against such adverse effects. These constraints relate to the customary tenure system (e.g., insecurity of land tenure, unequal access to land, lack of a mechanism to transfer rights and consolidate plots) and result in an under-developed farming system, high landlessness, food insecurity, degraded natural resource and increased poverty for rural women.

Faced with the challenges as a result of climate change, insecure and unequal tenure, alongside the need to provide food for the family, rural women seek to increase production (not productivity), by extending shifting cultivation practice. Although there exists no direct linkage between customary land tenure system and climate change impacts, a secured and equitable access to and control over farmland reduce the risk of hunger and poverty and influence people's capacity to invest in sustainable and productive land related activities.

In order to build women's resilience (considered here as the ability of women to cope with external stresses and disturbances), policy response and advocacy particularly at the local (municipal and village) level involving local actors such as COMES, NGOs, CBOs, farming groups and traditional rulers, should be encouraged [55–58]. Land ownership allows people to sustainably manage resources and develop more equitable relations with the rest of society [29,53]. This will contribute towards raising farm yields which has a trickle-down effect on enhancing food security, income, livelihoods and the overall wellbeing of the family. Women can plan and quickly adjust resource allocation decisions under changing climatic and socio-economic conditions and can rely on the productive results of their labour. Therefore, secure and equitable access to productive resources such as land is critical to the millions of poor people in rural areas who depend on farming for their livelihoods [59]. This could serve as an entry point for community-based interventions aimed at reducing the vulnerability of subsistence farming to climate change.

Recognizing that smallholder farmers dominate Cameroon's rural landscape [60], land tenure issues continually take central stage in research and policy discourse. While there is a need to reduce inequality in land access, it is equally necessary to guard against land fragmentation. Studies have shown that excessive land fragmentation affects the technical efficiency of farms [61]. Small fragmented land holdings might create difficulties to grow certain crops and prevent farmers from switching to more profitable crops [62]. Also, in Cameroon, most financial institutions (e.g., banks and micro-credit institutions) are not willing to take small, scattered and fragmented land holdings as collateral; this prevents farmers from obtaining credit to make on or off-farm investments. Consequently, a process of land consolidation needs to be implemented through "family ownership" which allows equal access for both sexes.

Perhaps, the practice of joint property for couples could improve the unequal access problem for these communities. However, for this to be effective, the local government should encourage couples to acquire official documentation of their marital status by facilitating the issuance of marriage certificates. This will motivate joint ownership of property. Incentives for men to change behaviours, as in the case of Nepal where the policy to waive 20% of tax revenue if the land is registered in the name of a woman was highly successful, should be encouraged [58]. The creation of a Village Land Act could provide the legal framework for the management of village land; this has proven to be successful in Tanzania [63]. In executing this function, the village should make use of the already existing Village Council, after restructuring it to be gender sensitive, to act as the management committee and to render accounts for land management decisions. The village land act should then be integrated into the land governance framework of the country.

## 5. Conclusions

Due to the increase in research emphasis on building resilience in the context of climate change, climate interest has risen tremendously [64]. This study adopts a holistic thinking and argues that increasing women's access to farmland should be combined with other measures that focus on tightening legal loopholes such as legal pluralism or gaps in implementation. The study leads us to the following conclusions: (1) gender inequality with regards to natural resource access, increases the climate change adaptation burden for rural women in Cameroon; this trend likely prevails in other parts of sub-Saharan Africa. (2) Unequal natural resource (land) access is rooted in seemingly biased customary rules which favour men. Two lines of investigations are plausible, from the foregoing: Firstly, studies that are geared towards developing less natural resource-dependent climate change

adaptation schemes for rural women should be pursued. Secondly, the conditions under which existing customary rules could be revised and/or new rules crafted to bridge the natural resource access gap for women need to be explored. This paper not only contributes to existing theoretical frameworks on climate adaptation from an institutional perspective, it equally makes a succinct request for further studies to be undertaken to ground this theoretical assertion.

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