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Climate Change and Beliefs in Cameroon: A Qualitative Study Among Farmers in the Equatorial and Sudano-Sahelian Zones

Sandrine Gaymard[a],*; Nicole Kay[b]; Jean-Claude Etoundi[b]

[a]LUNAM Université, University of Angers, Laboratoire de Psychologie des Pays de la Loire (LPPL), France.
[b]University of Angers. Laboratoire de Psychologie des Pays de la Loire (LPPL EA 4638), France.
*Corresponding author.

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Abstract

The question of climate change is a topical issue as is shown by the numerous publications on the subject during the last few years. However few publications lay emphasis on populations considered to be particularly exposed to the problem of climate change (by location or by activity) and on the impact of religion on these beliefs. In this study, two groups of Cameroon farmers working in two distinctive zones: Equatorial and Sudano-Sahelian were interviewed about their social representation of climate change. Results with the free association method highlight two preoccupying social representations. The question of distance from the object is discussed in relation to studies carried out among wider publics. In addition, this study shows that religion can also play an important part in the construction of knowledge of climate change.

Key words: Climate change; Risks; Social representations; Religion; Free associations; Cameroon farmers

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INTRODUCTION

The planet's climate is experiencing changes over time; we talk about climate change, which is a term used to refer to any change in climate over time, whether due to natural variability or to human activity[1]. Climate change is due to global warming induced by anthropogenic emissions of greenhouse gases (Intergovernmental Panel on Climate Change [IPCC], 1990). On a global scale, climate change has many impacts such as the melting of glaciers, ice cap decrease, the intensification of extreme weather events (floods, droughts, famines, heat waves, increased frequency of cyclones, bush fires and other fires), the destabilization of forests, agricultural difficulties, threats to water resources, loss of biodiversity, the spread of tropical diseases, etc. According to numerous studies climate change is already underway and the climate system will probably undergo quite some changes (CICERO, 2000). An increase in average global temperature of about 1.3 to 5℃. in the next decades is predicted; a rising sea level of the order of 15 to 95 cm by 2100[2] and some extreme events will increase in frequency and intensity as a result of a change in natural variability (Mc Carthy et al., 2001).

Thus, the second part of the IPCC fifth Assessment Report 2014 notes and confirms with greater certainty that the impacts of climate change are already substantial and widespread, on both continents and oceans, and they lead to a disruption of ecosystems and biodiversity, hydraulic systems, agricultural and food production, generating human health problems and reinforcing social inequalities (especially in less developed areas). Climate change is therefore one of the biggest current concerns, to the extent that it is considered one of the primary concerns of humanity in the 21st century (Tingem et al., 2008).

In Africa, this concern is all the more important as the continent is one of the most vulnerable regions in the

[1] Definition given by the Intergovernmental Panel on Climate Change (IPCC) in 1990.
[2] http://www.braintrust.hautetfort.com/archive/2009/05/index.html

world (OSS/UNEP, 2010). It is here that the impacts of climate change are considered the most serious (IPCC, 1998). All studies also agree that the African continent is the most affected by the ongoing and future climate change (NECTAR, 2012). In fact, Africa is facing serious effects of climate variability and extreme events such as droughts, floods and storms which are likely to increase both in frequency and intensity; levels and patterns of rainfall may change. This situation further exacerbates the vulnerability of the continent, especially in sub-Saharan African countries like Cameroon.

1. CLIMATE CHANGE AND AGRICULTURE IN CAMEROON

Cameroon is a country in equatorial Africa, located on the Gulf of Guinea in Central Africa. It lies between 1°40′ and 13°05′ latitude north and between 8°30′ and 16°10′ longitude east; its area is 475,412 km^2 (see Appendix 1). Cameroon is commonly called "Africa in miniature" due to its extremely diversified landscapes, its rich natural resources (petroleum, bauxite, timber and many tropical crops), and its variety of climatic and geomorphologic zones (tropical forest, coastal and maritime, savannah and Sudano-sahelian zones) (Ministère de l'économie de la planification et de l'aménagement du territoire au Cameroun[3]).

Despite this diversity and these natural resources, Cameroon is equally undergoing several varied effects of climate change. Average temperatures have risen since 1930 (CEEPA, 2006) and average rainfall has reduced by more than 2% per decade since 1960 (Molua & Lambi, 2007). Projected changes in rainfall range from -12 to +20 mm per month (-8% to +17%) by the 2090s (Mc Sweeney, New, & Lizcano, 2008). Furthermore average annual temperatures are predicted to increase between 1.5℃ and 4.5℃, by 2100 with a 1.6℃ to 3.3℃, rise in coastal zones and a 2.1℃ to 4.5℃, rise in the Sudano-Sahelian region (UNFCCC, 2005). Average rainfall is predicted to continue to decrease, leading to a prolonged dry season in the northern region. Desert conditions are expected to dominate the northern region by 2100. It is predicted that Lake Chad will be nearly completely dried up by 2060 (CEEPA, 2006). Moreover, knowing the fact that a 2℃ rise globally will result in a sea-level rise of between 69 cm and 1m (depending on location) across the world[4], Cameroon, given its location along the coast is also expected to experience the impacts of sea level rise over the next century (Norrington-Davies, 2011).

All the above-mentioned effects of climate change in Cameroon show that Cameroon is one of the countries most threatened by climate change. It goes without saying that the effects of climate change are a serious threat to sustainable development and represent new problems that will not only make the Millennium Development Goals harder to reach, but also jeopardize certain progress already made in the fight against extreme poverty and disease (Nkem et al., 2007). The analysis of the impacts of climate change in Cameroon shows that the country suffers the consequences of climate change in almost all the sectors involved in development (UNEP/GEF, 2000; MINEF, 2001) mainly in the agricultural sector which is one of the most vulnerable to the risks and impacts of climate change.

Agriculture is the mainstay of the Cameroon economy, with close to 80% of the labor force employed in this sector, which is responsible for providing food security to both rural and urban populations from domestic production (Tingem et al., 2008). Its contribution to the formation of the Gross Domestic Product (GDP) was always > 20% and even in the order of 40% since 1994 and its contribution to employment and labor remains above 40 (Bella, 2009). The Cameroon agricultural sector is highly vulnerable to climate change and the expected adverse impact of climate change on agriculture in the future may pose a challenge to the country's food security (Tingem et al., 2008). Estimated agricultural production, which contributed 20% to Cameroon's GDP in 2008 (World Bank, 2010[5]) is expected to decrease due to increased desertification in the north and higher incidence of flooding in the south (UICN/PC, 2013). Falls in production are observed in the range of 10%-25% (MINEF, 2001); agricultural production could fall by 20% due to lower yields of around 6% (World Bank, 2010).

Agriculture is the human activity most directly affected by the effects of climate change and given the extreme vulnerability of agriculture to the adverse effects of climate change and given the importance of this sector in Cameroon, it is urgent to continue to apply mitigation and adaptation strategies to climate change (IPCC, 2007, 2014). However, these strategies will be truly efficient if the social thought of the farmers is taken into account. In fact, it would firstly be important to understand how farmers appropriate the concept of climate change.

2. THE QUESTION OF BELIEFS

2.1 Social Representations (SRs)

The theory of social representations initiated by Moscovici over 50 years ago (Moscovici, 1961/1976), has proved to be extremely productive and enriching in the knowledge of common sense. Collectively elaborated and shared by

[3] http://www.minepat.gov.cm/

[4] According to the 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

[5] http://data.worldbank.org/data-catalog/world-development-indicators/wdi-2010

individuals of the same group, social representations are systems of thought, beliefs and opinions toward an object. From the structural approach (Abric, 1976; Gaymard, 2014a), social representation is composed of a core which groups the non negotiable shared elements of the representation and of a much more flexible periphery which integrates individual practices and experiences. Moreover the periphery is considered to be the privileged place for expression of the normative aspects thanks to its essential characteristic, that is, conditionality (Flament, 2001; Gaymard, 2014a). Studying an object of social representation helps to understand how this object is constructed and how it is appropriated by the group according to its stakes and its practices. The particularity of SRs is that they address the multiplicity of systems of knowledge (Gaymard, 2014a; Jovchelovitch, 2007). In the field of risk and hazard, the theory of social representations reveals a dynamic model in which the response to risk is a symbolical, emotional and inter-subjective entity (Breakwell, 2007; Gaymard, 2012; Joffe, 2003).

The question of climate change has been widely researched in the last few years on account of its multiple implications and stakes at the political and economic levels and of its consequences at the level of health. The impact of the media and the many controversies about the effects of climate change (O'Neill & Hulme, 2009), explain why this constitutes an object of social representation. The words referring to climate change, notwithstanding the cultural environment, are known to most of the groups questioned and concern the physical effects of climate change namely linked to global warming, rainfall, the melting of the ice fields, or food supply (Leiserowitz, 2005, 2006; Lorenzoni et al., 2006; Wibeck, 2001). These studies refer to a public in a wide sense and when working on social representations the question of distance from the object always arises. For the publics interviewed climate change can be more or less concrete according to the extent to which the countries suffer certain effects. This can explain why uncertainty in the face of climate change can be found in the research or even the expression of an ambiguous object (Bain, Hornsey, Bongiorno, & Jeffries, 2012; Whitmarsh, 2011). This uncertainty also explains the differences observed between knowledge, feelings and behaviour or intention, known as "the value-action gap" or "the attitude-behaviour gap" (Bord, Fisher, & O'Connor, 1998; Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007), as well as the varying perceptions between natural causality and human implication in climate change. A national survey among American adults shows that 42% attribute climate change to both natural causes and human activities, 40% attribute it solely to human causes and 18% solely to natural causes (Bostrom, 2001). Rare studies support the hypothesis that the effects of climate change are more perceptible in some regions and in some countries. Reusswig & Meyer-Olendhorf (2010) found that the Indian climate discourse appeared more heterogeneous than that of Europeans or Americans. According to the structural approach, the hypothesis defended up till then was that the more limited the diversity of the words given, the more the object could be considered to be an object of social representation (Flament & Rouquette, 2003). This points merits discussion. Gaymard (2006) showed that the social representation of an elderly person was more complex and gave rise to a greater production of associations among health carers with professional experience than students. The impact of the media in the construction of an object of SR is known and it is equally appropriate to consider that a greater diversity in associative production could be characteristic of populations that have a less distant relation to the object.

2.2 Religion in Cameroon

Religious freedom is a right that is ratified by the Cameroon constitution as can be seen in the following examples. In its preamble, Act 06/96 of 18 January 1996, modified on 14 April 2008, revising the constitution of 2 June 1972 stipulates, among other things that:

> None shall be troubled because of his or her origins, opinions or religious, philosophical or political beliefs on condition that public order and standards of good behaviour are respected; religious freedom and freedom to practice them are guaranteed (our translation).

Act 053/90 of 19 December 1990 relating to right of association states under which conditions religious freedom can be practiced. Thus, as Guimdo highlighted (bibliothèque.auf.org), article 2 of this Act holds that: "All religious association shall be authorized". It states in article 24 that:

> Authorization of a religious association or congregational establishment shall be decreed by the President of the Republic, after reasoned notice from the Minister of territorial administration (our translation).

Confident of these legal provisions Cameroonians practice their religious belief daily without great hindrance. In practice, according to the figures of the 2005 general population census, in 20.5 million inhabitants (estimations of the American administration in July 2013): 69% of the population is Christian 38% of whom are Roman Catholic, 26% Protestant, 4% other Christian denominations, and 1% Orthodox Christians; 21% are Muslim and 6% Animist. However, it should be noted that there are a great many Christians and Muslims who also practice rituals relating to African Animist religions. If a rapid observation of the geographical distribution of the different religions can give to believe that the Muslim religion is mainly practiced in the Northern regions (Sudano-Sahelien zone) of the country and Christian religions in the

southern, eastern (Equatorial zone), and western parts of the country, a more thorough study like the American State Department's on practices of countries concerning human rights (2013) clearly shows that the different religions cohabit throughout the territory, namely in the large urban centers.

Unlike certain African countries in which religious practices are a source of social tension, in Cameroon, Christians, Muslims and Animists live their faith without any real clashes. However, it should be noted that the upsurge of churches known as "of awakening" in the last decade, consubstantial with living problems of populations turning to these churches in the quest for a possible miraculous solution to their problems, gives rise to some exasperation in public opinion as a result of not very commendable practices that have grown within them. Between noise pollution all day, occult practices and extortion of money from congregations, churches known as "of awakening" are permanently in the news because of the associated scandals. In August 2013, this state of things led the government to shut down at least 34 churches on the national territory even if the official reason rested on the fact that these churches were not approved. These churches re-opened their doors however a few weeks later, which goes to prove that religious freedom is certainly the individual freedom exercised most in Cameroon. If traditional religions are not spared controversies, they continue to enjoy a relatively favorable opinion. They owe this consideration to the fact that they have adapted to the local context. Thus religious services are celebrated in the local languages. To mark their anchorage in Cameroon society's realities, certain Christian religions namely the Roman Catholic religion, organize services specially devoted to certain events such as services dedicated to harvests organized on the eve of the beginning of agricultural seasons. Overall it can be said that religious freedom is an established fact in Cameroon. It is applied so well that certain religious denominations go too far, arousing the anger of a part of the population to such an extent that the government is forced to use harsh measures to put things in order.

As the context of the study is on an environment that is particularly exposed to the effects of climate change and groups several tribes and religions, the following hypotheses are put forward:

a) The social representation will differ according to the farming region (Equatorial or Sudano-Sahelian). This hypothesis rests on the importance of the context, the two zones being differently exposed.

b) SRs will be more anchored in agricultural practices and the climatic characteristics of the region. This hypothesis rests on the link between practices and SRs and the "concrete" aspect of the object for the population.

c) We hypothesize that for both groups the central core will be composed of natural elements and not elements linked to human activities. This hypothesis is based on the importance of religion, which would be expressed in the central core of the idea "climatic change is first and foremost a natural fact".

3. METHODOLOGY

3.1 Presentation of the Study Zones

Cameroon has five agro-ecological zones: the equatorial zone, the high Guinean savannas, the highland area, the coastal area and the Sudano-Sahelian area. In these areas, vulnerability to climate change is variedly experienced. Our study will focus on the equatorial and Sudano-Sahelian zones.

3.1.1 The Equatorial Zone

Forests in Cameroon cover an area of 165,770 km^2 and extend between the 2° and 4° latitudes North. This area covers the Central, South and East regions. The equatorial zone consists of a medium high plateau range between 300 and 700 m (MINEP, 2010); it extends from the coastal area to the south-east, to the southern boundary of Adamawa, over an area of 22.5 million hectares (IRAD, 2008).

The climate is hot and humid; it is an area characterized by a sub-equatorial climate of Congo-Guinean type. The average annual temperature is relatively constant in the range of 23-27°C, with an average rainfall varying between 1,500-2,000 mm over 10 months, divided into two dry seasons alternating with two rainy seasons: a short dry season from July to August; a long rainy season from September to November; a long dry season from December to February and a short rainy season from mid-March to June. The average relative humidity is above 80% (MINEP, 2010).

The vegetation consists, on the one hand, of the evergreen forest of low and medium altitude plus the Atlantic forest of medium altitude; and on the other hand, of the semi-deciduous rainforest of medium altitude (MINEP, 2010). Ferralitic and hydromorphic soils are to be found here. The climatic conditions in this area are favorable for the development of a wide variety of plant species and provide opportunities for the practice of agriculture throughout the year with various crops (MINEP/PNUD, 2009). The destruction of forest ecosystems is due to loggers, but also to hunters and farmers. Thus, it is estimated that about 1,000 to 2,000 km^2 of forest disappear each year with the result of a loss of equivalent timber, that is to say, an annual order of 13.5 million m^3 (MINEP, 2010). Although this area is not as vulnerable as the Sudano-Sahelian zone, the equatorial region is also experiencing changes in climate.

In the equatorial zone, the main impacts are related to changes in rainfall (MINEP, 2011). In fact, the most significant climate variability results from a wetter dry season, which in the long run, tends to induce a change in the annual hydrological cycle. This change in rainfall is characterized firstly by a relative increase in mean precipitation of the dry season, and after, by a relative decrease in the rainfall. Changes in the seasonal rainfall seem to be accentuated: the differences observed between rainfall totals of rainy and dry seasons are the greatest since the 1990s.

Vulnerability in the equatorial region is observed through several phenomena: the loss of forest area; degradation of the forest: biodiversity loss (flora and fauna); the upheaval of the seasons and rainfall; increasing climate phenomena; strong winds causing crop losses (UICN/PC, 2013). Despite the consistency of their vegetation cover, the rainforests will undergo many disappearances and/or mutations of species because of the selection and/or the adaptation to new climatic conditions (Liénou et al., 2008).

3.1.2 The Sudano-Sahelian Zone

This is an area between the 8th and the 13th North parallels. It extends from Adamawa to the shores of Lake Chad over about 102,068 km^2, and represents more than a fifth of the area of Cameroon (MINEP, 2010). The Sudano-Sahelian zone covers the regions of the Far North and North, with 23% of the land dedicated to agriculture, 9% of which national pumpkins. The most important crops are rice, millet, maize, sorghum and cotton. Over 35% of national livestock are found in the Sudano-Sahelian region (CICERO, 2000).

The climate of the Sudano-Sahelian zone is characterized by a short rainy season lasting from June to October, and a dry season that can last up to 9 months. The mean annual temperature is 28℃, but can reach up to 40℃ during the dry season. Annual rainfalls vary from 500 mm to 900 mm (MINEP, 2010). They are low and unevenly distributed. The Sudano-Sahelian zone is covered by a dense network of seasonal streams and rivers, along with a few permanent ones. Most small ponds and temporary rivers (*mayos*) disappear a few months after the rains stops. The vegetation consists of shrubs on soils of sand and clay. The grasslands of this region are scorched by the dry season heat. The major ecological problem in the zone is the constant threat of desertification, characterized by a scarcity of trees and water. High population pressure, inefficient management of protected areas, and over-exploitation of fishery resources is also threats to the environment in the Sudano-Sahelian zone of Cameroon (CICERO, 2000).

The Sudano-Sahelian zone is the most vulnerable to climate change. In fact, this zone is the poorest region of Cameroon, and subject to epidemic diseases and health care challenges that are likely to be exacerbated by climate change. The Sudano-Sahelian zone is also affected by extreme events, including droughts and floods (UNEP/GEF, 2000). This could especially be at risk from extended dry periods; the scarcity of water is already a major constraint to local development (IPCC, 1998). Indeed, drought is the first climate shock felt in the area and the recent climate trends show that in this region of Cameroon warming is most rapid, occurring at rates of 0.2 to 0.4℃ per decade (Mc Sweeney et al., 2008). The projections increase from 2.0 to 6.0℃ by 2100; average annual temperatures are predicted to rise between 2.1 to 4.5℃ in the Sudano-Sahelian region. Precipitation changes are also likely to be more dramatic in this region. A number of studies and models predict that average rainfall will continue to decrease, desert conditions are expected to dominate the Northern region by 2100 (CEEPA, 2006).

Higher temperatures would affect agriculture and water supplies, as well as the human and animal populations. According to the World Bank (2010), in the year 2050, the population in the Sudano-Sahelian region will be 3.6 million and agriculture and livestock will continue to be the major economic activities up to 2100.

Agricultural production in this region is extremely vulnerable to climatic variability. Farming in the zone depends largely on the amount of rainfall with variations from year to year and sporadic floods and droughts are significant. Rainfall variability ranges from 73% to 195% in the Sudano-Sahelian zone; this degree of variability clearly indicates how precarious and unpredictable the climate is, and what problems it creates for agriculture (CEEPA, 2006). In fact, crop yields, which have been affected by a shortened rainy season and an increase in temperature, would result in significant falls in production, ranging from 10 to 25%. This has an undeniable impact on household food security and about 18,000 households are already food insecure due to drought, which will increase (UICN/PC, 2013).

3.2 Study Sites

In the equatorial region, our survey was conducted in the locality of Nsimalen, 22 km from Yaoundé, the capital of the Central Region. Here, food crops abound as well as cash crops.

In the Sudano-Sahelian zone, we were deployed in the city of Kongola, 15 km from the city of Maroua, the capital of the Far North region which is a vast agricultural region. The main crops are cotton, corn, millet and sorghum.

4. POPULATION AND ADMINISTRATION OF THE QUESTIONNAIRE

Our population is composed of farmers. In the town of Nsimalen (A town located in the central region; equatorial zone), in March 2014, the administration

of the questionnaire was done directly; farmers were interviewed either in their homes or on their plantations. This group is composed of 30 individuals, 19 men and 11 women with an average age of 34.17 (*SD*=9.06). When we arrived at Kongola (A town located in the far North; Sudano-Sahelian zone), in the first week in February 2014 we were able to meet with farmers easily, but we were faced with the problem of communication since most of the farmers met with did not speak French fluently, so we had to use an interpreter who explained the point. We interviewed 30 individuals, 25 men and 5 women with an average age of 34.57 (*SD*= 8.96).

5. FREE ASSOCIATIONS

In the structural approach of SRs, the free associations method is among the favored ones whether in an exploratory phase or in the study phase itself. Its popularity comes from the fact that it calls on spontaneous representation and that it is an easy-to-use tool. In 1992, Vergès proposed to take account of two indicators: the word (or expression) frequency and its rank of appearance. According to this approach named prototypical, a word or expression frequently cited and in the first ranks would be part of the representation's central core. An element quoted less in the first ranks or frequently quoted in the last ranks would be part of the first periphery. Finally a word infrequently quoted in the last ranks belongs to the second periphery whose characteristics have been recognized up to now as being non-determinant in the SR's structure (Table 1). This method has been criticized and notably the use of the criterion of average rank of appearance; it has been suggested to substitute this by average rank of importance (Abric, 2003). Nevertheless it has also been shown that the prototypical method was more adapted and understood by young publics that have not studied or people with intellectual disabilities (Gaymard, 2014b; Gaymard & Cazenave, submitted; Gaymard, & Joly, 2013); effectively the criterion of importance can be misunderstood by the population and so the ranking can be biased. In the particular case of this study there also exists a language problem, which explains why the prototypical method was chosen.

Table 1
Prototypical Method

Central core = words frequently cited in the first ranks of appearance.	First periphery = words frequently cited in the last ranks.
First periphery = words infrequently cited in the first ranks.	Second periphery = words infrequently cited in the last ranks.

6. ANALYSIS STRATEGIES

Words quoted at least twice were retained for the analysis and presentation of the 4-box table. According to the criteria established by the researcher as mentioned in the method (Gaymard & Bordarie, 2014), the words or expressions quoted at least 7 times (23% of the population) were ranked in the category highly frequent, and the words or expressions quoted less than 7 in the category infrequent. As the farmers all gave at least 7 words, the criterion of average rank of appearance was fixed at 3.5; consequently the ranks below this threshold are considered as the first ranks and the ranks above this threshold as the last ranks.

The "Evoc" (for evocations) program (Vergès, 2005) was used for the data analysis. This software package was designed specially for evocation analysis (Grize, Vergès, & Silem, 1987; Vergès, 1992). It provides a lexicographic analysis with the study of word or expression frequency and rank (appearance or importance).

7. RESULTS

Concerning farmers from the equatorial zone, the central core is composed of the words "heat", "drought", "seasons", "rainfall" and "sun". In the periphery the consequences and risks of climate change appear more with words such as: "famine", "diseases", "pollution", "upheaval of seasons" (Table 2).

Concerning the farmers from the Sudano-Sahelian region, the central core is composed of the words: "desert/desertification", "floods", "heat" (Table 3). Only the word "heat" belonged to the central core of the representation of the other group (equatorial zone). The words "drought", "seasons" and "sun" become peripheral and conversely the words "desert/desertification" and "drought" which belonged to the periphery of the other group (equatorial zone) become central. It can be seen with this population that the references to rainfall are more precise: "scarcity of rainfall", "acid rains". In the periphery there can also be found the consequences of climatic change such as pollution but equally the impact on crops.

Table 2
Social Representation of Climate Change Among Farmers in the Equatorial Zone

			Frequencies (absolute values)	First rank <3.5		Frequencies (absolute values)	Last rank >3.5
Frequency	High	**Central words**			**First periphery**		
		Heat	13	2.54	Desert/desertification	11	4.82
		Drought	13	2.92	Famine	9	5.78
		Season	7	2.00	Diseases	8	5.00
		Rainfall	8	2.37			
		Sun	7	2.86			
	Low	**First periphery**			**Second periphery**		
		Pollution	6	3.50	Temperatures	6	4.67
		Climate	5	3.20	Floods	5	4.40
		Greenhouse gases	5	3.00	Cold	5	3.60
		Upheaval of seasons	4	3.25	Ozone layer	4	4.50
		Deforestation/logging	4	2.50	Wind	4	4.50
		Vegetation	3	3.33	Melting ice caps	3	4.33
		Production of CO_2	3	3.00	Forest	2	4.50
		Nature	2	3.00	Species	2	5.00
		Warming	2	3.00	Poverty	2	7.00
		Health	2	3.00	Harvests	2	5.00
		Crops	2	1.50	Destruction	2	4.00
		Transformations	2	2.00			
		Bush fires	2	3.50			

Note. Average appearance rank.

Table 3
Social Representation of Climate Change Among Farmers in the Sudano-Sahelian Zone

			Frequencies (absolute values)	First rank <3.5		Frequencies (absolute values)	Last rank >3.5
Frequency	High	**Central words**			**First periphery**		
		Desert/desertification	14	3.28	Drought	14	4.07
		Floods	9	3.33	Deforestation/logging	9	3.67
		Heat	7	3.00	Limited rainfall	7	4.29
					Lower yields	8	5.75
	Low	**First periphery**			**Second periphery**		
		Pollution	5	3.40	Endangered species	6	5.67
		Temperature	5	3.40	Melting ice caps	5	6.40
		Seasons	4	2.75	Famine	4	7.00
		Wind	4	3.50	High temperatures	4	4.50
		Climate warming			Greenhouse gases	4	4.75
		Cold	3	3.00	Depletion of ozone layer	3	4.67
		Environment	2	1.00	Rainfall	3	5.67
			2	2.67	Sun	3	7.00
					Vegetation	3	5.33
					Disease	3	4.00
					Acid rains	2	5.00
					Global warming	2	5.00
					Cattle farming	2	5.50
					Agriculture	2	2.40
					Water	2	5.00

Note. Average appearance rank.

DISCUSSION

In this study we have explored the social representation of climate change among a population that is highly exposed to its effects: Cameroon farmers. Moreover we have compared the state of this representation among two groups living in differently exposed zones: the equatorial zone and the Sudano-Sahelian zone. According to the structural approach it is considered to be the same social representation when the central core is identical for the two populations (Gaymard 2014b). The findings with the free associations method confirm that the social representation differs in relation to the zone concerned (hypothesis 1) and that it is anchored in the climatic

characteristics of each region; the representation's content goes beyond certain clichés that can be conveyed by lay publics (hypothesis 2). This study verifies the link that exists between practices and social representations and at the same time feeds the discussions on the question of distance from the object in the field of social representations. Among the farmers of the two zones, elements characterizing the climate can be found in the central core and in the periphery elements concerning the causes and consequences of climate change that also refer to agricultural production (hypothesis 2).

The composition of the central cores relates to the specificities of each environment studied, highlighting a SR that is close to the reality of the terrain and of the effects of climate change described in the accounts of research (Cicero, 2000; MINEP, 2010). The equatorial zone is a humid zone characterized by abundant rainfall and its relatively well-balanced distribution throughout the year. With the modifications to the climate, rainfall is diminishing disrupting the seasons, which explain the presence of the elements rainfall and season in the central core. The items sun and heat present in the central core could have been grouped since they involve the same reality, that is, rising temperatures which result from this reduction. The central position of the item drought testifies that its effects are felt more and more in the zone since the results of climate change are characterized by longer periods of drought and reduced rainfall (MINEPAT, 2011). The elements appearing in the periphery mostly indicate the consequences of these climate changes with an alarmist representation of environmental problems (desert/desertification, deforestation/logging, upheaval of seasons) and food and health issues (famine, disease) which constitute real threats in Cameroon. Although less exposed to these health problems than the Sudano-Sahelian region, the equatorial zone is nevertheless part of a country that is more exposed to climate change.

Concerning the farmers of the Sudano-Sahelian region, the central items are anchored around the elements "desert/desertification", "flood" and "heat". The item heat concerns the climatic characteristics of this region; the Sudano-Sahelian zone is effectively first and foremost characterized by a hot tropical climate with high temperatures and scarce rainfall (UICN/PC, 2013). Heat can thus be seen to be one of the consensual elements of the representation. Moreover, the items "desert/desertification" and "floods" refer to the vulnerability of this region due to climate constraints related to climate changes.

It must be noted that the major problem of the Sudano-Sahelian region of Northern Cameroon is the permanent threat of desertification as a result of repeated deficits in rainfall (CEEPA, 2006; Kramkimel, Grifoni & Kabeya Mukenyi, 2004); this zone faces climatic constraints (great variability of rainfall in space and time; aggressive rainfall and problems of erosion; poor annual distribution of rainfall and risk of premature cease of rainfall), which contribute to the intensification of the desertification process in the region (MINEP, 2011). The presence of the item floods in the central core is not without significance since floods constitute another constraint of this zone. In fact, since 2009, heavy rainfall followed by floods is the lot of the Sudano-Sahelian region (MINEP, 2011) and the last flood dating from August 2012 in addition caused loss of human lives and the swamping of several agricultural domains.

In the periphery, the items "deforestation/logging", "scarce rainfall" and "lower yields" can be found, describing the consequences of increased drought in this area. In the Sudano-Sahelian eco-regions, rains are scarcer and scarcer and drought tends to increase (IUCN/PC, 2013). The main impacts of climate change in this region are linked to the modifications to the regime of the rainfall, especially after cultivation. This can cause significant reduction in yields going from 10% to 25%, particularly for sorghum and long-cycled sweet corn (Ngnikam & Tolale, 2009). As the country's economy is agrarian above all, the consequences linked to reduced agricultural yields are widely demonstrated. In this context climate and seasonality are a determining factor in the variety of crops and types of agriculture practiced (Molua & Lambi, 2007). From these results hypothesis 2 can be validated since the farmers refer to the consequences of climate change for their crops.

The third hypothesis is also verified since it can be seen that for both groups the central core is composed solely of natural elements (Heat, Desert, Rainfall...). According to the theory a characteristic of the central core is that it is non-negotiable but this characteristic is debatable if the normative aspects of the SR are taken into account (Gaymard, 2014a). Instead, we put forward the idea that these elements are uncontrollable since they are natural facts and can translate the impact of religion. Cameroon is effectively a country in which religion is both very present and very diversified (De Rosny, 1999; Onomo Etaba, 2007; Séraphin, 2004); more than 200 ethnic groups live side by side carrying with them their traditional beliefs, and "magical-religious" elements pervade the problems of development. For example, Esoh (2006) refers to magical-religious practices linked to water among the Sawas, a people from Sub-Saharian Africa. In the representation of climate change the causes linked to human activity are perceivable in the periphery with the elements: "pollution", "greenhouse gases", "carbon dioxide production" or "ozone layer".

The studies of SRs that confront the visions of lay people with those of scientists concerning climate change refer to the difficulties for most people to understand a phenomenon that is governed by time and whose effects

are not necessarily visible (Wibeck 2014). In the field of perception some studies make references to the scepticism of populations (Capstick & Pidgeon, 2014 ; Cardwell & Elliott, 2013; Whitmarsh, 2011). In the UK Whitmarsh thus showed that the proportion of people who think the impacts of climate change are exaggerated almost doubled between 2003 and 2008; for his part, Leiserowitz (2005) refers to the perception of a moderate risk in the US. For the Cameroon farmers interviewed the causality and the effects are not difficult to determine (Connor & Higginbotham, 2013; Lorenzoni & Pidgeon, 2006) since they are subjected to them. Through this study among a population that is highly exposed to changes in climate, the discussion of the question of distance from the object can be furthered. These farmers find themselves "in the front line", due to their location and activities and they daily undergo the effects of climate change in their farming practices and their crop production. In their case it can be seen that certain items of knowledge coincide since formal knowledge comes within the core of the SR. We know that the media play a role in the construction of SRs; they can contribute to an awareness of the phenomena of climate change in certain publics (Krosnick, Holbrook, & Visser, 2000). The population interviewed in this study is very different from that in most studies, which question publics with a more distant relation to climate change. The discourse collected is not sceptical; it is alarmist but above all refers to dramatic food supply problems (famine), which Western countries do not experience. If negative images usually associated with climate change can be found in the literature, such as melting ice caps, rising temperatures, destruction and diseases (Cabecinhas et al., 2006; Lorenzoni et al., 2006), the Cameroon farmers' associations more particularly describe the disappearance of the ecosystem (flora and fauna) but also the reduction of their yields. If the information that circulates plays an important role in the construction of knowledge of climate change, this study also shows the importance of practices and religion in the construction of the object. Natural elements in the central core also have a protective role in the face of perceived hazards.

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APPENDIX 1: CAMEROON IN AFRICA

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