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Influence of Anthropogenic Activities on Climate Change in the Adamaoua Region (Cameroon)

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Abstract: Numerous anthropogenic pressures, including periodic fires, influence the current functioning and structure of tropical savannas. Few scientific studies have focused on the influence of fire on carbon stock despite its impact on climate change. The objective was to contribute to the evaluation of the effects of activities on the woody cover in the high Guinean savannahs of Cameroon. The work took place in the Arrondissements of Ngan'Ha, Ngaoundéré III for the Vina and Mbakaou Departments and Ngaoundal for the Djerem Department. A socio-economic household survey was conducted among 200 people, 100 per department. The results show that 93.60% of respondents stated that the advantages of fires are the renewal of pastures, the cleaning of fields and the facilitation of hunting. As for the disadvantages, they cite the destruction of fields, the burning of houses and granaries; and environmentally, the reduction of agricultural yields, the increase in heat, diseases, and the disappearance of certain animal and especially plant species such as *Lophira lanceolata, Carissa edulis, Sarcocephallus latifollius*. The main endogenous knowledge developed by the populations for the adaptation and mitigation of climate change are the use of organic fertilizers, awareness against fires, tree planting, fences for the protection of concessions etc. It is urgent to take adequate measures to limit bush fires and the cutting of wood for energy.

Keywords: Adamaoua, Anthropic Activities, Climate Change, Influence

1. Introduction

The problem of climate change is a concern that spares no continent and affects all sectors of the economic and social life of the populations [1]. According to the populations surveyed, rainfall and temperature have varied greatly in recent years [2]. This high temperature could lead to climate change Increased temperature and rainfall variations are the part of climate change that is likely to have multiple impacts [3]. Global temperature variations provide insights into the causes of major changes that are largely anthropogenic [4] and particularly in land use sectors [2]. Rural populations in Sub-Saharan Africa are particularly exposed to climate hazards because they are heavily dependent on rain-fed agriculture. Rainfed agriculture accounts for nearly 93% of cultivated land [5]. Rising temperatures and rainfall variations are the part of climate change that is likely to have multiple impacts on coastal regions [6]. Some phenomena such as salinity leads to reduction in agricultural production [7], vegetation growth, deteriorates the natural environment, and creates a negative impact on socio-economic conditions [8, 9]. These long-term changes will lead to fluctuations in vegetation cover in drylands. In this case, there is already an environmental emergency [10]. The global data in this study indicate that temperature and precipitation are the main natural drivers of climate variation. In the same sense that Dona [11] also believes that superimposing monthly temperature and precipitation curves highlighting areas of drought or wetness makes it easy to characterize and compare climates.

In Cameroon, the ecological interest of climate change has led to numerous studies aimed at better understanding its origins and evolutionary mechanisms. In forest areas [12].

However, the UNFCCC, through the Clean Development Mechanism (CDM) of the Kyoto Protocol, has in recent years aroused great enthusiasm among developing countries, which see it as an opportunity to improve the environment through an increase in forest areas while benefiting from carbon credits established through international financial instruments [13].

In the Adamaoua region, populations are facing climate change. These changes are manifested by a decrease in rainfall and an increase in temperature. To better understand the causes of this phenomenon, it is important to study the endogenous knowledge of local populations on the effects of anthropogenic activities on the Guinean high savannas.

2. Materials and Methods

2.1. Presentation of the Study Area

The study took place in the Divisions of Vina and Djerem. The sites belong to the vast Adamaoua Plateau, located between the 6th and 8th degrees north latitude and between the 10th and 16th degrees east longitude, with an average altitude of 1,000 meters. Its climate is Sudano-Guinean with a humid tendency, with a rainy season from April to October and a dry season from November to March. The average annual rainfall is 1,400 mm, the average annual temperature is 23°C and the relative humidity is 70%. The dominant soils are low modal ferralitic soils developed on granitic rocks and red ferralitic soils developed on ancient basalts [12]. The vegetation of Adamaoua is a savanna with *Daniellia oliveri and Lophira lanceolate* [14]. The physiognomy of this vegetation is maintained by zoo-anthropic actions such as bush fires, grazing, clearing and anarchic wood cutting [15, 16].

2.2. Activities

The most profitable activities of the population are mainly represented by livestock and agriculture.

The development of natural resources is done mainly through agriculture, cattle breeding, beekeeping and fishing [17].

Agriculture

According to the work carried out by [17], agriculture occupies first place in the economic activities of the Adamaoua region. More than 53 percent of the rural population practices traditional subsistence agriculture. The main crops grown are millet, cassava, sorghum, potatoes, corn, yams, peanuts, sorghum, tomatoes, soybeans, macabo, cucumbers, rice, oranges, etc.

Agriculture in the city is also marked by the important practice of market gardening with the production of *Lycopersicon esculentum, Ipomea batatas, Solanum tuberosum, Lactuca sativa, Daucus carota, peppers,* etc. [18]. However, the region experienced industrial cultivation in the 1970s with the creation of an agribusiness company called SODEBLE (Société de Développement de la Production de blé) in Wasandé (80 km southeast of Ngaoundéré). This company was closed in 1990 and in the 1980s, the creation of MAÏSCAM (Maïserie du Cameroun) in Borongo. The main crops produced by the population are cassava (11,2539 t), maize (15,444 t) and sweet potatoes (10,656 t).

Livestock

Livestock farming is an activity that involves several types of actors: pastoralists, agropastoralists, non-livestock owners, ranche owners, and non-farmers practicing livestock farming as a secondary activity [19, 20]. The distribution of livestock takes into account the land use system. The usable land area is 18,487 km^2 divided into 1,055,000 ha of grazing land, 793,700 ha of non-grazing land, and the remainder in crops.

2.3. Climate

The climate is of the Sudano-Guinean type, since this wooded savannah zone is located in high ground. Temperature variations are quite significant in the dry season. The year is divided into two seasons: one dry and one rainy. The month of February is the one where the temperature is the highest. It can reach 24°C on average during the day. However, the average annual temperature is 25°C, with annual precipitation ranging from 0 to 271 mm on average in 2017. The dry season is marked by a dry wind from the north such as the harmattan, which becomes a dry and hot wind. As for the rainy season, it is marked by sometimes violent and discontinuous rains [20].

2.4. Methodology

The study was conducted in the Adamaoua region, particularly in the Departments of Vina and Djerem. Two districts were selected in each department.

Semi-structured interviews were conducted with 200 people, 100 per department (Djerem, Vina), using a questionnaire prepared in advance. In each department, two districts were selected. Ngaoundéré III and Ngan'Ha were chosen in the Vina and Mbakaou and Ngaoundal for the Djerem. In each Arrondissement, 5 villages were selected. The questionnaire was composed of open-ended questions, closed-ended questions and guided questions. In the case of the closed questions, the respondent answered yes or no, whereas in the case of the open questions, the respondent expressed himself freely. For the guided questions, several answers are proposed and the respondent chooses one or more of them. The main headings of the questionnaire are: environmental perception, the problem of periodic fires, climate change, local strategies developed to mitigate and/or adapt to climate change, endogenous knowledge on biodiversity management, deforestation, ecosystem services, clean development mechanisms (CDM), etc. The resource persons had a long tenure in the locality.

3. Results and Discussion

3.1. Socio-economic Characteristics of the Populations and Their Perception of the Environment of the Guinean High Savannahs

Knowledge of the social and economic characteristics and their relationship with the environment is essential to this study. This step allowed us to confirm the field data. In this

section, the composition of the population as well as its perception of local climate change were examined. The socio-economic and demographic characteristics of the populations are essential in understanding the phenomena of periodic fires and climate change.

3.1.1. Age of the Population

The total sample consisted of individuals ranging in age from 20 to 80 years. The majority of the Guinean high savannah population interviewed for this exercise is predominantly (57.59%) in the 20.01-40 age class. The class of 40.01-60 years comes in second place with 18.82% of people. Between the Boroughs, the trend is respected for the dominant class (Table 1). The age group below 20 years is less represented while the one above 80 years is absent. This result is contrary to that obtained in the Sudanian savannahs of Cameroon [21].

Table 1. *Age of the population.*

Districts	Age				
	<20	[20-40]	[40-60]	[60-80]	Average
Ngaoundal	7.05	55.18	24.28	13.48	25±21.34
Mbakaou	10.45	57.62	16.53	15.38	25±21.90
Ngaoundéré III	10.65	50.88	24.93	13.53	25±15.86
Ngan'Ha	19.04	66.66	9.52	4.76	25± 28.40
Average	11.80± 5.10	57.59± 6.66	18.82± 7.27	11.79± 4.76	25±21.20

3.1.2. Gender and Beliefs of the Population

The population of the Guinean high savannah that participated in the interviews is predominantly male (74.84%). The trend of dominant gender is respected regardless of the Arrondissement (Table 2).

This strong male dominance can be justified by the fact that women are called upon to stay in the households to do certain domestic chores, making it difficult to meet them. Furthermore, the statistical test reveals that there is a significant difference between the sexes (0.001<0.01). Similar results were obtained by Nyasiri [22] in the Ngaoundéré cliff. In terms of religion, Islam and Christianity are among the main religions encountered in the Guinean high savannah. The Muslim religion (60.04%) dominates regardless of the Arrondissement.

Table 2. *Gender and Beliefs of the Population.*

Districts	Male	Women	Average
Ngaoundal	73.52	26.47	50±33.26
Mbakaou	72.68	27.3	50±32.08
Ngan'Ha	78.57	21.42	50±40.41
Ngaoundéré III	74.57	25.43	50±34.74
Average	74.84± 2.60	25.16±2.60	50±32.25

3.1.3. Marital Status of the Population

The majority of the total sample is monogamous, 37.63% on average (Table 3). Monogamy is followed by polygamy (35.31%). The trend in monogamy varies between districts. In Ngaoundal, polygamy is predominant (52.22%) while celibacy is more pronounced (47.61%) in Ngan'Ha. This result indicates that the youth of this district are not as attracted to marriage as in other districts. The predominance of polygamy in this administrative unit can be explained by the fact that the indigenous population is Muslim and in the majority. This result is contrary to that of Nduryang [23], who obtained the predominance of monogamy among the populations of the Far North.

Table 3. *Marital status.*

Districts	Celibacy	Monogamy	Polygamy	widower	Divorced	Average
Ngaoundal	9.3	36.71	52.22	1.05	0.71	19.99±23.25
Mbakaou	7.59	50.27	41.25	0.88	0	19.99±23.91
Ngan'Ha	47.61	40.47	11.90	0	0	19.99±22.62
Ngaoundéré III	20.05	23.05	35.87	0	0	15.79±15.59
Average	21.14±18.48	37.63±11.27	35.31±17.02	0.48±0.56	0.18±0.35	19.99±22.87

3.1.4. Family Size

Examination of table 4 reveals that the population has between 5 and 15 persons. Nevertheless, the majority (34.18%) of the population has an average of less than five persons per household. In the 5 to 11-person class, the average is 21%. Among the Arrondissements, those of Ngaoundéré III and Mbakaou stand out in the 5 to 7-person class, with more than 30% (Table 4).

Table 4. *Percentage of the population by family size.*

Districts	Pourcentage of family						
	<5	[5-7]	[7-9]	[9-11]	[11-13]	[13-15]	Moyenne
Ngaoundal	35.71	26.59	18.28	19.42	0	0	16.66±14.32
Mbakaou	14.75	30.32	29.57	23.11	2.25	0	16.66±13.29
Ngan'Ha	59.52	24.42	9.52	4.16	0	2.38	17.16±22.44
Ngaoundéré III	26.73	30.20	16.54	12.38	4.13	10.02	17.36±9.82
Average	34.18±18.95	27.88±2.88	18.48±8.30	16.55±6.82	1.60±1.99	3.10±4.74	16.66±13.18

3.1.5. Professional Experience of the Population

The seniority of the population varies between 5 and more than 20 years. The majority of the population has more than 20 years of professional experience in the environment of the Guinean high savannahs of Cameroon (Table 5).

Between the Arrondissements, the population of Ngaoundal (40.49%) stands out for having worked for between 15 and 20 years.

In order to improve their living conditions, farmers have projects that they would like to carry out in the near future, such as building a modern home, purchasing modern agricultural machinery, etc.

The populations of the Guinean high savannahs state that environmental conditions are becoming increasingly harsh because of droughts and torrential rains, in short, climate change.

Table 5. *Percentage of the population by age.*

Districts	Ancienneté (années)					
	<5	[5-10]	[10-15]	[15-20]	>20	Average
Ngaoundal	8.57	10.52	13.18	40.49	27.22	19.99±12.15
Mbakaou	9.78	13.78	14.35	29.90	32.17	19.99±10.26
Ngan'Ha	21.42	7.14	16.66	7.14	47.61	19.99±16.63
Ngaoundéré III	12.12	7.64	15.91	9.52	52.13	19.46±18.52
Average	12.97±5.82	9.77±3.06	15.03±1.56	21.76±16.13	39.78±11.96	19.99±10.15

3.1.6. Educational Level of the Population

Overall, it appears that the population of the Guinean high savannahs is predominantly undereducated (58.42%). This result corroborates that of Nduryang [23] in the Sudano-Sahelian zone. The author noted that the populations exploiting non-timber forest products in the zone were mostly undereducated.

Of those who are educated, only 1.10% have attained higher education (Table 6). These results could also be due to the early marriage observed among young people in the area. It could also be explained by the unwillingness of parents to send their children to school. They prefer farming and animal husbandry. The economic "slump" of the peasants and the distance from schools are also causes of the low literacy rate.

Table 6. *Percentage of the population by level of education.*

Districts	Ngaoundal	Mbakaou	Ngan'Ha	Ngaoundéré III	Average
Analphabète	71.42	55.52	40.47	66.28	58.42±13.67
Primaire	18.42	16.55	30.95	23.05	22.24±6.41
Secondaire	10.14	25.9	26.19	10.65	18.22±9.03
Supérieur	0	2.02	2.38	0	1.10±1.27
Average	24.99±31.85	24.99±22.59	24.99±16.20	24.99±29.09	24.99±21.28

3.2. Importance of the Savanna to the Riparian Population

Surveys have shown that riparian populations derive most of their needs from the savannahs.

They use natural resources to satisfy their needs. The farmers use these resources for various purposes: food, pharmacopoeia, domestic energy, wood for services, handicrafts, etc.

Table 7. *Species providing food products.*

Species	Ngaoundal	Mbakaou	Ngaoundere III	Ngan Ha	Average
Annona senegalensis	55.00	33.33	45.00	38.07	42.85
Bombax costatum	46.67	86.67	80.00	78.67	73.00
Borassus aethiopum	100.00	100.00	98.89	100.00	99.72
Mitragyna inermis	7.21	0.00	5.67	11.63	6.13
Parkia biglobosa	33.33	46.67	80.00	53.33	53.33
Pterocarpus lucens	20.00	2.23	46.67	6.67	18.89
Sarcocephalus latifolius	63.33	40.44	40.00	51.33	48.78
Strychnos spinosa	7.00	3.00	20.33	2.10	8.11
Vitellaria paradoxa	40.34	22.17	51.07	28.20	35.44

Species	Ngaoundal	Mbakaou	Ngaoundere III	Ngan Ha	Average
Vitex doniana	19.95	48.77	2.79	28.82	25.08
Ximenia Americana	31.48	15.07	46.99	57.72	37.82
Zyzygium guineense var. *macrocarpum*	63.40	27.04	93.10	39.90	55.86
Average	40.64	35.45	50.88	41.37	42.08

3.2.1. Species for Food Use

The local population uses plant species for food. The edible organs of plants used in the diet of the local population surveyed are the fruits, flowers, leaves, tubers and rhizomes. The other parts of the plants, notably the barks, are traditionally used as condiments or seasonings. These results corroborate those of Toirambe [24] in the DRC, who showed that fruits and leaves are the most commonly used non-timber forest products by the local population. The high use of leaves of a species by the local population can be explained by the easy access to this part of the plant or an awareness of the sustainability of the species as it does not significantly compromise the survival of the species. The most commonly used species are: *Borassus aethiopum* (99.72%), *Bombax costatum* (77.00%), *Syzygium guineense* var. *macrocarpum* (55.86%), *Parkia biglobosa* (53.33%). *B. aethiopum* is used more by the populations in all the villages of the Guinean high savannas (Table 7). Although all parts of this plant are used, the fruit remains the most valued. Hypocotyl axes are produced from the germinated kernels. The flowers of *Bombax costatum* are used in sauces as vegetables and the seeds of *Parkia biglobosa* are used in the preparation of a traditional magi cube "Dadawa" for seasoning sauces [25]. The fruits of the different species are consumed and traded in local markets. Thus, the exploitation of local food plants contributes to the diversion of the daily diet and the improvement of peasant incomes and thus improves their well-being in the Guinean high savannas of Cameroon [26].

3.2.2. Plant Species Used in the Pharmacopoeia

For medicinal needs, *Khaya senegalensis* (67.67%), *Securidaca longepedunculata* (56.34%) and *Vitellaria paradoxa* (56.25%) are the species most solicited by the local population (Table 8). The local population appreciates *Securidaca longepedunculata* for treatment of rheumatism; *Anogeissus leiocarpus* for malaria and *Khaya senegalensis* for typhoid. The different parts of these plants are mostly used in decoction or transformed into powder. The organs used in the traditional pharmacopoeia are among others: barks, leaves, fruits and roots. These organs are well known for their circulatory role of the raw and elaborated sap and metabolic waste. The use of plant bark and roots varies according to the endogenous knowledge of each socio-cultural group or village. The barks and roots of *Anogeissus leiocarpus*, Annona senegalensis and Khaya senegalensis are used against stomach ailments according to the populations. This result is in agreement with that of Kadiri [27]. The author indicated that the bark of the roots and trunk of Khaya senegalensis are used against intestinal diseases. The populations of the Sudano-Guinean savannahs exploit various plant species that provide different types of non-timber forest products, the commercialization of which in local and regional markets contributes to the diversification of farmers' income [26].

Table 8. *Species used in the pharmacopoeia.*

Species	Ngaoundal	Mbakaou	Ngaoundéré III	Ngan'Ha	Average
Annona senegalensis	0	0	12.33	5.67	4.50
Anogeissus leiocarpus	30.33	16.67	38.4	21.2	26.65
Bridelia scleroneura	15	36.67	2.1	21.67	18.86
Burkea africana	23.67	11.33	35.33	43.4	28.43
Daniellia olivieri	47.67	20.33	70	30	42.00
Ficus platyphylla	20	0	21	2	10.75
Gardenia aqualla	26.67	20	53.33	20	30.00
Khaya senegalensis	80.66	56.67	76.67	56.67	67.67
Securidaca longepedunculata	65.67	41.67	74.33	43.67	56.34
Vitellaria paradoxa	54.34	25.33	87.67	57.67	56.25
Average	35.51	22.24	43.46	26.49	31.93

3.2.3. Plant Species Used as Service Wood

The value as service wood of the species surveyed varies on average from 7.80 (*Bombax costatum*) to 76.38 (*Isoberlinia doka*). At the district level, this value varies from 25.70 for the Ngaoundéré III sites to 39.44 for the Ngan'Ha site (Table 9). The use of different species of local flora in construction and handicrafts further supports the endogenous knowledge of the populations of the zone [28]. For service wood, stems are more commonly used. The most commonly used species are: *Isoberlinia doka, Anogeissus leiocarpus* and *Daniellia oliveri* (Table 9).

The use of different species of local flora in construction and handicrafts argues more in favor of the endogenous knowledge of the populations of the zone (Gosselin, 1987). For service wood, stems are more commonly used. The most commonly used species are: *Isoberlinia doka, Anogeissus leiocarpus and Daniellia oliveri* (Table 9). According to the populations, these species are used for carpentry, in the construction of the shed, and for making bridges over rivers in different communities. From the above, it appears that artisanal activities contribute to the vulnerability of biodiversity. These results are similar to those of Bergonzini [29] who showed that these species play various roles (artisanal practices, construction...) and their exploitation has

negative effects on biological diversity. All these species are exploited in different ways. For service wood, it is stems or barrels that are cut while the fruits are harvested for human consumption. The bark, roots and leaves are used in traditional pharmacopoeia. These are multipurpose species. The usefulness of a species can contribute to its disappearance.

Table 9. *Species used as service wood.*

Species	Ngaoundal	Mbakaou	Ngaoundéré III	Ngan'Ha	Average
Annona senegalensis	16.23	21	34.33	45.12	29.17
Anogeissus leiocarpus	87.77	25.66	67.67	80.44	65.39
Bombax costatum	21.33	4.23	0	5.65	7.80
Bridelia scleroneura	24.17	10	11.33	41.4	21.73
Burkea africana	40.34	51.43	16.17	45.57	38.38
Daniellia olivieri	56.7	67.27	80.1	40.43	61.13
Ficus platyphylla	7.23	2.1	4.17	24.6	9.53
Khaya senegalensis	36.67	44.67	14.33	76.67	43.09
Parkia biglobosa	48.67	40.21	6.67	32.33	31.97
Pterocarpus erinaceus	46.67	26.67	30	42.32	36.42
Securidaca longepedunculata	60.33	51.43	25.67	36.32	43.44
Strychnos spinosa	23.43	0	5.67	18.67	11.94
Vitex doniana	7.6	15.33	20.23	40.3	20.87
Ximenia americana	20.67	16.67	40.44	10.33	22.03
Isoberlinia doka	82.67	86.17	56.67	80	76.38
Terminalia laxiflora	23.33	10.33	20	50.33	26.00
Average	37.89	27.83	25.70	39.44	32.72

3.2.4. Species Used as Fuelwood

The percentage of use of species as fuelwood varies between sites. The species most used are *Isoberlinia doka* (85.05%), *Anogeissus leiocarpus* (76.05%) and *Daniellia oliveri* (72.15%). Other species such as *Parkia biglobosa* (78%) and *Securidaca longepedunculata* (70.20%) are widely used by the populations of Mbakaou and Ngaoundéré III respectively. These results corroborate those of Tchobsala [30] and Nyasiri [22], who cited *Isoberlinia doka, Anogeissus leiocarpus Annona senegalensis, Daniellia oliveri* and *Securidaca longepedunculata* among others as the species most used for wood -energy.

The search for fuelwood and the sale of wood in local markets leads to a lack of fuelwood in the villages. In the same vein, Mapongmetsem and Akagou [16] showed that the fuelwood situation is already alarming in Adamaoua. The authors reported that savanna vegetation is sold in pieces in local and regional markets and that alternative measures should be developed to stop the over-exploitation of natural resources.

Table 10. *Species used as fuelwood by the local population.*

Species	Ngaoundal	Mbakaou	Ngaoundéré III	Ngan'Ha	Average
Acacia polyacantha	39.00	46.80	15.60	23.40	31.20
Albizia coriana	4.35	7.80	15.60	1.70	7.36
Anogeissus leiocarpus	78.00	93.60	101.40	31.20	76.05
Bridelia scleroneura	15.60	46.80	31.20	4.68	24.57
Burkea africana	31.20	54.60	46.80	62.40	48.75
Combretum adenogonium	7.80	31.20	39.00	7.80	21.45
Combretum macrocarpum	7.80	31.20	2.59	15.60	14.30
Daniellia olivieri	93.60	46.80	70.20	78.00	72.15
Ficus sycomerus	7.80	15.60	3.51	5.85	8.19
Isoberlinia doka	78.00	81.90	89.70	92.57	85.05
Lophira lanceolata	7.80	39.00	54.60	46.80	37.05
Mytragina inermis	23.40	31.20	5.85	31.20	22.91
Parkia biglobosa	15.60	78.00	31.20	54.60	44.85
Piliostigma thonningii	15.60	46.80	7.80	39.00	27.30
Sarcocephalus latifolius	3.51	4.68	3.51	39.00	12.67
Securidaca longepedunculata	31.20	54.60	70.20	62.40	54.60
Strychnos spinosa	7.80	31.20	39.00	2.34	20.09
Syzygium guineens var. *macrocarpum*	3.51	7.02	46.80	7.02	16.09
Terminalia glaucescens	46.80	15.60	31.20	7.80	25.35
Terminalia macroptera	23.40	62.40	39.00	15.60	35.10
Vitex doniana	23.40	46.80	7.80	15.60	23.40
Average	26.91	41.60	35.84	31.17	33.88

3.3. Causes of Climate Change

The main causes of climate change according to the populations are, among others, abusive cutting of trees, periodic bush fires, cutting of trees associated with bush fires, agriculture, livestock, and cutting of trees associated with livestock. In the Ngaoundéré III site, bush fires (12%) are among the factors responsible for climate change. These anthropogenic activities accelerate the degradation of vegetation. For some people, climate change is the result of the non-respect of social prohibitions such as the destruction of sacred forests. This statement is in line with authors like Ishaya et al. [31] in Nigeria. Some of these activities such as, tree cutting (50%), bushfires (42.85%), or the combination of both (35.71%) are more accentuated in Mbakaou and Ngaoundéré III sites. The results of the population surveys are in agreement with those of other authors regarding the causes of climate change [30, 32]. Generally speaking, wood cutting and fires on vegetation are the most cited. Deforestation also has a local and immediate climate impact.

These impacts could result in major ecosystem disruptions [33]. Climate variability can be due to anthropogenic or natural variations (external variability) [4]. Bush fires are among the most important external factors in triggering climate change. They result in the loss of some plant species after their passage. Climate change will alter ecosystems, and human populations would obviously be affected with all the negative consequences that this could bring. People are aware of the negative effects of fire on woody cover. Ecosystems can be disrupted, thus causing the disruption of ecosystems [33].

3.4. Endogenous Climate Change Mitigation Strategies

In the face of climate fluctuations, the population of the Guinean high savannahs of Adamaoua is adopting local adaptation and mitigation strategies. Thus, they are increasingly implementing the cultivation and protection of trees in the fields and around their homes. The main endogenous knowledge for adaptation and mitigation of climate change in the two Departments are awareness raising on the protection of savannahs (setting up of vigilance committees), the use of organic fertilizers (compost, manure...) instead of chemical fertilizers, the planting of trees, and the setting up of vegetal fences to surround the concession and/or the fields. Similarly, in Nigeria [34, 31] and Benin [35], people have developed knowledge to cope with climate disruption.

4. Conclusion

From this study, it appears that the populations of the Guinean high savannahs have good knowledge on the advantages and disadvantages of fires on woody plants. The destruction of property (destruction of fields, burning of houses and granaries), the reduction of agricultural yields, the increase in heat, and diseases are the disadvantages of fires according to the populations. The disappearance of certain animal species (rabbits, etc.) and especially plant species such as *Lophira lanceolata, Carissa edulis, Sarcocephallus latifollius* was also cited. Some savannah species are used for various purposes: food, traditional pharmacopoeia and service wood. Climate change will modify ecosystems. The populations are aware of the negative effects of fires on the woody cover. The frequency of fires limits, on the one hand, the regeneration of woody species whose seeds and seedlings are destroyed and, on the other hand, the growth in height of woody species. These two factors have an important impact on the dynamism of the vegetation and its progression towards the climax. Faced with climatic fluctuations, the population of the high Guinean savannahs of Adamaoua adopts adaptation and mitigation strategies such as raising awareness on the protection of the savannahs, the use of organic fertilizers (compost, manure, etc.), the planting of trees, the setting up of vegetation fences, and the practice of home gardens. This technique allows not only the increase and diversification of vegetation in the area. These trees will make it possible to build houses, to feed and to look after oneself. *Khaya senegalensis* and *Anogeissus leiocarpus* are the most protected around the concessions by the populations. These species provide fodder for livestock and shade for people.

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