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MASTER’S THESIS

Topic:

Climate-related adaptation capabilities of scientific and local climate information communication farmers in Dano and Ouahigouya, Burkina Faso.

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Declaration

I, Diarra Aly declare that "**Climate-related adaptation capabilities of scientific and local climate information communication farmers in Dano and Ouahigouya, Burkina Faso**" is my personal work and I have not used any sources and others than those have been indicated in the references. This thesis has not previously been submitted for any degree or examination. No part of this thesis may be reproduced without prior permission from the author and or the University of The Gambia.

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Abstract

The research is carried out in two different climate zones of Burkina Faso, the sahelian climatic zone in the North, in the province of Yatenga and the Sudanian climatic zone in South West, in the province of Ioba. In each province, two villages were selected under the administrative authority of a commune and a province. The villages were selected according to their size (bigger and small) and their membership to an ongoing WASCAL/APTE21 climate information dissemination project. The big size villages were without the project intervention whereas the project intervenes in the small size villages. Bissigaye and Bembela were used in the Commune of Ouahigouya under the Province du Yatenga. Tambiri and Bolembar were selected in the Commune of Dano under the Province du Ioba. The research aimed to determine whether the respective local farmers and scientists' climate information are related, integrated or not. It seeks to understand the climate related adaptation capabilities enhanced by climate information communication and propose suggestions for an effective climate information communication strategy. Both quantitative and qualitative method was used and the comparative approach led the results discussion in this work. A total of four Workshops, respectively one in each village using a guide of focus group discussion were organized and took into account 87 participants. Purposive sampling methods led to having 240 survey questionnaires which were administered accordingly to the above the criteria of selection of the villages with 2/3 of the partial sample allocated to the big size villages and 1/3 to the small size villages. 38 key informant interviews were also administered with farmers, extensions service workers, media and communication, and NGOs professionals. The results show the possible but weak relation between the Mann-Kendall trend analysis of meteorological data on rain and temperature of the past 30 years and farmers perceptions of climate evolution over the past 30 years observed data on rain and temperature from their responses in the survey questionnaires. Scientific climate information was found communicated mainly to farmers via radio, and extension actors with fewer feedbacks form farmers. The climate available information on print media is less accessible especially to women with an illiteracy rate of 95, 2 % in rural areas. No direct interaction was found between scientific weather information sources and farmers. However, farmers need to understand the probabilistic nature of scientific weather forecasts and level of accuracy. For climate information to be effectively communicated to farmers, the information itself need to be accurately generated and more accessible in term of simplification and contextualization of its concepts and contents.

The research suggests that agro meteorological and climate adaptation measures should be associated with communicating climate information to farmers. The climate information communications network of actors needs to be enough engaged and interactive. The study proposes to mainstream farmers' local climate information and knowledge in a strategy of an efficient and effective climate information communication. The study recommends the elaboration of a comprehensive corpus of climate information communication translated into major spoken languages of Burkina Faso as an appropriate tool to put Scientists and Farmers in harmony and at the same pace of understanding. Further studies are suggested on climate early warning, mainstreaming of local climate information and knowledge in climate information policies and strategies. The essence of these suggested areas of study is to show and advice more on farmers climate-related adaptation strategies enhanced by effective climate information communication.

Key Words: Burkina Faso, Climate, Adaptation, Communication, Information, Network.

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Dedication

I dedicate this work to my father Drissa Diarra who remains a model, an educator, an inspirer, a motivator and an eternal advisor. Thank you, Dad, for your affection, trust, and support.

I also dedicate this work to memories of my late Mother, Tenin Dembele and the late Dr. Musa Sowe who have all seen assisted with advice in the early steps of this research project. May their souls rest in perfect and eternal peace.

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List Acronyms

ACCIC :	Projet d'Appui à l'adaptation au Changement Climatique par l'amélioration de l'Information Climatique
AfDB :	African Development Bank
APTE21 :	Application des Prévisions Climatiques et Pratiques Agricoles dans la Traduction des Evenements Climatiques Extrêmes du 21eme Siècle en Zones à Risques
BCEAO :	Banque Centrale des Etats de l'Afrique de l'Ouest
CILSS :	Comité permanent Inter-Etats de Lutte contre la Sècheresse dans le Sahel / Permanent Inter-State Committee for Drought Control in the Sahel
CNPP :	Coordination Nationale des Projets du PANA
ECOWAS :	Economic Community of West African States
GG:	Greenhouse Gas
GWP/Ao:	Global Water Partnership / Afrique de l'Ouest
ILO:	International Labour Organization
INDC:	Intended nationally determined contribution
INSD:	Institut National de la statistique et de la démographie
IPCC :	International Panel for Climate Chance
ITF:	Intertropical Front
MEFR:	Ministry of environment and fishery resources
MJFIP:	Ministère de la jeunesse, de la formation et de l'insertion professionnel
NAP :	National plan of action
NAPA :	National adaptation plan of action
NC:	National communication
NMS:	National Meteorological Services
PCD:	Plan Communal de développement
PDA:	Programme de Développement de l'Agriculture
RCOF:	Regional climate outlook forums
RGPH:	Recensement général de la population et de l'habitat
SSA :	Sub Saharan Africa
UNFCCC:	United Nations Framework Convention on Climate Change
USAID:	United States Agency for International Development
WASCAL:	West African science service center on climate change and adapted land use.
WFP:	WFP: World Food Program

CHAPTER ONE: INTRODUCTION

1.1. Background

A landlocked country in West Africa, Burkina Faso is located between 9°20' and 15°05' N, 5°20' W, and 2°03' E, with a land area of 274 000 Km^2 (SP/CONEDD,[1]2014). Burkina Faso shares borders with six countries, which are the Republics of Mali to the north; Niger to the east; Benin to the southeast; Togo and Ghana to the south; and Cote d'Ivoire to the southwest.

Burkina Faso is part of the West Africa Sahel region and has three climatic zones which are the sahelian, soudano sahelian and the Sudanian zones (see Map in Kambire et al., 2015). This situation makes Burkina Faso vulnerable to spatial variability and deficit of rainfall. Every rainfall deficit means with a drop in crop yields and a deficit of food. Indeed, two extreme events particularly demonstrate the fragility of the Sahelian natural resources (surface water, groundwater, and eco-systems), the drought of 1972–1973 and the drought of 1984–1985 (Ibrahim et al., 2012), p.1287.

Focusing on climate change impacts in Sahelian countries, the United States Agency for International Development highlights a trend of lengthening of dry seasons, and reports that "Water scarcity, longer dry seasons and impacts of higher temperatures may trigger new conflict and forced migration, issues that already impact the region (USAID, 2017. p.1).

The Fourth Assessment Report of IPCC also recognizes in 2007 that, "Africa is one of the most vulnerable continents to climate variability and change because of multiple stresses and low adaptive capacity" (Adger et al. 2007. p.10.)

[1] SP/ CONEDD is Secrétariat permanent du Conseil national pour l'environnement et le développement durable, The Permanent secretariat of the Council for Environment and sustainable Development

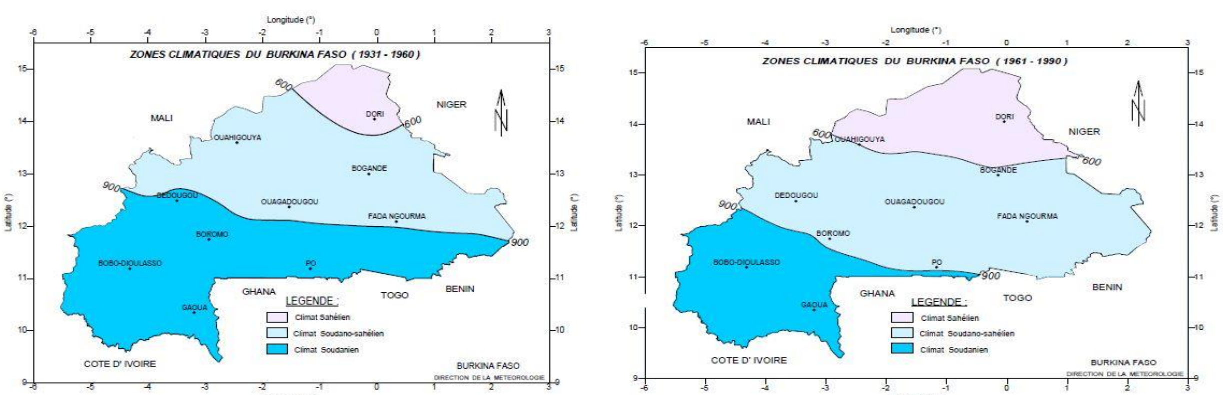
The climatic conditions of Burkina Faso coupled to its demographic growth might make it feel more the impacts of climate change and its variability.

Funk et al. (2012, p.3) indicate the population of Burkina Faso increases double at every 23 years, which could be explained by a "birth rate of 41 ‰ in 2010 and a population growth rate of 3.2 % in 2015" according to (BCEAO, 2015, p.41). Consequently, it is predictable that the rapid population expansion will place increasing stress on limited natural resources.

In agriculture, the reality in Burkina Faso is the exposure of its population to climatic condition with a varying rainfall distribution ranging from 1000mm south to below 500mm north. The livelihoods supported by the agriculture sector depends largely on rain fed agriculture as it contributes to 40% to the GDP in the west African Sahel region, including Burkina Faso (USAID, 2017, p.3). The rainfall averages are not above 500 mm in the sahelian climatic zone; between [600-900 mm] in the Sudano-sahelian climatic zone and between [900- 1000mm] Sudanian climatic zone. (See the two adjacent maps on next page)

- *Figure 1 is a set of two maps on rainfall distribution and variation due to isohyet migration from north to south over two time scales of thirty decades each. [1931-1960] and [1961-1990] from DGM, 2000. Found in SP/CONEDD, 2014*
- *Figure 2 shows the current climatic zone of Burkina Faso.*

Figure 1: Regression of isohyets migration from North to South Burkina in two periods of time [1931-1960] and [1961-1990]



Source: SP/CONEDD, 2014.

Figure2: Map showing the climate zones of Burkina Faso

Source: Kambire et al., 2015.

This Map shows the recent climate features of Burkina Faso including the ones of the study area. The Research was conducted two Regions[2] of Burkina Faso. In Region du Nord (North Region) the two villages of the research are Bissigaye and Bembela. They were selected in particular in the Commune of Ouahigouya that is under the administrative governance of Province[3] du Yatenga (Province of Yatenga) and the capital town is Ouahigouya.

[2] Region is the first level of governance and administrative subdivision in Burkina Faso and they are 13 in number
[3] Province is the second level of governance and administrative subdivision in Burkina Faso and they are 45 in number

With the same process, in Region du Sud-Ouest (South West Region), the two villages of the research are Bolembar and Tambiri.

They were selected in particular in the Commune of Ouahigouya that is under the administrative governance of Province du Ioba (Province of Ioba) and the capital town is Dano.

In the effort to adapt to the impacts of climate change, many actions have been undertaken by countries and implemented at the global level since the 1992 international initiative that led to the United Nations Framework Convention on Climate Change (UNFCCC). Among the various strategies developed to counter climate change impacts, efforts in raising awareness and promoting knowledge and skills-development, as well as education are essential components for responding to global climate change (Article 6 of UNFCCC, 1992, p.10).

The United Nations Educational, Scientific and Cultural Organization encourages governments to support non-formal education opportunities provided by communities, civil society, and the media, all of which play important roles in conveying information about climate change mitigation and adaptation. (UNESCO, 2015, p.5)

The Note of the ECOWAS Summit in Bamako explains the nature of the National Action Plans for Adaptation (NAPAs) and National Communications (NCs). With regards to their importance are of especially for West Africa, NAPAs contain identified present and future vulnerabilities and urgent adaptation actions to be supported by international climate finance.

NC present national inventories of Greenhouse Gases (GHG) emissions and removals, as well as countries' vulnerabilities, and some climate changes, adaptation, and mitigation policies and measures. (ECOWAS, 2013, P.1.)

UNFCCC member countries develop National Communications (NCs), which are a set of information elaborated on their climate profiles, the needs, the policies and activities planned to implement the convention in line with the common but differentiated responsibilities principle of parties (Annex I, and Non-Annex I) in Article 4 of the UNFCCC. Burkina Faso (a developing country part of the Non-Annex I parties) developed its first NC (2002) and the second NC (2014)) according to the communication requirements UNFCCC (1992; Article 4, 1 (a) p, 5 and Article 12, 1 (a, b, c) p.15). The countries also develop National Adaptation Plans of Action (NAPAs) in which they state their initiatives toward adapting to or mitigating climate change effects. Despite these communication efforts, Burkina Faso still has much to do with effective communication to take place.

Communication, as "an act of sharing or exchanging information, ideas or feelings" (Oxford Wordpower Dictionary New 4th Edition, 2016, P.146), can also be seen as involving many stakeholders, particularly in Burkina Faso, where the largest part of the population is living in rural areas with difficult access to information and means of communication. To be effective, communication must go in two directions, where senders and receivers of information interplay roles through information sent and feedback. The principle of effective communication requires that both senders and receivers interact via a channel through which they can timely send and receive information one to another.

When the receiver sends feedback to the sender, the communication becomes effective because the initial sender interchanges his role of the sender to a receiver in the same process of information.

A communication process fulfilling these conditions of exchange between sender and receiver can be labelled “bidirectional” according to (Ambani and Percy, 2014, p.13).

In 2014, the literacy rate of the population was 34.5 %, specifically 26.2% in South west region - and 24.4 % in Northern Region (INSD, 2015, P. 78). To be accessible, climate information needs to be communicated at an easier understanding level for its users. The diachronic aspect of climate information (information about the past, the present, and the future) calls for the constant interaction of its stakeholders in both its production and communication. If access to information is relevant for decision making or to orient it users’ action, it is even more so in climate-related adaptation strategies and options.

The study analyses the communicative interaction and exchange of climate information between scientific and local sources through information flow from top-down and bottom-top. It determines how farmers’ climate-related adaptation capabilities may be enhanced by scientific and local climate information communication and formulate some recommendations.

Chapter Two discusses related literature, Chapter Three describes the methodology, and Chapter Four will cover the study’s results and discussion. Chapter Five give the conclusion and recommendations. The following sections of this chapter are: ii) Statement of the Problem, iii) Purpose of the Study, iv) Research Questions, v) Significance of the Study, vi) Scope of the Study, and vii) Limitations of the Study.

1.2. Problem statement

In the logic that “Climate information is information about past, present and future climate conditions from both local and scientific sources, and the resulting implications for development, people's livelihoods and the environment" (Ambani and Percy, 2014. P.5), it can be deduced that its production, communication, and usage is diachronic.

In Burkina, climate information communication is broadcast through the media (audio, visual and print), where the information flow channel is mainly one-way, top to bottom, which poses a problem for its effectiveness. In effective communication, the flow of information follows a principle of reciprocity in the exchange through different channels used as a medium.

In that way, interaction is enhanced between receivers (the farmers in this study) and senders (scientists and information disseminators), so that receivers can raise concerns and give their feedback to the senders, and vice versa. Interactive communication can better engage all information stakeholders to where the targeted message is effectively sent by the sender, and received and understood by the receiver. In that way, if we can assume that climate information communication can help in educating, training and raising it to end users' awareness (in reference to Article 6 of the UNFCCC, 1992, p.10) local or traditional Knowledge may be relevant for forecasting or indicators to orient decision in farming practices. In the Gambia, Yaffa (2013) found that farmers "use traditional knowledge such as the full sprouting of a particular baobab seedling to predict the onset of the rain and then to determine the planting time for millet and groundnut."(Bagagnan, 2015, P.3).

Similar indicators are found in the results of this study such are farmers' observation of their surrounding environment on trees manifestation (leaves, fruits) and birds' movement to forecast the farming season and the time of some related activities (onset or ending time).

The constitution of Burkina Faso (1991, rev 2012, p. 4) recognizes in Article 8 that "The freedoms of opinion, of the press and the right to information are guaranteed. Every person has the right to express and to disseminate his opinions within the order of the laws and regulations in force." In reality, however, a lot remains to do in communicating climate information to it end users. For example, the impacts of the exceptional floods occurred on September 1st, 2009 in Ouagadougou, which caused loss of life and damage estimated at over 70 billion francs CFA, raised awareness of how people could suffer due to climate change, and the necessity of knowledge and information access. With all its consequences, this exceptional flood event was sudden and unexpected because citizens were not informed about it before it happened.

Since then, climate information communication became more of a public concern for stakeholders, both senders, and receivers in urban and rural areas.

Under the Ministry of Environment and Sustainable Development of Burkina Faso, the Permanent Secretariat of the National Council for the Environment and Sustainable Development (SP/ CONEDD in French) edits Burkina Faso's climate change profile information. Policies at the country level are documented and communicated in the NAPA and NCs to the UNFCCC. The information in these documents appears technical and strategically oriented towards the country's achievement in adaptation and mitigation activities or for the funding requirements. Although farmers are not the intended audience, it can be assumed that the NCs and the NAPAs contents can provide a better understanding of the country climate profile and adaptation plans if at all they are made accessible to the population. For this reason, it can be suggested that farmers should be consulted when writing NCs and NAPAs because, their contents may not be accessible to that majority of the population, who are largely illiterate (with particularly a large proportion living in rural areas) in need of information in their decision-making processes for various socioeconomic concerns.

SP/CONEDD [4](2014) pointed out that the rural environment is disadvantaged compared with the urban environment in terms of literacy (16.9% against 61.7%).

The proportion of people who have no level of instruction in Burkina Faso is about 70%, except in the regions of Centre and Hauts-bassins, because they host the two biggest cities in the country. Fifty-nine percent of the urban population is literate against 14.5% in the rural areas. According to the gender, 16.6% of women are literate against nearly double concerning men (SP/CONEDD 2014, p.9). When making climate information useful and accessible, Ambani and Percy (2014, P.9) state that "Climate information is useful when different knowledge sources are combined and 'translated' to relate to local livelihoods, context, and experience". A reciprocal exchange of information between senders and receivers can be enhanced when scientific climate information is integrated with local farmers' climate information. Then the effectiveness of the communication may be perceived with feedbacks given by the farmers who are not left behind in the process of interaction in the information communication.

Few studies have covered climate information effective communication in Burkina Faso. As farmers represent the largest amount of its users, it is relevant that climate information senders (as scientists and information communicators) and receivers (farmers at the local level) interact in exchanging knowledge that can help to a better information accessibility and adoption. Scientists and farmers exchanges of climate information and adaptation related knowledge seems to be less covered in studies specifically in the communes of Ouahigouya and Dano. This study will consider the exchange of climate information which is conducive to interaction between the scientific community and the local end users farmers. Information that comes from such dialogues

[4] SP/ CONEDD is the Secrétariat permanent du Conseil national pour l'environnement et le développement durable/ Permanent Secretariat of the National Council for Environment and Sustainable Development.

can help anticipate climate risks and encourage adaptation to climate change effects, especially in rural communities.

This thesis considers how scientific and local knowledge has been or could be linked and engaged to address adaptation to the effects of climate change and climate variability on farmers.

It analyses climate information communication interactions between scientists, farmers and other climate information stakeholders in the communes of Dano and Ouahigouya.

1.3. The significance of the research

The purpose of this study was to understand how more effective information communication, integrating scientific and local knowledge, can be implemented in Burkina Faso, with a focus on four climate-related events or hazards: rainfall, droughts, wind storms, and floods. The following outcomes were expected from the study:

1) Identification of the networks of stakeholders for climate information communication to farmers,

2) Exposition of ways to integrate science-based and local knowledge on climate change and variability into the Burkina Faso's climate information and communication strategy.

3) Suggestions to key stakeholders as decision makers (scientists, farmers and communication professionals) of ideas to build local communities' resilience to climate change impacts through an engagement of all stakeholders in an effective climate information communication system through a multi stakeholder engagement platform.

4) Submission of the outcomes of this work to all interested stakeholders for them, to use the study's recommendations into their daily practices.

5) An indication of further research areas on climate information communication in Burkina Faso

1.4. Objectives of the research

The main goal of this research is to determine a strategy to effectively communicate climate information and adaptation knowledge to in Burkina. The specific objectives are:

a) to investigate the relation of scientific and local knowledge in climate information and communication on rainfall, droughts, wind storms, temperature and floods to farmers in southern and northern Burkina Faso ;

b) to analyze farmers' climate related-adaptation capabilities through climate information communication channels on rainfall, droughts, wind storms, temperature, and floods in southern and northern Burkina Faso, and

c) to understand and suggest how to effectively communicate climate information on rainfall, droughts, windstorms, and floods to farmers in Burkina Faso.

1.5. Research questions

The main question of the research asks: do integrated scientific and local knowledge in climate information communication enhance farmers' climate- related adaptation in the selected villages of the study area in the communes of Dano and Ouahigouya, Burkina Faso?

Specifically, three sub questions from the main question are:

1) Is scientific and local climate information integrated into climate information communication to farmers in the selected villages of the study area?
2) Do the channels used to communicate climate information to farmers as end users enhance their adaptation capabilities in the selected villages of study areas?

3) What can be suggested for an improved climate information communication strategy to help farmers adapt to impacts of climate change and variability in the selected villages of the study areas, and Burkina Faso in general?

1.6. The scope of the Research

The focus of the study was on the communication of climate information to farmers. To achieve the three objectives, primary data and secondary were all used to support the analysis. The mixed methods (quantitative and qualitative) employed in this work (workshops, surveys, and key informant interviews).

240 people were surveyed, 87 participated in total to the 4 workshops, and 24 key informant farmers were interviewed in the respective 4 villages of the study areas. They were selected in two villages in each of the two areas (Study area A and Study area B) of the study.

The villages of Study area A were chosen in Région du Nord, la province du Yatenga and precisely Commune de Ouahigouya, (the Northern Region, the Province of Yatenga, precisely the commune of Ouahigouya). The villages of Study area B were chosen in Région du Sud-Ouest, la province du Ioba and precisely Commune de Dano, (the South West Region, the Province of Ioba, precisely the commune of Dano.

The respondents were mainly farmers from both sexes organized in three groups according to their age range (active young farmers aged from eighteen to thirty-four; active farmers of middle age range from thirty-five to sixty-four, and farmers at elderly age of sixty-five and above).

The study villages were chosen both based on size and whether or not WASCAL's APTE21[5] climate information dissemination project intervened in the village. Within each commune, the project intervened in the small village, and the large village had no intervention.

The project intervention village is coded WPIV (WASCAL Project Intervention Village) for the two small size villages (one in each Commune) and NWPIV (Non- WASCAL Project Intervention Village) which are the two big size villages (one at each side).

Key informant interviews provided the points of view of professionals' (mainly extension agents, national Agencies, and NGO staff). They were interviewed at the commune, provincial, regional and national levels accordingly to their professional profile, and were 14 in total.

A comparative approach was used to expose the differences and similarities of the results collected from the villages among three criteria: i) between northern and southern Burkina); ii) whether or not the project intervenes in the village and iii) considering the villages sizes.

The climate parameters observed and considered for the study were rain, wind, temperature (with droughts and floods) and time scale considered was the past 30 years.

1.7. Research Limitations

Given that the study was carried out for the sake of a master thesis, time and resources were limited to conduct the study to a larger, more representative scale in Burkina Faso. The study encountered unavailability of updated demographic data on the villages as the last official information on demographics to be published is from 2006, conducted by *Institut National de la statistique et de la démographie, recensement général de la population et de l'habitat* (INSD/RGPH, 2006). Some

[5] Application des Prévisions Climatiques et Pratiques Agricoles dans la Traduction des Evenements Climatiques Extrêmes du 21eme Siècle en Zones à Risques

potential key informants were not reached because of time constraints at the moment they were targeted to be involved in the study.

In the villages, data collection was conducted in local languages, where some concepts easily understandable in French could lead to information gaps if not properly and exactly explained in the interaction with respondents.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1. Empirical review

This section comprises the summary of the background climate information and climate realities of Burkina Faso, including the study areas.

2.1.1. Background on climate information communication of Burkina Faso

In Burkina Faso, the Constitution of 1991 (rev. 2012) recognized the right and duty of citizens towards the environment and their commitment to protecting it in reference to the terms of its article 29, and 30. With regards to climate information, the country climate profile information is produced in NCs and NAPAs and communicated to the United Nation Convention Framework on climate change.

Pursuant to article 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC), Burkina Faso developed a second NC in 2014 containing the measures aimed at mitigation or appropriate adaptation to climate change (Eguavoen &Wharen 2015, p.8.). This document points out the changes in climate, completes and updates certain information brought to the attention of the international community in the first NC of 2001.

The Burkina Faso NCs, as well as the NAPA, contain information on the country's climate vulnerability assessment, policies and adaptation plans for climate related socioeconomic activities, specifically, the agricultural sector. The historical evolution of the NAPA (PANA in French) indicated that NAPA turns into a NAP (National Adaptation Plan) in 2012 according to a presentation from (CNPP[6], 2014). In a certain manner, the adoption of the NAP is related to projected socioeconomic development in the effort to address climate change impacts.

The CNPP (2014, p.10) exposed in its research on the country's climate profile that the major extreme weather events are floods, droughts, windstorms and high temperatures.

This information supports the choice of the climate parameters or variables that are used and analyzed in this research.

The Burkina Faso INDC[7] document edited in 2015 completes the list of the referential documents in which are communicated the official climate relevant information specifically with regard to the climate adaptation, needs, policies and strategies of Burkina Faso, to the UNFCCC.

If the presence of this information illustrates the efforts in communicating its climate information, they seem to target a ‘selected audience ‘Their technical contents are not easily understandable by lay people, and 93, 4% of the population does not have any level of literacy (MJFIP [8] 2016, P.1.)

Scientific climate information on Burkina Faso also includes the work of biodiversity researchers described the country climate profile. Thiombiano, A & Kampmann D (eds). (2010) explained that Burkina Faso has a tropical climate of alternate seasons: a long dry season (from November to May) and a short rainy season (from June to October). The climatic regime of Burkina Faso which is regulated by the oscillation of the Intertropical Front (ITF). The ITF movement largely determines the rainfall patterns of Burkina Faso and can explain Burkina Faso’s vulnerability to rainfall spatial variability and deficit (Ibrahim et al., 2012). The north is much drier and more prone to rain deficit, drought and high temperatures than the south where rainfall conditions give relatively high humidity and flood prone areas.

This difference in climate condition gives a picture on the climate profile specifically in its rainfall patterns, and oriented the choice of the study areas in the North Region (Region du Nord) more precisely in the Province du Yatenga (Ouahigouya) and in the Southwest region of (Region du Sud-Ouest) in the Province of Ioba (Dano). The differences noted in rainfall patterns of the two areas will help in a comparative analysis.

In the document of the NAP (National Adaptation Plan) authored by the Ministry of Environment and Fishery Resources of Burkina Faso (MEFR, 2015), the cumulative rainfall data analysis for thirty-year periods (normal values) shows unequal spatial distribution and variability of rainfall while indicating that the 600 and 900 mm isohyets migrated about 100 to 150 km from north to south between 1930 and 2010.

2.1.2. Climate change and agriculture

If the indicated impacts of climate change are predicted to affect the socioeconomic sector in Burkina Faso, agriculture is one sector that will be more exposed. With the predicted changes and risks of climate changes impacts, "40% the GDP in West African Sahel countries including Burkina Faso is from agriculture and the farming system mainly rain fed" (USAID, 2017)and all agriculture-dependent livelihoods will be at risk. With the extensive mode of agriculture development in the West African sub region, farming activities are exposed to climate challenges that affect crop production and yields (Palazzo et al. 2016; Samari 2011).

As a Sahelian country, Burkina Faso is regularly confronted with droughts and floods. From 1991 to 2009, the country experienced eleven major floods and three major droughts according to a study by WFP (2014).

The last crisis, which occurred in 2011, was the most serious. A drought of a rare magnitude affected 170 municipalities in 10 regions of the country and caused a gross cereal deficit of 154,462 tons affecting 3.5 million people. A subsequent question which can be asked is what and how an effective and interactive climate information communication could have achieved in avoiding or addressing these climate related severe impacts? Information on the estimated impacts of climate related extreme events supports the relevance of the research.

According to the second NC (SP/CONEDD, 2014), the agriculture sector represents one of the sources of climate change drivers. The total emissions of GG in equivalent CO2 indicated 19.142 Gg, 88% of the national total of GG emissions, in 2007, increasing by 42 % from 1999 in correlation with the increase in agricultural practices in Burkina Faso. The category of enteric fermentation causes the most emissions of GG (nearly half of every year). The table below highlights six agricultural practices which respectively generate Greenhouse Gases. In the listed categories, the related greenhouse gases emitted are respectively Methane (CH4) for the enteric fermentation and manure management; carbon monoxide, nitrous oxide, methane, and nitrogen oxide form the residues brunt in the fields. The farming soils emit in a certain measure nitrous oxide resulting from the use of fertilizers. In communicating climate adaptation related information to farmers, this information can be used as fact to alert, convince, and raise awareness or advice farmers in the field.

Table 1: Percentages and cumulative percentages of various categories

Categories	Percentages	Cumulative percentages (%)
Enteric fermentation	49,72	49,72
Farming soils	42,83	92,55
Manure management	6,25	98,80
Farming residues burnt in the fields	0,96	99,76
Rice	0,21	99,97
Controlled burning of savannahs	0,03	100,00

S*ource: Adapted from SP/CONEDD (2014, p.27)*

Based on some projection from 2000 to 2050, for instance, the yields of cereals according to their demand and their conditions of productivity under three scenarios in the table below.

Table 2: Comparison of the plausible productions according to the scenarios of the country cereals needs estimates

Years	Country Population (inhabitants)	Cereals needs (T)	Total productions under no climate change conditions Productions (Tons)	Total Productions in tons under climate change conditions (scenario1)	Total Productions in tons under climate change conditions (scenario3)
2000	14.017.262	2.663.279	276.202	276.202	276.202
2025	24.790.936	4.710.277	6.028.247	914.248	1.516.204
2050	51.906.936	9.862.317	9.774.322	1.288.603	2.365.175

Adopted from SP/CONEDD (2014)

From the content of this table, we can say that agriculture sector will fail to supply population needs under severe climate conditions. Despite the importance of the agricultural sector in the national economy, food security is likely compromised and vulnerable specifically under severe climate condition.

(GWP/AO 2015, p.11) explained that “[f]ood production targeted to cover population needs is mainly rain fed” Then, of the 5.3 million hectares of area planted on average over the period 2009 to 2014, traditional rain fed cereals (millet, sorghum, fonio, maize) represent more than 3.9 million hectares.

Finally considering a proper stakeholder engagement requires a collaboration in a peaceful environment for agriculture sector development and all its collateral enhanced benefits on farmers’ livelihood. In reality, Climate change is a factor that can exacerbate these conflicts according to Sanfo, et al. (2015) in their finding on climate related-conflicts between farmers and pastoralists.

With conflict risks and all the agriculture features and challenges mentioned above, adaptation to climate change and variability could require a multi-dimensional effort including climate information communication.

2.1.3 Climate change adaptation related studies in agriculture

As climate change impacts are projected to severely impact Africa with it a low capacity of adaptation (IPCC, 2007), climate change adaptation is gaining more focus on multi sectorial initiatives from global to local levels. Because, "Africa's primary climate-related vulnerabilities stem from the negative impacts of climate change on agriculture and food security, water stress, ecosystem degradation, health risks, and weak adaptive capacity" (Norford, 2009, p.6), the agriculture sector is one of the areas stressed by climate change that need to be addressed.

From the global level, many countries are signatories of the UNFCCC, membership in which requires that climate adaptation studies be done in accordance with the NCs, NAPAs, NAPs, and more recently NAMAs and INDCs. In Burkina Faso, both NCs conducted vulnerability assessments for the country climate profile and also identified normal scenarios under which the agricultural sector could flourish (best case scenarios without climate change conditions) and positively impact populations' livelihoods.

Zougmore et al., (2016) list a series of adaptation strategies in crop production through a review on West Africa agriculture climate related adaptation situation. The salient strategies developed are cultivar development, water management, agroforestry, soil carbon sequestration, seasonal weather and climate forecasting, and fertilizer efficiency. Below et al. show (2010, p.vi) "that African smallholder are already using a wide variety of creative practices to deal with climate risks." They recognize because adaptation takes place at multiple levels and involves multiple actors, introducing or adjusting crop insurance or even international grain futures markets and making simple changes in the mix of traditional crops grown in a single field can also help smallholder farmers in Africa adjust to climate change. Kurukulasuriya and Mendelsohn (2006) indicate African farmers' choices in selecting crops varieties according to its suitability to the climatic conditions of their milieu. Traditional adaptation knowledge from end users can be associated with the one from a scientific source and might help to increase adaption options and strategies to integrate scientific and local or traditional adaptation information or knowledge.

To solve the problem of the limited adoption of technical options to adapt to climate change by farmers, the first step could be to meet their willingness and ability to accept new practices in reference to Below et al.(2010, p.8). It can also depend on factors such as their awareness level of the problem (need to adopt and adapt), economic interests, social and ecological values and norms, and self-perception.

Similarly, a study Sanfo et al. (2014) suggests farmers' perceptions be considered when negotiating adaptation measures in farming communities. In the study farmers rate choices of media from which they prefer to acquire knowledge or information.

The outcome of this rating can help to advise decision makers in undertaking any initiative of adult farmers' education in the climate area.

From a gender perspective, if Jost et al. found that smallholder farmers are changing agricultural practices due to observations of climatic and environmental change, the pace at which they adopt and change their agricultural practices might not the same. "Women appear to be less adaptive because of financial or resource constraints, because of male domination in receiving information and extension services and because available adaptation strategies tend to create higher labour loads for women", (Jost et al. 2016, p. 133). These authors expose the dualistic situation of farmer engagement into some adaptation strategies. Farmers equally go about adaptation measures if there is no financial implication for women, and unequally when the strategies require finance and labour from women. Adaptation measures should be contextualized because the actors who drive them or for whom their outcomes are meant may not be at the same level of capacity or capability of adoption. The effects of climate change on a region are the same for all its inhabitants, but men and women have different assets and resources at their disposal with which to tackle these effects. Women are therefore more vulnerable, and the impact on their livelihood is greater (Gonzalez et al. 2011, P.4).

Women's vulnerability could be worsened by the severe projected impacts of climate change on agriculture specifically in a context of Sahelian rain fed agriculture in Burkina Faso.

In most of the cases, climate adaptation strategies from at the global to the local level are implemented (or supposed to be) more or less through stakeholder engagement and in development projects, be they action research, research for development, or socioeconomic development. In recommendation section of chapter five, a stakeholder engagement could be relevant to advice policy and decision in a climate information communication strategy.

A non-published work report of an ongoing WASCAL Project (APTE-21) also helps to explain climate related adaptation capabilities through some adaptation measures (agro meteorological advice) disseminated to farmers which in this research.

Finally, if "[s]takeholder engagement taps into indigenous knowledge when designing and implementing adaptation measures" as suggested by Dinesh & Vermeulen (2016, p.4), it requires a prior effort of communication that could help achieve more in terms of interaction.

These authors explained that the performance of adaptation measures depends on multiple factors that vary across agricultural systems. "[A] major function of national and local planning is to match adaptation options to local contexts" (Dinesh & Vermeulen 2016, p.4). The way forward for climate information communication has to be interactive, engaging and effective.

2.1.4. Climate information communication related studies

With its various impacts described in several research works, climate represents a "double-edged sword" with regards to the way forward, there is an ambivalent situation of fear because of the unpredictability of its extremes events with all the collateral impacts, and hope if proper adaptation measures are done. According to the African Development Bank (AfDB), Climate change could be an opportunity to enhance Africa's agricultural development through adaptation measures. In West Africa, for instance, "Niger's farmer-led approach to agroforestry, has improved livelihoods while contributing to both adaptation and mitigation across 5 million hectares of land." AfDB (2015, p.4). These agroforestry techniques have now spread to Mali according to this source.

Communication could play a significant role in helping people to adapt to the adverse effects of climate change because before to know and to adopt new adaptation packages, these packages need to be communicated first.

Similarly, with the adoption of climate smart technologies by farmers, the key factor prior to the process of that adoption is communication. Climate information communication has been captured by a few authors, specifically in the West African context. "Given the highly localized, site-specific nature of agriculture, climate change capacity building and adaptive governance are needed among lower administrative units, especially at district levels" (Kissinger et al., 2014.p.8).

To achieve this one must rely on a proper stakeholder engagement and an effective communication strategy.

From a general point of view, communication is a process which requires at least four components to take place: the sender, the medium, the message and the receiver.

Communication is first of all seen as a mutual process by which a person, group, organization (the sender) transmits some type of information (the message) to another person, group, organization (the receiver). However, understanding of meaning can determine the success of the communication in reference to effective communication which takes place when the intended message sent is understood as meant by its sender. For instance, telling a farmer "it is warm X amount degree Celsius", "it rained Y amount in millimeters" sounds more technical and quite difficult to be directly used Farmers in their activities. They may even not understand what this information means and how to do act accordingly. In consequence, initiatives like the WASCAL's APTE21 project and the *Climate Change Adaptation Support Project by Improving Climate Information*[6] (are more relevant because they go beyond the simple climate information to farmers and aim at improving its related adaptation skills enhancement.

Practical definitions from Baskin & Aronoff on communication and its network include *Communication flow*, the direction (upward, downward, and horizontal) messages travel through networks in an organization; and *Communication networks*, the patterns of communication flow between individuals in the organization (Hurme, 2001). These definitions are used in this research to support the analytical framework of communication and help to better understand climate

[6] Projet d'Appui à l'adaptation au Changement Climatique par l'amélioration de information Climatique under CILSS/ Permanent Interstate Committee for Drought Control in the Sahel through Projet ACCIC/DANIDA, ended in 2015.

information dissemination to its end users. Upward communication means an exchange of information initiated from the bottom to the top (from farmers to scientists); downward communication flows from top to bottom (from scientists to farmers).

The “traditions” of climate information in Burkina Faso show that information flows one way. Farmers are just receivers of information. Horizontal communication corresponds to an effective communication principle where senders and receivers interplay or interchange roles in the process of the transaction of climate information communication. Receivers respond to senders with feedback, becoming senders to their initial message sender. When meaning is equally understood, the communication can be supposed to have effectively taken place.

An effective communication perspective is where the communication flow is supposed to be dynamic and flow a two way information circulation path. This research used paradigms of communication from Vlăduţescu (2013): “communicative interaction,” “communicative transaction” and “communicative transactions” to discuss the effectiveness of climate information communication.

Regarding climate information dissemination to farmers in Sub Saharan Africa (SSA), Hansen et al. found that “Regional climate outlook forums (RCOF) and national meteorological services (NMS) have been at the forefront of efforts to provide forecast information for agriculture” (2011.p, 205).

Even if today climate information communication remains the source of weather forecasts delivery, the reality is also that climate information is a matter of stakeholders engaged in the interaction of climate information delivery if we consider how the information can reach to the end users. Many authors (Jiri et al., 2016; Ambani & Percy, 2014; Bagagnan, 2015) consider the local [indigenous] people perception in communicating climate related information to them as end users. Srinivasan, et al. (2011, P.1) found that " [i]n order for climate information to inform risk management and adaptation effectively, it is helpful to have it embedded within an institutional system that starts with monitoring weather and climate events and ends with a community level response. This institutional system contains a number of components, of which perhaps the most important is the customization of information according to user requirements and its delivery to the community level.

The Africa Strategy on Climate Change recognized that as well on its **Goal 42** where it is suggested to "*Harness the use of endogenous and indigenous capacities for understanding and communicating climate change and its implications on communities." (*The Drafted document on Africa Strategy on Climate Change, 2014, P. 60.)

This goal could be achieved by undertaking some action in relation to the terms the Article 6 of the UNFCCC education training and awareness enhancement.

Finally, if it is possible to consider climate information communication as a multi-stakeholders "thing", then these authors respectively conducted their studies on how climate information should be communicated to some of its key stakeholders. Then, Moser (2010) pointed out the novelty of communicating the impacts of climate change and possible adaptive responses is a relatively recent branch of the larger endeavor of climate change communication.

This article describes when [climate change] impacts and adaptation communication becomes important and approaches to do so effectively. the issue of the diversity of indigenous people's climate change understanding raised by Cochran et al. (2013) that "Indigenous understandings of climate change are as diverse as the many environments and cultures in which they are situated," in (Callison, C., 2017, P.4) and this might pose the necessity of an effective communicative interaction which could enhance a successful climate information delivery.

Morrison, M., Hine, D., W., & D'Alessandro, S.(2017) recommend the use of publically available farming sources (e.g., agricultural scientists) as well as farmer networks in climate change messages delivery to farmers. It is good to notice with these authors, “The challenge for those communicating about climate change is to make climate change and the ways farmers can respond to it more real at the farm level” (Morrison, M., Hine, D., W., & D'Alessandro, S., op. cit, P.21). Then reason to be and some of the responsibilities of extension workers and scientists in relation to Denny (2014) social network tutorial (transitivity) play the role of information brokers. In communicating climate information to farmers imply that as senders they provide contextualized useful information to them at the farm level. This is why climate information should be from both senders or producers and receivers or users perspective, involving and “(…) it is now recognized that co-production between extension and farmers is a more effective means of producing actionable information (Jones & Garforth, 1997)” according to (Prokopy, L., Bartels, W., Burniske, G., & Power, R., 2017, P.2.)

From the development above, it can be assumed that climate information and communication research in its multiple facets and requirements, calls for reference to be made on a theoretical framework to support the analyses.

2.2. Theoretical framework

This section comprises: a) methodological and analytical framework references, b) communication theoretical and analytical framework references, and c) technical and legal instruments used in relation to the research.

2.2.1. Methodological and analytical framework references.

The overall analysis in this research will lie on the comparative approach. The two study area will then be compared considering their physical, geographical, demographics and climatic features. In reference to its objectives, the research indicates similarities and the differences in its findings in the Commune of Dano and Ouahigouya. The data will be analyzed and the same approach will prevail in the effort to the differences and the similarities as describes here "The two conventional types of comparative analysis focus on the explanation of differences, and the explanation of similarities". (Pickvance, 2005.P.2).

In addition to that, in reference to the mixt approach employed, a triangulation is used to link non-statistical information gathered from the survey to the ones from key informant interviews and workshops (where Focus group Discussions were used).

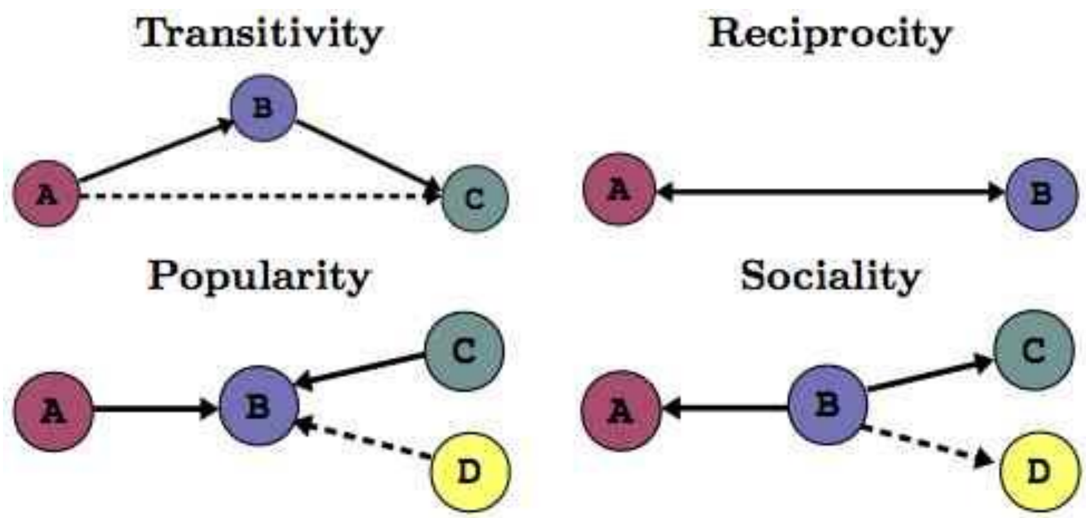
Colorado State University (1993–2013) cited in (Harvey, L., and 2012–18) defines Triangulation "The use of a combination of research methods in a study. An example of triangulation would be a study that incorporated surveys, interviews, and observations."

The research refers to both theoretical and methodological triangulation to explain and relate its findings one to another.

2.2.2. Communication theoretical and analytical framework references

The Social Network Theory work of Denny (2014) presents an analytical framework that could help to better understand the communicative interaction of climate information various stakeholders in the study areas. The graph below illustrates the type of connection according to some interaction principles (transitivity, reciprocity, popularity, and sociality) and could serve to detect and explain information or communication flow as well.

Figure 3: Networks relationship and structures



Source: These graphs are adapted form Denny (2014)

From communication analysis perspective, they seem relevant to explain the direction of the communication flow and formulate some recommendation upon the weaknesses that the network analysis of the climate information communication present at the end of the research.

More specifically, as the study focus on how climate information communication can enhance the climate-related adaptation capabilities of the end users, this figure is useful and can help to analyze the network in which it is carried out.

In this regards, “Social network analysis can be used at this stage in at least five ways: (1) identifying opinion leaders to act as change agents, (2) using community members as recruiting agents, (3) consideration of other network interventions methods, (4) consideration of the social context of program delivery, and (5) attending to social media and other communication needs” as indicates (Valente et al. 2015, P.9).

To be able to explain the effective communication between climate information stakeholders in the study area, the research considered this definition: “Social network analysis focuses on the analysis of the pattern of relationships among people, organizations, states, and such social entities. Social network analysis provides both a visual and a mathematical analysis of human relationships” (Jamali, M., & Abolhassani, H., 2006, P.1)

2.2.3. Communication theoretical and analytical framework references

The framework of vulnerability and resilience based on access and usage of climatic information (modified from Pasteur, 2011), used in (Jiri et al., 2016, p.157), to analyze the climate-related adaptation capabilities in the farming communities of the study areas.

The main communication process considered in this work is the effective communication system where information flow is bidirectional, two ways information flow. (Top-bottom and bottom-top, where the information sender and receiver can interplay roles through information transfer and feedbacks).

Furthermore, the section on climate information access will be analyzed by the Knowledge Gap Theory in communication studies specifically on gender perspective. The research develops in Chapter four women climate information related challenges.

The communication deficit, public engaging and lay expertise models are employed to describe and explain both the flow and the interaction among climate information stakeholders.

From these realities stressed out by the analysis are suggested recommendations in Chapter five of this thesis and one of those recommendations agrees with “a need to develop and evaluate communication training to climate change communicators (…)”, (Suldovsky, 2017, p.22).

2.2.4. Technical and legal instruments used in relation to the research.

In order to build the sample of the study which was purposively targeted, the research made reference to the international labor organization convention terms of agriculture worker profile.

The research's sample includes active farmer from both sex, at least 18 years aged of the study areas accordingly to the terms of the Minimum Age Convention, 1973 in The International Labour Organization's Fundamental Conventions (ILO, 2003).

On its Article 3, is indicated "The minimum age for admission to any type of employment or work which by its nature or the circumstances in which it is carried out is likely to jeopardise the health, safety or morals of young persons shall not be less than 18 years." (ILO, op. cit, P.46.)

The statistical information gathered in INSD (2010; 2012 & 2015) and BCEAO (2015) support in statistical information for analysis and discussion in this research.

The United Nations (2004) work on BURKINA FASO Public Administration Country Profile provide some relevant information on Burkina Faso's administration and its subdivisions what are exploited in this research specially in describing the study areas in the following chapter.

In the same way, the content of the code of information of Burkina Faso issued by the Parliament of (herein in French "*LOI N° 56/93/ADP (JON°05 1994) portant Code de information au Burkina Faso"*) help to understand the environment of the sector of communication specially with the regulations which could hamper or hinder communication sector's initiatives and practices.

Some information found in online in bulletins, newspapers are found relevant for the content development of Chapter four are used and acknowledged with their links in text citation and in the reference section.

Finally, the ongoing WASCAL project (APTE21) progress reports on works carried out in Ouahigouya and Dano contain information specifically on agro metrological advice and practices that might enhance farmers’ adaptive capacity farmers that are relevant to the research even if these reports are at the stage of unpublished work.

CHAPTER THREE: METHODOLOGY

This Chapter present the methodology used in this study and it is divided into the following sections: i) presentation of the study area, ii) Research design, iii) Sample and sample building procedure, iv) data collection process and instruments used and v) data analysis procedure.

3.1. Presentation of the study area

The research is conducted in two areas respectively located in Region du Nord (Northern Region of Burkina Faso) in the commune of Ouahigouya and in Region du Sud Ouest (South West Burkina Faso) in the commune of Dano. The administrative environment of Burkina Faso is stratified into five entities from national to local levels accordingly to the governance capacity. Burkina Faso has 13 regions, the first level of administrative subdivision, and 45 provinces at the second administrative stratification level. The third is at the departmental level (similar to districts) and they are 370 organized into rural and urban communes (49 urban and 302 rural). The communes are the fourth level of political and public administration subdivision and they are above the villages the fifth entity. The communes of interest for this research are both urban communes under which were selected the villages, 4 in total, 2 in each commune.

The status and administrative profile of these areas are explained through the process of decentralization which is described by United Nations (2004, P.7). This source indicates that in August 1998, Burkina Faso embarked on decentralization governed by Law No. 40/98/AN. This law is to “cede more administrative and financial autonomy to local communities” Miller, K. L. (2002)   and it is explained that in Burkina Faso, decentralization policy is dictated by the ability of the local community to mobilize local financial resources to run the local government.

In Burkina Faso, the administrative city of a Province or a Department has the status of a commune regardless of these thresholds.

The commune is a local government entity led by a five year elected mayor. The Commune of Ouahigouya in Northern comprises 15 sectors according to population settlement and living areas in its urban land coverage space to which are associated 37 villages under its administrative authority.

In the same way, the commune of Dano is subdivided into 7 Sectors in its urban land coverage space and has 22 associated villages under its administrative authority.

Considering the distances by driving and as the crow flies between Ouahigouya (North, Province du Yatenga, Burkina Faso) and Dano (South West, Province du Ioba, Burkina Faso), the following was estimated by an online website (http://ladistance.1km.net/bf/ouahigouya/bf/dano/).

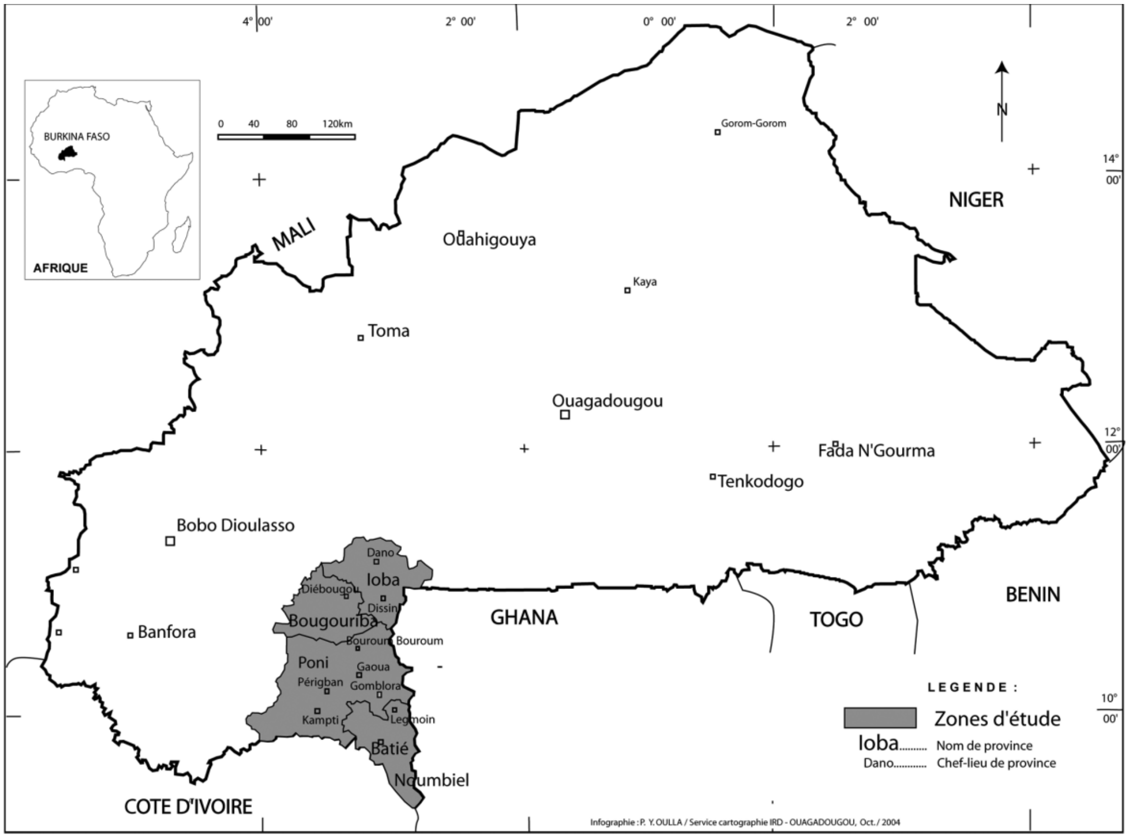
Table 3. Estimate of the Distance between Ouahigouya and Dano in Driving and distances as crow the flies

Ouahigouya-Dano (driving)	km	mi.	plane	helicopter	pigeon
Distance as the crow flies	279.6	173.7	0h 21m	1h 16m	3h 60m

Source: Adopted and modified (translated into English) from http://ladistance.1km.net/bf/ouahigouya/bf/dano/

These estimates could help in understanding the isohyets movement impacts as the results of the weather related spatial variability with a decrease of rainfall as we are moving from the south (Dano to North (Ouahigouya).

Figure 4: Illustrative Map to illustrate the width in distance between Ouahigouya and Dano



Source: Adapted from Baux, S (2006)

Having noticed the existence of a WASCAL ongoing Climate information dissemination project (Project APTE21) in its working villages also located in both selected communes, the research this took in consideration as a criterion in selecting the villages to be part of the research.

A total of four villages is chosen with one village of this project and the second village to be a non Wascal climate information communication Project intervention area. Hence the choice of the villages in Ouahigouya was put on Bembela (WASCAL APTE21 Project intervention village) small size village in comparison to Bissigaye the non-intervention village, bigger in size, land coverage, and demography.

The same process prevailed in Dano where, the choices were put on Tambiri part of the WASCAL APTE 21, project village network in the commune of Dano. Bolembar was the second village also involved in the study in consideration of its bigger size, land coverage and demography.

In Dano, Tambiri was my small size chosen village and it is a WASCAL APTE21 Project intervention village. The choice of the WASCAL APTE21 Project villages was notified and made by the Project Coordinator, Dr. Seiny Salack, and his collaborators' support and agreement.

A brief overview of the commune of Ouahigouya.

Ouahigouya plays a triple role of administrative place being the capital city of the Region du Nord, the province of Yatenga and the Commune of Ouahigouya. The urban commune of Ouahigouya is located in the northern part of Burkina Faso. The city of Ouahigouya (also called la cite de Naaba Kango) corresponds to the geographical coordinates 2.30 ° west longitude and 13.35 north latitude. It is located on the national road No 2, connecting Ouagadougou to Mopti in Mali, 181 km from Ouagadougou and 222 km from Mopti, and 57 km from the Mali border.(PCD, 2009 p.14).

The following information is extracted from (PCD, 2009): With the law N ° 055-2004 / AN of December 2004, on the general code of the local authorities in Burkina Faso, the commune of Ouahigouya now covers the departmental entity. Then there are 37 administrative villages which are attached to the urban commune for a total area of 491 km².

Located in the province of Yatenga, the commune of Ouahigouya is embedded into the Sahelo - Sudanese type of climate, characterized by two main seasons: a short rainy season from June to October marked by the monsoon blowing from southwest to north east and, a long dry season with two variants: a dry and cold period from November to January and a dry and hot period from February to May marked by the harmattan blowing from east to west.

The average annual temperature is 28.4 ° C. May is the hottest month with an average of 42.8 ° C. January is the coolest month with an average of 25.7 ° C.

Agriculture activities are mainly conducted in the rural area and its actors are in between rain fed crops production and irrigated crops production. In rain fed crops production is mainly done for both cash (peanuts, sesame, cotton, beans, and cowpea), and food (millet, sorghum, maize, fonio and rice). The irrigated crop production is done on the market – base gardening and vegetable production. Based on the demand, gardeners produce vegetable for sale, and the income collected to serve in affording other socioeconomic needs for the household.

Table 4: Distribution of the resident population and households in Urban and rural Ouahigouya accordingly to the RGPH data from 1985 to last in 2006

Commune of Ouahigouya (Urban and Rural)	Households	RESIDENT POPULATION (estimated size)				
		2006			1996	1985
		Male	Female	Total	(both sex)	(bot sex)
COMMUNE / OHG	**22 702**	**61 002**	**64 028**	**125 030**	**96 353**	**74 373**
Urban (the city)	14 157	36 370	36 783	73 153	52 193	38 902
Rural	8 545	24 632	27 245	51 877	44 160	35 471

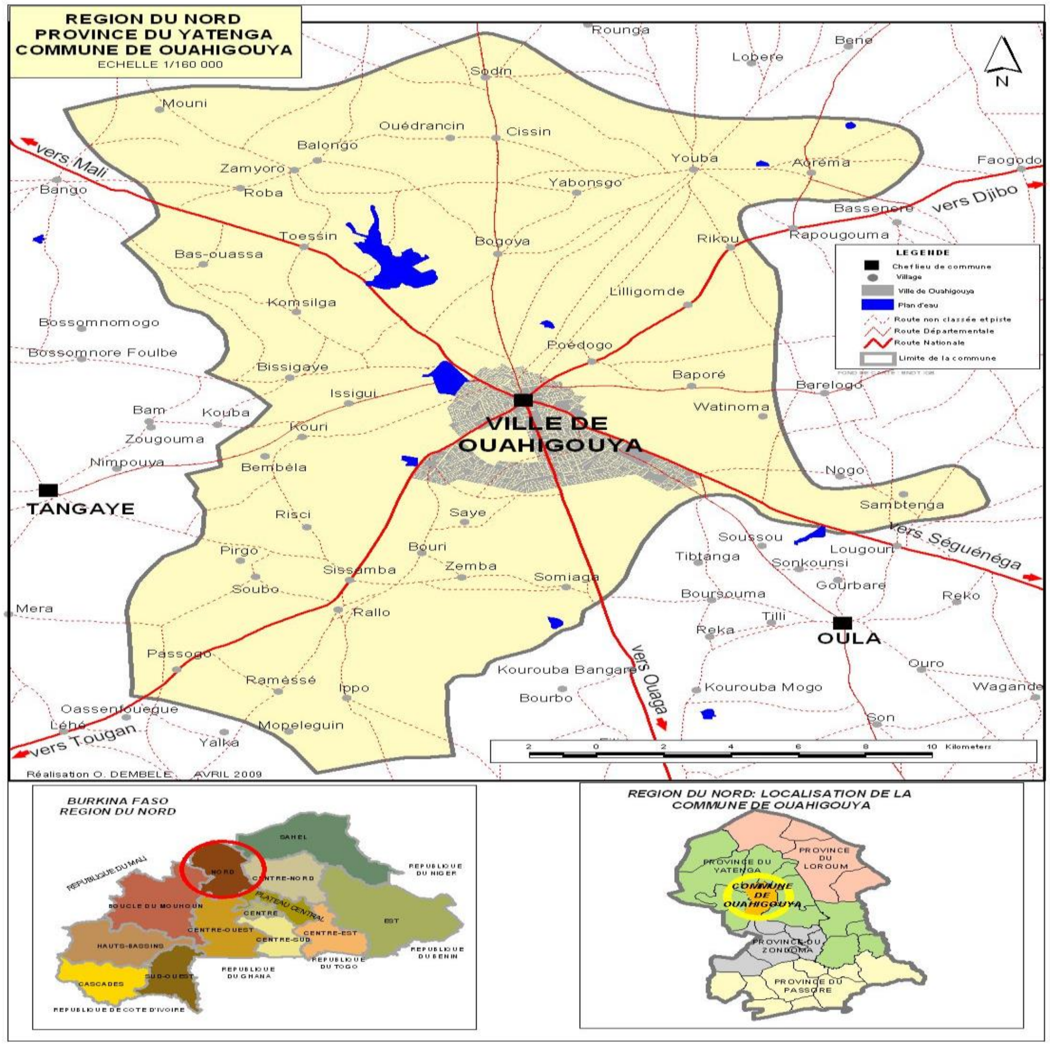
Source: Adopted and modified from PCD (2009)

Table 5: Estimates of the Demographic situation of the research selected villages in the Commune of Ouahigouya

Village	1985	1996	2006	2007	2008	2009	2010	2011	2012
Bembèla	740	963	1 128	1 146	1 164	1 183	1 201	1 221	1 240
Bissigaye	1 264	1 609	1 884	1 914	1 945	1 976	2 007	2 039	2 072

Source: Adopted and modified from PCD (2009)

Figure 5: Map of the Town and administrative villages of Ouahigouya



Source: Adopted and modified from PCD, 2009.

A brief overview of the commune of Dano

Dano plays a double role of being the capital city of the Province du Ioba and the capital town of the urban Commune of Dano. The commune of Dano is situated between 3 ° and 4 ° west longitude and between 11 ° and 12 ° north latitude. It is limited by its neighboring rural communes as following: To the east by that of Koper; to the west and south by the communes of Guéguéré and Dissin; North by that of Koti; Northeast by Fara; and to the northwest by Oronkua.

It has twenty two (22) administrative villages in addition to the city of Dano which includes seven (7) sectors. Dano, capital of the commune and province of Ioba, is located at a distance of 117 km from Gaoua (head and Capital city of the South West Region), 150 km from Bobo-Dioulasso (via Pâ) and 280 km from Ouagadougou. The municipality of Dano covers an area of 669km². (PCD, 2006), p.6.

The province of Ioba has located between the isohyets 900 and 1200 mm approximately. The climate is of Sudanian type characterized by two (2) seasons: a dry season that lasts from six (6) to seven (7) months (from November to April or May) and a short rainy season according to PCD (2007). Agriculture is the main economic activity of the population of the villages of the commune of Dano and represents more than 90% (PCD, 2007) of the population livelihoods support come from agricultural production. In rain fed crops production is mainly done for both cash (peanuts, sesame, cotton, beans, soy, and cowpea), and food (millet, sorghum, maize, fonio and rice). The cash crops are peanuts and cotton. However, the rainfall patterns are favorable to the cultivation of some tubers such are yams and sweet potatoes which are subject to be food and or cash crop according to the yields. In addition to rain fed crops, market gardening is practiced in the dry season and increasingly small-scale irrigation.

Table 6: Distribution of the resident population and Number of households in the Commune of Dano accordingly to the RGPH data 2006

The Commune of Dano (urban and Rural)	**Males**		**Females**		**Total**	
	Effectif	%	Effectif	%	Effectif	%
Dano (the city)	7 091	*48,53*	7 522	*51,47*	14 613	*100*
Dano villages	14 028	*48,42*	14 942	*51,58*	28 970	*100*
Total	**21 119**	***48,46***	**22 464**	***51,54***	**43 583**	***100***

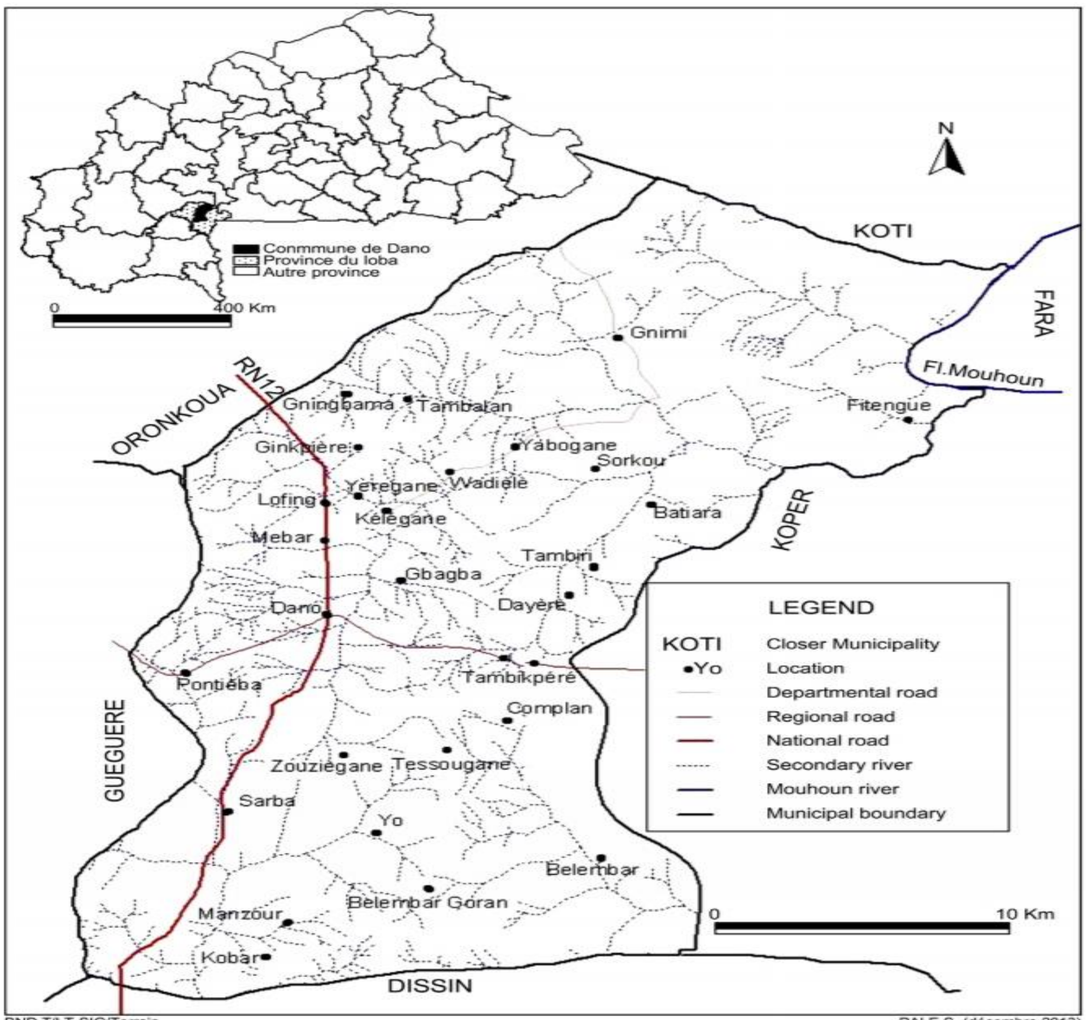
Source: Adopted and modified from PCD, 2007

Table7: Estimates of the Demographic situation of the research selected villages in the Commune of Dano

Villages	Populations			Distance from Dano (km)
	Males	Females	Total	
Bolembar	2 920	3 030	5 950	13
Tambiri	467	478	945	10

Source: *Source: Mairie de Dano, Résultats provisoires du RGPH 2006,* [Adopted and modified from PCD, 2007]

Figure 6: Map of the Commune of Dano



Source: Adapted and modified from Pale, S. and Constant DA, D.E. (2016)

3.2. Research design

The research is a mixed method study which combines qualitative and quantitative methods of data collection. Based on a comparative approach, the research focus is farmers' climate related adaptation capabilities of climate information in the communes of Dano and Ouahigouya, Burkina Faso. The research refers to the comparative approach and mixed methods used by Probst et al., (2012). This study involved peripheral and urban cabbage production sites in three West African countries that are Burkina Faso, Benin, and Ghana. In the research here, as the focus is on two distant communes respectively located in two different area, it specifically investigates on the relation between farmers' local and scientific knowledge through climate information communication on rain, temperature, and winds. The local [indigenous] knowledge is based on the population empirically observed data, got by weather forecast or the socio cultural climate related information. The scientific information is mainly any climate information generated by a scientific source such are weather forecast from meteorogical services and also other science climatic related information. Then it looks at the interaction between farmers and the climate information stakeholders and shows out the climate information communication related adaptation capabilities of farmers' end users of it. The research finally proposes recommendation out of the results discovered from the analysis.

The choice of the study area was based on the climatic particularities of each commune, and all together depicts the climate features of the country in term of rainfall distribution and variability which determine its climatic zones. The comparison is made to expose the differences and also the similarities between the results collected from the villages at three stages: i) inter study area level (Northern # Southern Burkina), ii) APTE21 project intervention level and iii) at villages' size level.

The principle of triangulation is used to link some results to the others and will show as well the agreement or not in all the information used in building this thesis.

The social network analysis is used to explain the types of stakeholders in their communicative interaction of climate information. From these depicted types of interaction, the deficit model, the public engagement model, and the lay expertise are used to describe the type of communication flow and the one (s) to be recommended in the way forward.

Finally, the research used surveys, key informants interviews and workshops (where focus group discussion was used) to respectively inform on the correlation analysis and content analysis, and triangulation principle in Chapter four.

3. 3. Sample building procedure

This research uses a purposive sampling method explained as "(…) purposive sampling strategy (Bernard, 2006) was applied to provide a diverse group of farmers with respect to three criteria: (i) gender, (ii) age and (iii) level of experience in farming." in (Probst et al., 2012, p. 5.)

In fact, the data from the Burkina Faso censuses of 1975, 1985 and 1996 in (Ouedraogo, M., & Ripama, T., 2009), indicate whatever the census, the young populations (0-14 years) are strongly represented, in contrast to of high age (65 years or older) who are much less represented. Also, to young people ages, there are more men than women; but between 15-64 years old, the trend was reversed and at age 65 and above. Consequently, "In terms of age structure, the population of Burkina Faso is characterized by its youth: more than 30% of the population is under 10, while those under 15 accounts for 46.6% of the population, the 15-64 age group represents 50.0% and the population aged 65 and over only 3.4%. The average age is 21.8 years for the entire population.

It is 21.2 years for men and 22.5 years for women" according to (Ouedraogo, M., & Ripama, T., op. cit., p 22).

Specifically, in ILO (2003), the age that is considered from an active farmer for this research is 18 years old or above for sex to be selected. The study designed specially with the survey to involved people at a younger, a middle and the elderly considered to start from 65 and above. Since the research is a climate change related-study, taking into account respondents experience over time and space was found highly relevant. Hence in the situation to address the research question to these respondents properly, the sample considered any farmers aged not less than18 and above. The respondents were weighted in reference to the age ranges discussed above. Finding that the actual cumulative active population working age could fall mainly in the interval [18-64] and few in [65 and +], the following was applied: [18-64] is subdivided into ranges [18-34] considered as young active and [35-64], the middle aged actives.

Based on the experience in farming and the labor force, the three age intervals were weighted as following; i) 40% of the sample to be young active workers, ii) 35% of the sample to be the middle aged active and iii) 25 % for the elderly active in the household farm activities or not, (but still involved the household life at some extent).

More specifically as the study uses convenience and purposive sampling techniques, a threshold of 120 individuals was set to be the sample size to be covered in the villages at both sides (in the Commune of Ouahigouya and that of Ouahigouya). The total sample for the survey in the research is 240 divided into sub sample A, (120 in Ouahigouya) and sub sample B, (120 in Dano).

In relation to the size of the research respective four villages, a quota was set and the non WASCAL APTE21 project intervention villages which are Bissigaye (in Ouahigouya) and Bolembar (in Dano) were the big size villages according to their respective demographics. Then 2/3 of the sub sample size ($N_A = N_B = 120*2/3 = 80$) at each side. The research also balanced the number of respondents and each Sub Sample (A & B) was built of 50% of Males and Females.

In the key informants' interviews, the interviewees were chosen based on age, their climate adaptation socio professional related experiences, and sex. Then 6 farmers were interviewed in each of the 4 villages making a total of 24 key informant interviews. Key informant interviews were conducted with professionals considered as a resource person by their respective working place and they were selected at the commune level mainly in the capital town of each commune. This list was completed by few officers that were interviewed from their office in Ouagadougou, mainly. To start with the project data collection, a one day workshop of averagely was conducted in each of the villages.

Workshops participants' threshold was set to not exceed 20, but there was at each village some slight variation and finally, the participants were in 24 in Bissigaye, 19 in Bembela, 21 in Tambiri and 23 in Bolembar. The same criteria in choosing the survey sample individuals were applied. In addition, a geographical representativeness was observed accordingly to the related each village's population spatial distribution or settlement.

3.4. Data collection process and instruments used

The data collection started by one day and three hours lasting workshop conducted in each of the villages. A focus group discussion animation guide was used to lead the exchanges.

Each workshop was conducted following content discussion on five major topics which are on the guide in the Annex. Two methods were used both participatory and participants were subdivided in to two small group of discussion or all together in responding to the items of the guide contents. The workshop group was mixed and kept so even in small group discussion. A paper was provided (Papier craft or flip charts) on which participants were recording their common responses to the questions asked under each section. A secretary was consensually chosen by each group to write and report on the mini restitution at the end of each section.

Workshop 1 participants /Bissigaye

Source: Author snaps on the field, 2017

Workshop 1: Mini restitution of discussion

Source: Author snaps on the field, 2017

At the end of the workshop, a refreshment was provided to all participants and a perdiems of participation for transportation. The sessions were also recorded on Dictaphone and pictures were snapped during all the activities.

Workshop 3: Participants/ Tambiri

Source: Author snaps on the field, 2017

Workshop 3: Small group Discussion

Source: Author snaps on the field, 2017

In Ouahigouya with the support of four field assistants, the two workshops were co-facilitated (specially the small discussion) and the same team helped in questionnaires administration for the survey. In Dano, the same process was observed with the support of three field assistants.

The key informant interviews were conducted with the assistance of a translator (especially with all the female farmers and few aged men who did not share a local speaking language with the author, the main interviewer.) The summary is following in tables below. Each table comprises sections on the work load completed in the workshop, survey, and key informant interviews. Step one was in Ouahigouya and took 23 days to cover the work load in Bissigaye and Bembela.

Step A1: The work load completed in Bissigaye (NWPIV[7]$_1$)

Entrance signal board to the Village of Bissigaye (commonly pronounced Bissiguin)

Source: Author Snaps, 2017

[7] NWPIV stands for Non WASCAL APTE21 Project Intervention village; WPIV stand for WASCAL APTE21 Project intervention Village

Action one: Workshop with four research assistants and 27 participants (8 women)

Small group discussion and activities were conducted in two groups with 4 women at each side.

The four surveyors attended and support in reporting the findings of the participants on the paper sheet averagely of 1 m^2 . Pictures and recording of the restitutions sessions were exclusively done by the author.

Action Two: 80 Surveyed person together with the field assistants as detailed in the table below.

Prior to the survey, a pilot was done by the team to test the practicality of the survey form. Two forms were filled and the responses were not taken into account in the research.

Table 8: Survey questionnaires and Sub sample A_ Specification_Bissigaye

Sample built and amount of questionnaires administered in Ouahigouya/ NWPIV= Bissigaye (n=80/120)						
No	Age of interval of the surveyed person	Male	Female	Amount in % to be sampled in the village & Sub Sample A	Equivalent number in Sub Sample A	Total survey questionnaire covered in Bissigaye
1	[18-34]	16	16	40	32	80 Questionnaires covered
2	[35-64]	14	14	35	28	
3	[65 +]	12	8	25	20	

Action Three: 6 key informant farmers interviewed with the support of a translator in 4 (3 women and the Chief of the village).

Step A2: The work load completed in Bembela ($WPIV_1$)

Entrance signal board to the Village of Bembela (commonly pronounced Bembla)

Source: Author Snaps, 2017

Action one: Workshop with four research assistants and 19 participants (9 women)

Small group discussion and activities were conducted in two groups with 4 women and 5 at each side. The team of four field assistants and surveyors attended and support in reporting the findings of the participants on the paper sheet averagely of 1 m^2 .

Pictures and recording of the restitutions sessions were exclusively done by the author.

Action Two: 40 Surveyed person together with the field assistants as detailed in the table below.

Prior to the survey, a pilot was done by the team to test the practicality of the survey form. Two forms were filled and the responses were not taken into account in the research.

Table 9: Survey questionnaires Sub sample A_ Specification_Bembela

Sample built and amount of questionnaire administered in WPIV / Ouahigouya = Bembela (n=40/120)						
No	Age of interval of the surveyed person	Male	Female	Amount in % to be sampled in the village & Sub Sample B	Equivalent number in Sub Sample B	Total survey questionnaire covered in Bembela
1	[18-34]	8	8	40	16	40 Questionnaires covered
2	[35-64]	7	7	35	14	
3	[65 +]	5	5	25	10	

Action Three: 6 key informant farmers interviewed with the support of a translator in 4 (3 women and the Chief of the village).

Action Four: This was completed only at the commune level because the two villages share the same appointed extension services agents as well as the professionals that were interviewed. In addition, 6 professionals (from the regional directorate of Agriculture, the regional directorate of environment, the focal point of the WASCAL APTE21 project, a local radio officer, both from FNGN).

Step B1: The work load completed in Tambiri ($WPIV_2$)

Workshop conducted out door because of heat and lack of light in the classrooms of this school (Venue of the meeting).

Source: Author Snaps, 2017

Action one: Workshop with four research assistants and 19 participants (9 women)

Small group discussion and activities were conducted in two groups with 4 women and 5 at each side.

The team of four field assistants and surveyors attended and support in reporting the findings of the participants on the paper sheet averagely of 1 m^2. Pictures and recording of the restitutions sessions were exclusively done by the author.

Action Two: 40 Surveyed person together with the two field assistants as detailed in the table below.

Prior to the survey, a pilot was done by the team to test the practicality of the survey form. Two forms were filled and the responses were not taken into account in the research.

Table 10: Survey questionnaires Sub sample Specification_Tambiri

Sample built and amount of questionnaire administered in WPIV/ Dano = Tambiri (n=40/120)						
No	Age of interval of the surveyed person	Male	Female	Amount in % to be sampled in the village & Sub Sample A	Equivalent number in Sub Sample A	Total survey questionnaire covered in Tambiri
1	[18-34]	8	8	40	16	40 Questionnaires covered
2	[35-64]	7	7	35	14	
3	[65 +]	5	5	25	10	

Action Three: 6 key informant farmers interviewed with the support of a translator in 4 (3 women and the Chief of the village).

Action Four: This was completed only at the commune level because the two villages share the same appointed extension services agents as well as the professionals that were interviewed. In addition, 6 professionals (from the regional directorate of Agriculture, the regional directorate of environment, the focal point of the WASCAL APTE21 project, a local radio officer.)

Step B2: The work load completed in Bolembar ($NWPIV_2$)

A church located at Bolembar Centre

Source: Author Snaps, 2017

Action one: Workshop with four research assistants and 24 participants (10 women)

Small group discussion and activities were conducted in two groups with 5 women at each side.

The four surveyors attended and support in reporting the findings of the participants on the paper sheet averagely of 1 m^2. Pictures and recording of the restitutions sessions were exclusively done by the author.

Action Two: 80 Surveyed person together with the field assistants as detailed in the table below.

Prior to the survey, a pilot was done by the team to test the practicality of the survey form. Two forms were filled and the responses were not taken into account in the research.

Table 11 : Survey questionnaires Sub sample B_ Specification_Bolembar

Sample built and amount of questionnaires administered in Dano / NWPIV= Bolembar (n=80/120)						
No	Age of interval of the surveyed person	Male	Female	Amount in % to be sampled in the village & Sub Sample B	Equivalent number in number Sub Sample B	Total survey questionnaire covered in Bolembar
1	[18-34]	16	16	40	32	80 Questionnaires covered
2	[35-64]	14	14	35	28	
3	[65 +]	12	8	25	20	

Action Three: Together with the local head of the community based development organization (President du CVD), the village's living areas and boundaries were identified. The above sampled individuals were contacted and surveyed based on a geographical and random selection and instruction was given to surveyors to strictly respect this principle for all the above age intervals in involving the surveyed individuals. The progress on the field was done on a daily basis and agenda, which indicates the areas and the number to cover by each surveyor.

Action Three: 6 key informant farmers interviewed with the support of a translator in 4 (3 women and the Chief of the village).

Action Four: This was completed only at the commune level because the two villages share the same appointed extension services agents as well as the professionals that were interviewed. In addition, 6 professionals (from the regional directorate of Agriculture, the regional directorate of environment, the focal point of the WASCAL APTE21 project, a local radio officer.

At the national level, out of 12 targeted peoples to be interviewed, only two have been available for key informant interviews. Consequently, the lack of these national level actors' elements of responses was compensated by an effort in collecting secondary data from various sources where it has been possible.

Table 12: The total number of key informants' interviews conducted (Village, commune and national level).

No	Key informants interviews conducted from village to National level							
	Identification		Interviewee status / sex	Farmers		Professionals		Total
1	Entities	Entities names		Male	Female	Male	Female	
2	Villages	Bissigaye	Non applicable	4	2	0	0	6
		Bembela		3	3	0	0	6
		Bolembar		4	2	0	0	6
		Tambiri		3	3	0	0	6
3	Communes	Ouahigouya		0	0	6	0	6
		Dano		0	0	6	0	6
4	National	Ouagadougou		0	0	2	0	2
5	Total			14	10	14	0	38

- The individuals' practical selection and involvement in research for the survey

Together with the local head of the community based development organization (President du CVD) in each of the selected villages, the village's living areas, and boundaries were identified.

The above sampled individuals were contacted and surveyed based on a geographical and random selection and instruction was given to surveyors to strictly respect this principle for all the above age intervals in involving the surveyed individuals. The progress on the field was done on a daily basis and agenda, which indicates the areas and the number to cover by each surveyor.

- The key informant's interviewees were chosen based on author's appreciation considering

Sex, age, experience, and professional background.

- Codification

The overall information is codified to enhance a proper anonymous data manipulation for both kinds of information collected for two distinct purposes. (Statistical and content analyses). For that reason, the questionnaire mainly contains the statistical information and values were given to all the numeral variables. Any response by "yes" was coded "1" and "no", "0". In the rating system of farmers' preferences and choices, the research refers to (Vagias, W M, 2006; Subedi, B. P., 2016) on their work on Likert measurements scales. Five level of measurement is adopted on way of "level of quality", "level of satisfaction", and "level of priority" and adapted in this research. In the same way, another rating system of five level was adopted to measure the frequency of climate related-events (drought, floods, High temperature, wind storms, rains and length of growing period) occurrence and manifestation in the farmer's respective communities. The education level was coded on a scale of six points. 1 for "primary level"; 2 for "secondary level", 3 for "academic level", 4, for Arabic. 5 was coding "Alphabetization[8]" and 6 "None" "These details are on the survey form copied in the annex (questionnaire).

[8] Alphabetization is the ability read and write in a language. In the context of Burkina faso it is done in locale languages.

The socio demographic variables mainly took into consideration in the research are; *"sex", "age", "being a farmer"*, *"level of education", "experience in agriculture"* at the village level. At the commune and national level, the variables into account are the "*professional background"* related to agriculture and climate change and adaptation (researcher or extension agent), *"communication", "network and interaction with farmers".*

Each of the 38 key interviews was coded for identification purposes and these codes will be used as an anonymous reference to quote some of the content of the discussion section under Chapter four.

3.5. Data analysis procedure

In the study, two type of data analysis (quantitative and qualitative) are used in this research. The quantitative data are all the information gathered from the numeral variables (observations) in the overall sample (240) and the values from the meteorological and statistical information gained from the secondary data. The quantitative data are all the information gathered from the nominal variables (observations) in the overall sample (240), the content of Workshops (A Focus group Discussion conducted in a total of 4), Key Informant interviews and the literature got the secondary data.

Quantitative data analysis is done mainly by statistical instruments Excel 2013, IBM SPSS version 18 in a complementary way. Excel helped in organizing quantitative data in tabulation form and the primary statistical analyses (frequencies calculation and also Graphs, curves and charts edition). IBM SPSS 18 test of significance analysis. Respectively IBM SPSS helped in descriptive statistics and the results used in Excel 2013 for trend analysis and to generate graphs, curves, and Charts.

Qualitative data analysis is done through content analysis according to Mayring, P. (2014) who suggested a research question as the “standpoint” of content analysis in research and to link research question to theory. Therefore the study refers to this description of if according to Hussein, A. (2015, p.2) defined triangulation as “the use of multiple methods mainly qualitative and quantitative methods in studying the same phenomenon for the purpose of increasing study credibility”. Consequently, the research will link the explanations of the relation analysis in objective one to the sociological interaction of functionalist perspective to measure the inter relationship between Scientific and local climate information. The same theoretical perspective will serve to also examine farmers especially women access to climate information and conclude on some potential climate related adaptation capabilities barriers in relation to their educational basis. The sociological symbolic interaction theoretical perspective supports the network and interaction analysis at both macro and micro sociology levels (Mooney, Knox, and Schacht, 2007) and helps to formulate some recommendations. In the perspective to analyze communication and its related interaction, the research adopts the effective communication conceptual framework on which, the analysis is built. The details follow in Chapter four on results and discussion.

CHAPTER FOUR

This chapter covers the results of the research and their discussion. It is organized in three section accordingly to the objectives. As the research combined three data collection instruments (Focus group discussion in Workshops, surveys using questionnaires and key informant interviews) the data are presented under each objective and discussed accordingly. In all three instruments, the research covered six major thematic and the related key aspects of interest in the table below.

Table13: Thematic of interest of the research

Generalities (Identification)	Environmental knowledge	Communication	Adaptation	Interaction	Network analysis
-Socio economic information -Demographic information	-Changes in the environment -Impacts of CC	-Source of information -Rating information sources -Rating type of information used -Evaluation of effective communication	-Measures communicated and used -Rating of the efficiency of the measures used	-Stakeholders Mapping -Rating scientist/ Farmers collaboration	-Rating the sense of connection of Climate Information's Stakeholders Network -Weighting the degree of exchange in the Climate Information's Stakeholders Network

Finally, on a comparative perspective, the research adopts three steps or level of comparison as stated early on in Chapter one, in the introduction. These levels are i) Village's Region, ii) Village's WASCAL APTE21 membership or not, and iii) Village size (big size versus small size).

The results are presented and discuss per objective with statistical (mainly applicable to the survey data) and content analysis information.

The steps of this chapters are labelled as follows:

- 4.1. Results and discussion under objective one;
- 4.2. Results and discussion under objective two
- 4.3. Results and discussion under objective three.

Each step comprises of two sections (A and B) respectively containing information of the comparison of the results and discussion of the results in bullet points. Each Section will show the similarities and the contrasts. All three data collection instruments: contents of workshops using focus group discussion guide, survey questionnaires with some statistical information and narratives from key informant interviews are considered.

4.1. Results and discussion under objective one

Objective one *is to investigate the relation of scientific and local knowledge in climate information and communication on rainfall, droughts, wind storms, floods and temperature to farmers in southern and northern Burkina Faso*

Only level one of comparison can stand objective one in the presentation of the results. To check the relationship or not between scientific and local climate information, the approach focuses on the two regions because they share respectively the same climatic conditions with the selected villages.

4.1.1. Section A: Similarities and differences in the results

This section is divided in a) the similarities in the results and b) differences in the results.

The following are the results of the two study areas when considered and compared at region level in terms of scientific and local climate information communication on rainfall, droughts, winds and floods and temperature.

To start, in all four villages, farmers reported the changes they have noticed in their respective surrounding environment. These changes are categorized into physical changes and changes in climate conditions. Over the considered time scale of the past 30 years, the physical changes can be summarized into land degradation, reduction of the flora and the fauna, and change in land use and land coverage.

- Similarities in the results from the two areas

Birds according to some features used as indicators in local climate knowledge or information. More similarities are observed in farmers' responses on their reliance on observations of facts in the environment as a source of climate information.

The change in climate conditions essentially mentioned both sides of the study area are: i) reduction of rainfall, weather becoming hotter and drier, a lot of wind blowing nowadays compared to the considered time scale of this study (the past 30 years). In Region du Nord (Region of North) as in the region du Sud-Ouest (South West region), to interpret the onset, the ending time of the rainy season, farmers reported watching the movement of Birds. Birds are found to be strong indicators of climate because of predicts of time in local climate knowledge. Their North to South movement announces the beginning of the rainy season and its end when they flow back South to North. The end of the North to South movement corresponds with the end of the sowing time of groundnuts. Similarly, a key informant interviewee, an agriculture professional confirmed that. "My father used to refer to the movement of cloud in the rainy season. When they move north –

south, it means the onset of the rainy season." In the same way, farmers observe the presence of bird nests in swampy areas.

When the nests are set lower and closer to the water level, it means that this particular year, rains will be not abundant. The opposite case predicts an abundant rainy season in rains when birds' nests are set high above the water level.

In addition, and similarly to Bagagnan (2015), farmers reported to rely on trees and they observe related events on them like flowering, fruiting, leafing times to predict, understand and decide of a particular action with regards to their farming activities.

The following Tables shows farmers reliance respectively on trees and

Table 14: Birds as local climate indicators

Birds as climate indicators and source of information		
Birds	Indicators	Meaning or Comment from farmers
Songs	Rainy season	Back to farm
Movement	North - South	Onset of the Rainy season
	South - North	End of the Rainy season
Nests position in swampy areas	Low	Deficit of rain
	High	Abundant Rains

Table 15: Trees as local climate indicators

Trees as climate indicators and source of information								
No	Trees: Name in French	Trees: Equivalent Name in English	Trees: Scientific Name	Features	Signs / Indicators	Information	Temporal correspondance and meaning	Comments
1	Baobab	Baobab	*Andosonia digitata*	leaves	Flowering and leafing	Beginning of the raining season	End of the dry season	At the end of the dry season or just before the first rains, often before the first leaves appear according to Bonnet P., Arbonnier M., Grard P (2005).
				Fruits	Haversting	Dry season	During the dry season	Harvesting occure exclusively in dry season from January to March in the year (Workshops)
2	Karite	Shea Butter Tree	*Vitellaria paradoxa or Butyrospermum parkii*	Fruits	Availability	Sowing, plowing,wedding period	one to two month in rainy season	"The fresh walnuts collected only during the rainy season, dried up and process into shea butter later", Source interview.
3	Nere	African locust bean tree	*Parkia biglobosa*	Flowering and Fruits	Time of Occurrence and time of presence	Ending month of dry season	Finished before the sowing period	Flowering and fruiting: In the second part of the dry season, generally more or less before leafing according to Bonnet P., Arbonnier M., Grard P (2005). Lamien et al (2011, p. 4) said the fruits are available from January to Mai and the flowering starts in April (which corresponds to the end of the dry season)
4	Raisinier	#	*Lannea microcarpa*	Leaves and fruits	Presence	Beginning of the raining season	Annouces the rainy season	Appear and are available the end of the dry season according to ccording to Bonnet P., Arbonnier M., Grard P (2005).
5	Tamarinier	Tamarind	Tamarindus indica	Flowers and Fruits	Time of presence	Flowering occurs at end of dry season	End of the dry season	Flowering occurs late in the dry season, after leafing according to Bonnet P., Arbonnier M., Grard P (2005).
						Fruits available at the end of rainy season	End of the rainy season	"we harvest the fruits when we are also harvesting the cereals like sorhum, millet" interview Flowering rather late in the dry season, after leafing according to Bonnet P., Arbonnier M., Grard P (2005).
6	#	Winter thorn, apple-ring acacia	Faidherbia albida	Leaves	Presence & absence	Dry Season & rainy season	Reference to know actual the season	"Leafless during the rainy season and leafy during the dry season" (Interviews)

Farmers reported from both sides of the research areas to miss some indicators which could help them measure or perceive the occurrence of windstorms, temperature from their local knowledge. Winds storms and temperature seem to be noticed at the time they are occurring even if a farmer report that "a lot of heat from sunshine in the dry season is an indicator that rain is not far away to come" which can be in relation with high temperature.

The scientific climate information farmers reported to receive are from many sources according to the contents of all three data collection instruments used. The type of scientific information can be mainly classified to two, weather forecasts and agro metrological information (advice and practical information or knowledge). The agro metrological information as one of the main source of farmers' adaptation capabilities will be more developed in objective two. The table below summarizes the weather/climate information farmers from the two study areas reported to be disseminated to them from scientific sources.

Table 16: Scientific climate information communicated to farmers

Scientific climate information communicated to farmers								
	Weather Forecasts				Early warning or alert			
Event / risks	Time	Extent	Frequency	Source & access	Time	Extent	Frequency	Source & access
Rain	covering the rainy season	Estimated amount in mm	Weekly	Meteo via Media (TV, Radio)	#	#	#	#
Temperature	Daily	min and max	Daily	Meteo via Media (TV, Radio)	#	#	#	#
Winds	#	#	#	#	When the risk is there, very critical and important	When the risk is there, very critical and important	according to the prevision	Meteo via Media (TV, Radio)
Droughts	not precised	length	not precised	Agriculture extension workers/ Media (radio)	#	#	#	#
Floods	#	#	#	#	When the risk is there, very critical and important	When the risk is there, very critical and important	according to the prevision	Meteo via Media (TV, Radio)

Farmers reported in the focus group that winds and temperature are the less communicated climate event. However, it came out from the information they provided from workshop information that agro climatic information related specifically to the "onset of the rainy season", ideal time of a particular activity to be conducted accordingly to the farming seasonal calendar (sowing, fertilization, weeding) are found concordant with their observation. For instance, in reference to the onset of the rainy season, it is often announced between (mid-April to June) and that coincides with the availability of some fruits local indicators of the upcoming or onset of the rainy season.

The following pictures explained the concordance of scientists' previsions at the local level with regards to the onset and end of the rainy season.

Fruits Lannea microcarpa

Rainy Season indicator

Fruits of Shea butter Tree

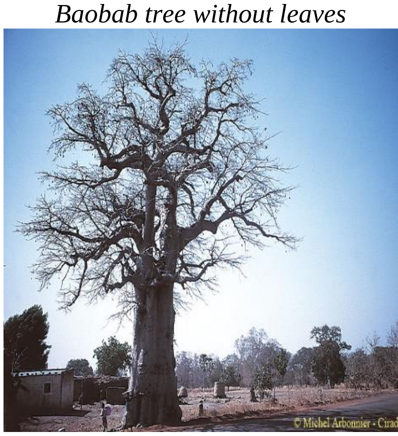
Rainy season indicator

Faidherbia Albida without leaves

Rainy season indicator

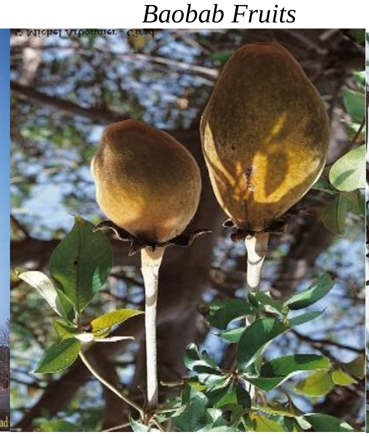
Source: Bonnet et al. 2005

Baobab tree without leaves



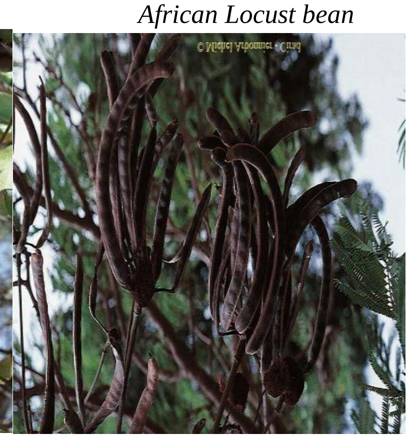
Dry season indicator

Baobab Fruits



Dry season indicator

African Locust bean



Dry season indicator

Source: Bonnet et al. 2005

Statistical information from the questionnaire contents also supports the concordance or relation between scientific and local climate information.

The variables were: *Scientific and local climate information says the same thing* labelled as "Link_S+L_Ci"; *I use together Local and scientific climate information* labelled as " Usage_S+L_Ci", and *Combining local and scientific climate information is relevant to face communicate climate information* labelled as "Relevance_S+L_Ci". The following table gives the statistics.

Table 17: Farmers weighting the link, usage, and relevance of the combination of scientific and local Climate information

	Link_S+L_Ci	Usage_S+L_Ci	Relevance_ S+L_Ci
Idk	60	25	110
yes	176	162	71
NO	4	53	59
Total	240	240	240

As shown in this table, the modality of response in the row labelled "yes" carries the higher weight.

- Differences in results between the two areas

The differences between the two regions can be perceived in farmers' respective traditional beliefs as a source of climate information and interpretation of climate events. These beliefs are related to spiritual, socio cultural context of each of this milieu. The North is Islamized and farmers reported the lack of rain depends on God and they ask it from him when it is in shortage via prayers in the mosque. The south West is predominantly Christianized with a greater portion of farmers relying on traditions and cultural practices.

The extent of each climate event considered in this study differs from the North to the South west because, for instance, winds are reported to blow more in region du Nord than in region du Sud- Ouest. Scientific and local climate information differs in terms of the nature and the time coverage of forecasts which can detail on daily basis from the scientific side and seasonally or occasionally observed by farmers.

Scientific and traditional climate information specifically in terms of forecast differs from a point of view of their related and relative accuracy. Some farmers said to rely more on what the "the traditional chief in charge of mores and rain" predicts as an upcoming rain event than the forecast got from the radio source. They relate this to the unrealized and forecasted or announced climate events in their area.

4.1.2. Section B: Discussion of the results

The similarities and differences are also supported by the statistical trend analysis done from the survey data.

- Discussion of the similarities

In reality, from the environmental features used as a source of climate information, the relationship is easy to be drawn because the time scale is not specified and it is on a season basis. Burkina Faso climate regime is made of two seasons (the dry and the rainy seasons) and varies in term of length and intensity from South to North. When for instance Baobab fruit indicates the dry season, their availability starts from January to February and this time matches with no rain in Burkina Faso from south to North. In the same way, the fruits of Lannea Microcarpa, shea butter trees are available in the rainy season and this is confirmed by Guinko, S., & Pasgo, L. J. (1992, p.2-3).

The fruits maturation, availability or harvesting time is concordant with some climate information communication to Farmers. “The [Farmers referring to scientists] use to tell us when the rain will start. This time is around mid - April to mid-May, and sometimes it found we are digging Zai pits or preparing for the rain to come” When this interviewee was asked what are the corresponding local observations, the responses was: “At this time we have the last fruits of néré [Parkia biglobosa], it is too hot, and the sky in the sky the clouds are dark, then we now the rain is not far away to come” the work of Lamien et al (2011, p.4) on that specie agrees with that: “ The fruits are produced from January to May.” From the empirical observations used as a source of climate information, a link can be made to the corresponding scientific information provided by scientist to farmers. This implies to partially conclude that theoretically, Farmers’ local source of climate information can be related to some scientific climate information communicated to them.

The research conducted a trend test of the time series data (from the Metrological service) of the respective region on rainfall and temperature. The aim of this test was to compare the results of the trends analysis with the trend of the observed data from the Farmers the survey on the same climate events (rain and temperature). The trend is measured by frequencies (and bar level of Histogram) of the respondent under the scale level “Increase” or “Decrease” according to the nature of the trend at both side and for all the climate parameter to be compared (rain and temperature).

In the test, are considered two statistical hypotheses from which decision can be made according to the relation between the p-value and the value of Alpha. The table below is the summary of the test of rainfall trend test in Ouahigouya from the Metrological data.

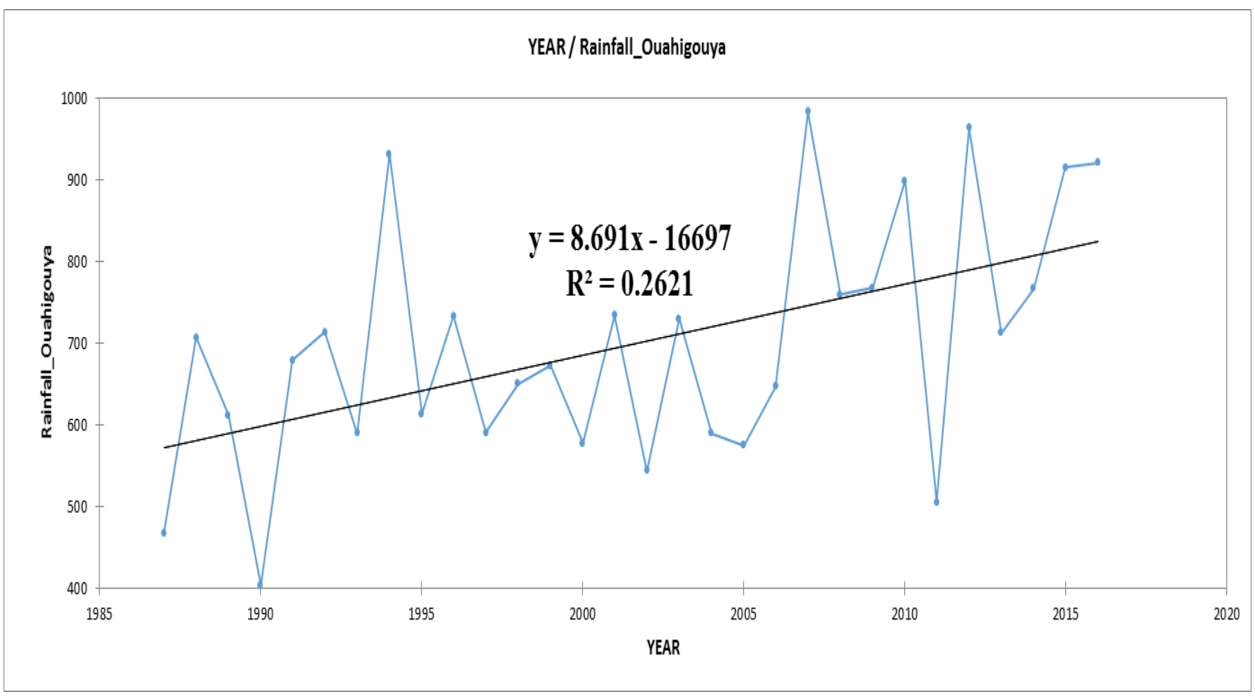
Table18: Summary of the Mann-Kendall trend test in rainfall in Ouahigouya

Mann-Kendall trend test / Two-tailed test (Rainfall_Ouahigouya):	
Kendall's tau	0.3287
S	143.0000
Var(S)	0.0000
p-value (Two-tailed)	0.0105
alpha	0.05

H_0 = null hypothesis and means "there is no trend in the Series".

H_a = alternative hypothesis meaning "there is a trend in the series".

Figure 7: Mann-Kendall trend test graph for rainfall in Ouahigouya

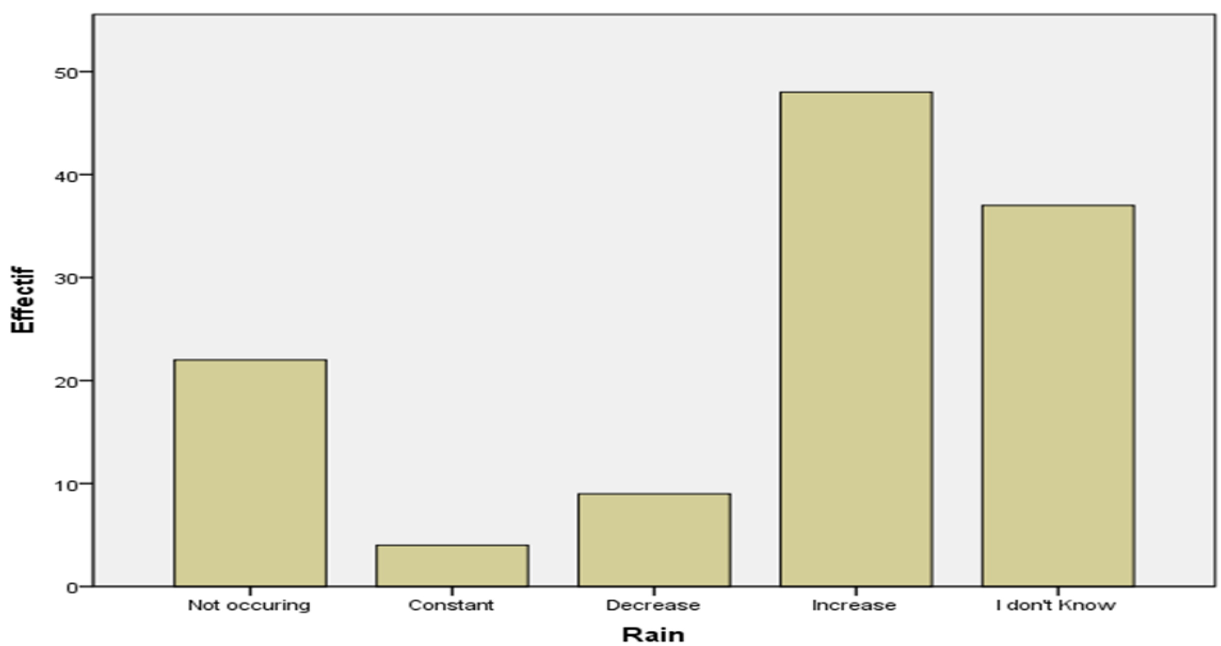


In the graph, the trend line shows a positive or increasing trend which can be explained by the positive value of y= 8.691x-16697 and R^2 = 0.2621 shows the strength of the trend. It can be interpreted as weak because far from 1 or 100% (0.2621=26, 21%). The significance of the test is measure at 95% with the rejection of H_0 because p-value is smaller than alpha (0.0105 < 0.05).

It can be concluded that over the past 30 years, rain increase but with less inter annual variation.

When we look at the histogram computed from SPSS on the observed data from the survey with farmers who were asked to rate rain events occurrences over the past 30 years, the following were the outcomes. The scale was adapted from likert 5 points scale but in the trend comparison, reference is made to point 3 (decrease) and point 4 (increase).

Figure 8: Farmers rating the occurrence of rain, temperature, floods, and droughts in Ouahigouya.



The point four of the scale labelled “Increase” shows the height of the respondents in the surveys who found that the trend of rainfall over the past 30 years was increasing.

A farmer Bissigaye (village of Ouahigouya) supported that in an interview support that because "in the 30 years back we use to have big rains, and in a season we could get up more than 8, now it is hardly possible to get 4" he said.

In the comparison of the Mann-Kendall Trend test and the observed trend of farmers' ratings of rainfall from survey data, there is a concordance between the two trends which can help to conclude there is a link between metrological information and observed data from farmers in Ouahigouya. However, is this condition always fulfilled with all climate parameters or variables? The same process was on both side and some contrasts were found in Dano on both parameters (rain and temperature).

- Discussion of the differences

The same statistical tests and comparison process was observed in Dano on rain and temperature and different results were found.

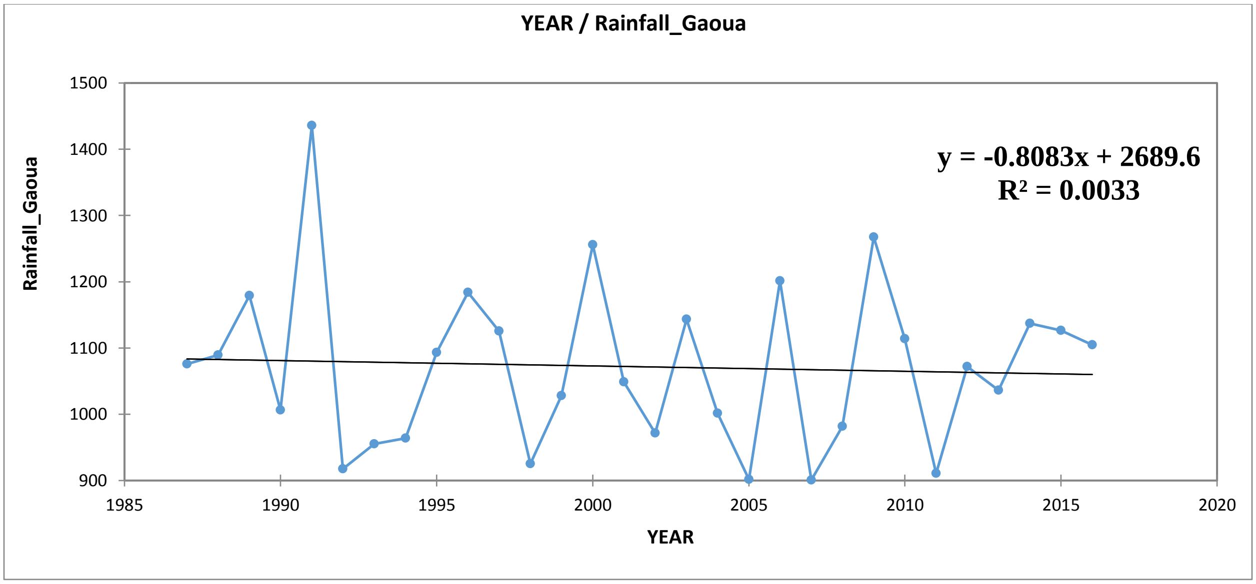
Table 19: Summary of the Mann-Kendall trend test in rainfall in Dano

Mann-Kendall trend test / Two-tailed test (Rainfall_Gaoua):	
Kendall's tau	0.0161
S	7.0000
Var(S)	0.0000
p-value (Two-tailed)	0.9156
alpha	0.05

H_0 = null hypothesis and means "there is no trend in the Series".

H_a = alternative hypothesis meaning "there is a trend in the series

Figure 9: Mann-Kendall trend test graph for rainfall in Dano

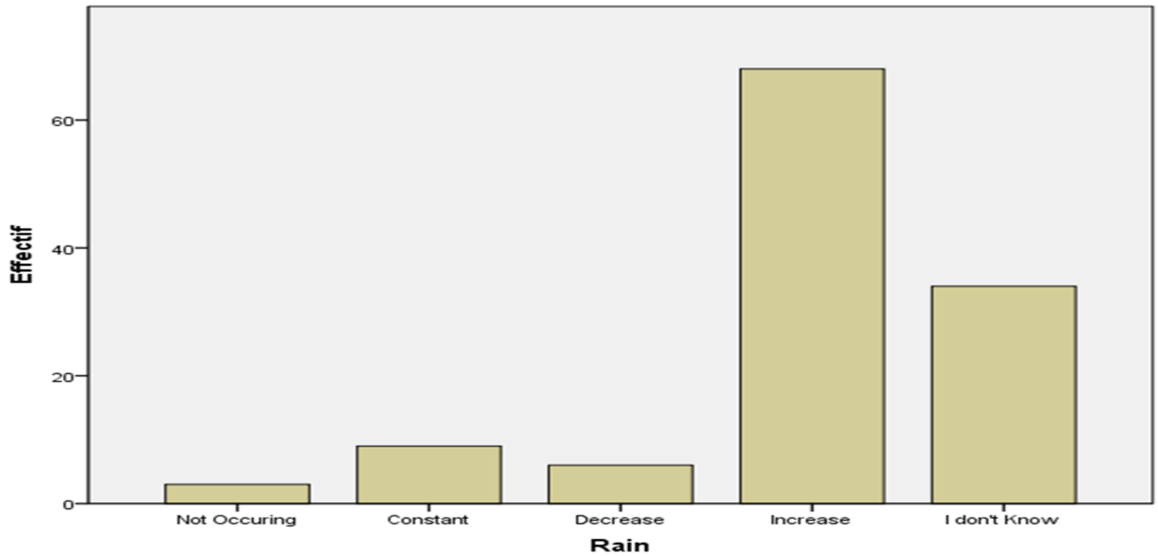


In the graph, the trend line shows a negative or decreasing trend which can be explained by the negative value of y = - 0.8083x+2689.6 and R^2 = 0.0033 shows the strength of the trend. It can be interpreted as weak because far from 1 or 100% (0.0033= 0, 33 %). With the significance of the test is measure at a level of 95%, H_0 is true and cannot be rejected because p-value is greater than alpha (0.9156 > 0.05). Consequently, there is no trend in the series and the risk of rejecting H_0 while it is true is 91, 56%.

It can be concluded that over the past 30 years, rain decrease in Dano sharing the same agro climatic zone Gaoua (from where the data were generated) but with less inter annual variation.

When we look at the histogram computed from SPSS on the observed data from the survey with farmers who were asked to rate rain events occurrences over the past 30 years, the following were the outcomes. The scale was adapted from Likert 5 points scale but in the trend comparison, reference is made to point 3 (decrease) and point 4 (increase).

Figure 10: Farmers rating the occurrence of rain, temperature, floods, and droughts in (Dano) Gaoua.



The point four of the scale labelled "Increase" shows the height of the respondents in the surveys who found that the trend of rainfall over the past 30 years was increasing. However, the trend histogram trend in height which labelled "Increase" is not concordant with the one the Mann-Kendall graph where the trend is negative. The same contrast is found in the comparison between the Mann-Kendall trend test analysis of temperature from time series data from the meteorological service on Dano and the observed data on temperature over the past 30 years from surveyed farmers.

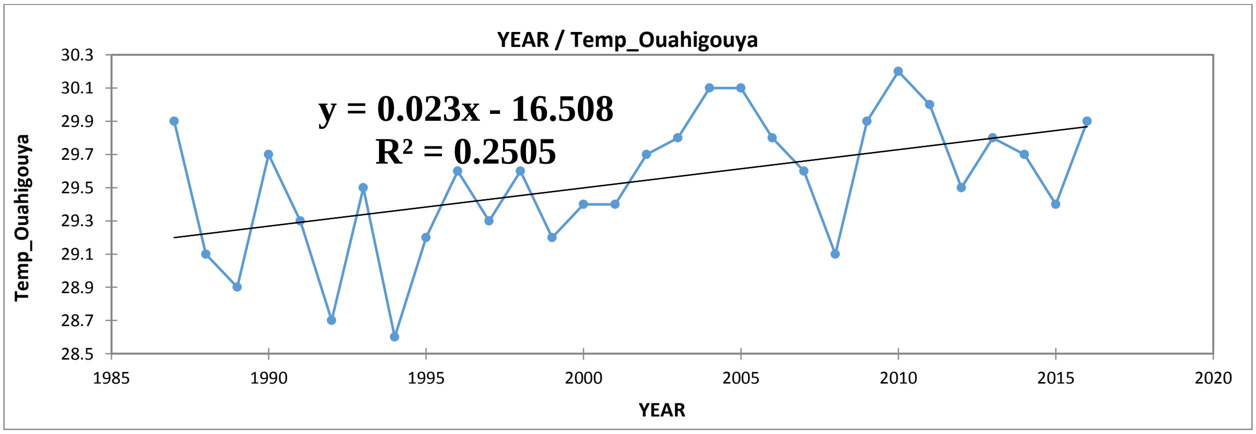
Table 20: Summary of the Mann-Kendall trend test of Temperature in Ouahigouya.

Mann-Kendall trend test / Two-tailed test (Temp_Ouahigouya):	
Kendall's tau	0.3554
S	151.0000
Var(S)	3118.3333
p-value (Two-tailed)	0.0072
alpha	0.05

H_0 = null hypothesis and means "there is no trend in the Series".

H_a = alternative hypothesis meaning "there is a trend in the series"

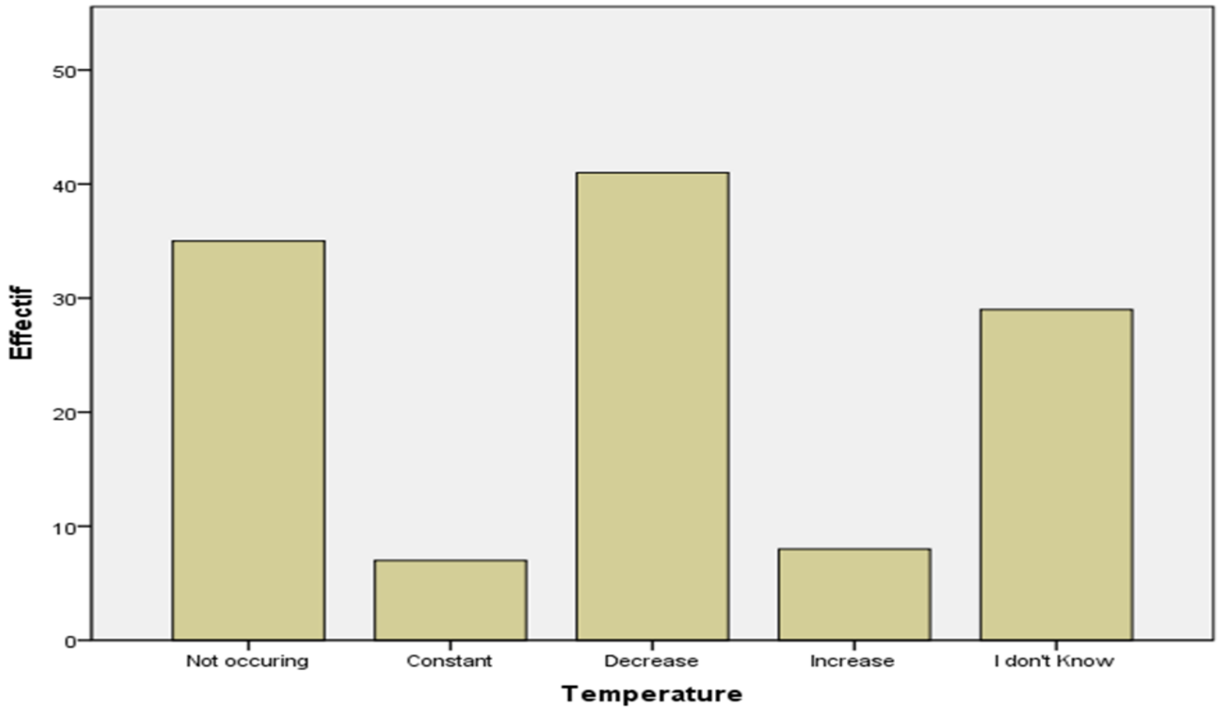
Figure11: Mann-Kendall trend test graph for temperature in Ouahigouya



In the Figure, the trend line shows a positive or increasing trend which can be explained by the positive value of y= 0.23x-16697 and R^2 = 0.2505 shows the strength of the trend. It can be interpreted as weak because both y and R^2 values are far from 1 or 100% (y = 0.23x-16697 and R^2 = 0.2505 = 25, 05%). The significance of the test is measure at 95% with the rejection of H_0 because p-value is smaller than alpha (0.0072 < 0.05). Consequently, there is an increasing trend of temperature in Ouahigouya accordingly over the years.

The histogram computed from SPSS on Temperature the observed data from the survey with farmers who were asked to rate rain events occurrences over the past 30 years in Ouahigouya give the following result. The scale was adapted from Likert 5 points scale but in the trend comparison, reference is made to point 3 (decrease) and point 4 (increase).

Figure 11: Farmers rating the occurrence of rain, **temperature**, floods, and droughts in Ouahigouya



The point three of the scale is Decrease and carries the highest rating of Temperature. Farmers found that there is decreasing trend of temperature in Ouahigouya contrary to results of the metrological data trend analysis. This show a discordance between the two information.

The last test of trend comparison confirmed the discordance between Metrological information and observed data from farmers on the temperature in Dano.

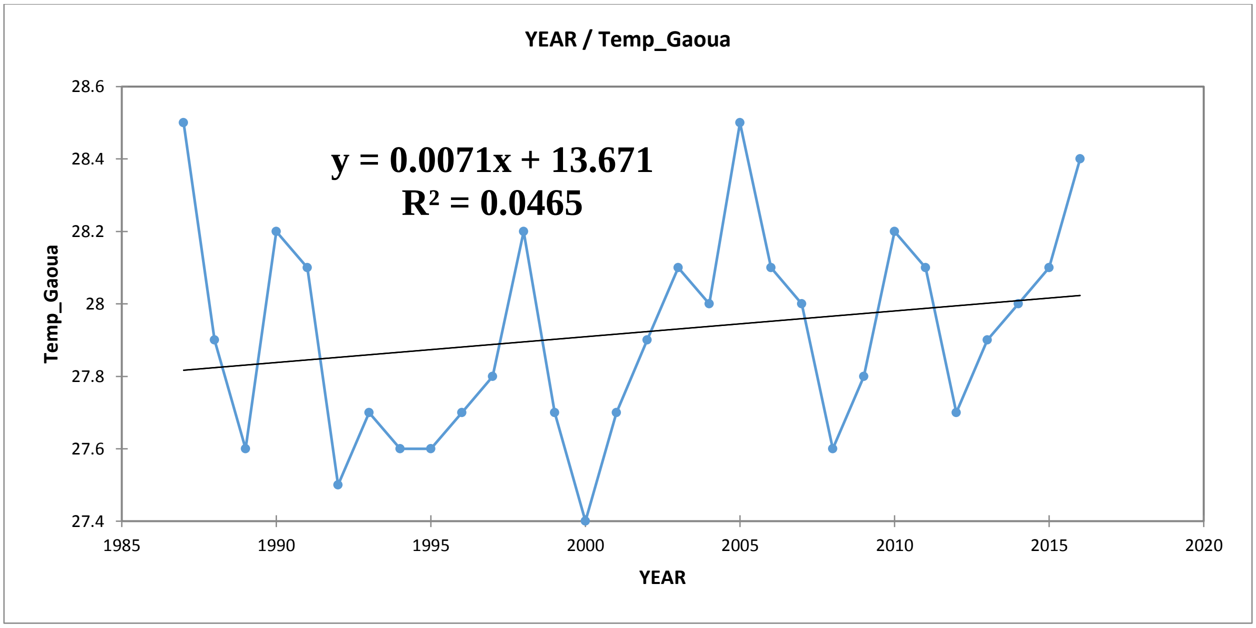
Table 21: Summary of the Mann-Kendall trend test of Temperature in Dano

Mann-Kendall trend test / Two-tailed test (Temp_Gaoua):	
Kendall's tau	0.1971
S	82.0000
Var(S)	3086.6667
p-value (Two-tailed)	0.1449
alpha	0.05

H_0 = null hypothesis and means "there is no trend in the Series".

H_a = alternative hypothesis meaning "there is a trend in the series"

Figure 12: Mann-Kendall trend test graph for temperature in Dano

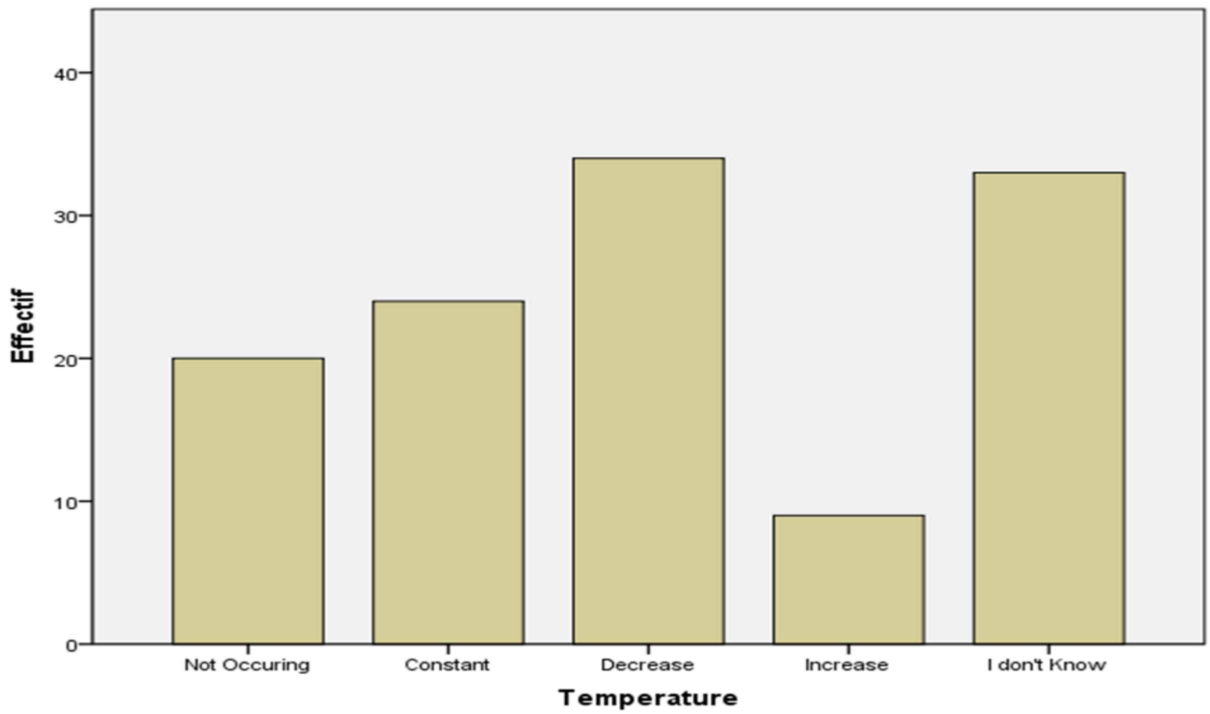


In the figure, the trend line shows a positive or increasing trend which can be explained by the positive value of y= 0.0071x+13.671 and R^2 = 0.0465 shows the strength of the trend. It can be interpreted as a weak trend because both y and R^2 values are far from 1 or 100% (y = 0.23x-16697 and R^2 = 0.2505 = 25, 05%).

The significance of the test is measure at 95% in accepting of H_0 because p-value is greater than alpha (0.1449 > 0.05). Consequently, there is no trend in temperature in Ouahigouya accordingly over the years and the increase shown in the trend line on the graph is not significant.

The computed histogram got the observed data on temperature from the observed data from the survey of farmers who were asked to rate rain events occurrences over the past 30 years in Ouahigouya give the following result. The scale was adapted from Likert 5 points scale but in the trend comparison, reference is made to point 3 (decrease) and point 4 (increase).

Figure 13: Farmers rating the occurrence of rain, temperature, floods, and droughts in Dano



The point three of the scale labelled "Decrease" carries the highest weight.

It means that the majority of farmers asked to rate the occurrence of temperature in Dano found that there is a decreasing trend. But the trend shown from the Mann-Kendall trend test disagrees with that even if this particular test was significantly low.

To summarize, on four trend analysis test, only one confirm the relation between the meteorological information and the observations of farmers. In such situation, it implies to say that the relationship between meteorological information and observed data from farmers' information is weak to not say that it doesn't exist. In reality, to be able to be compared statistically, the two type of information need to be measurable and uniformed on the same scale of measurement which was not the case in these test. Only trend analysis could bring the two type of information on a comparison basis.

In addition, accuracy is also a condition to enhance good and reliable measurement of weather and climate results. In the case of Dano, the metrological data are gain from the station of Gaoua which is far about 115 km on land away from Dano. The meshing of the coverage zone of meteorological stations of weather measurement can also hinder the generation accurate information. With all the probabilistic nature of weather forecasts, there is a need to generate accurate information because it helps end users to make a decision in their socioeconomic activities. This information is confirmed by one of the managing staff of the WASCAL APTE21 Project in Dano. According to him, the closer synoptic meteorological stations to Dano have located in Boromo distant of 68km and Gaoua away from Dano for about 96.5km in air distance. The Distance between Boromo and Gaoua is about 164 km in air distance. It is between this widths Dano is located and the data provided from any of these synoptic stations might be approximated according to him. From farmers side, even if they complained "the metrological information is not reliable, because some time they say it will rain and after we do not see anything" in a one of small group discussion during the workshop in Bembela, there is also a need for them to understand the probabilistic character of scientific forecasts. This could help to adjust the relationship or explain more the disparities between the two types of information.

Therefore, for it to be more usable, efficient, climate information communication which is from both scientists and farmers needs to be effectively communicated. These aspects are developed in objective two.

4.2. Results and discussion under objective two

Objective Two *is to analyze farmers' climate related-adaptation capabilities through climate information communication channels on rainfall, droughts, wind storms, temperature, and floods in southern and northern Burkina Faso.*

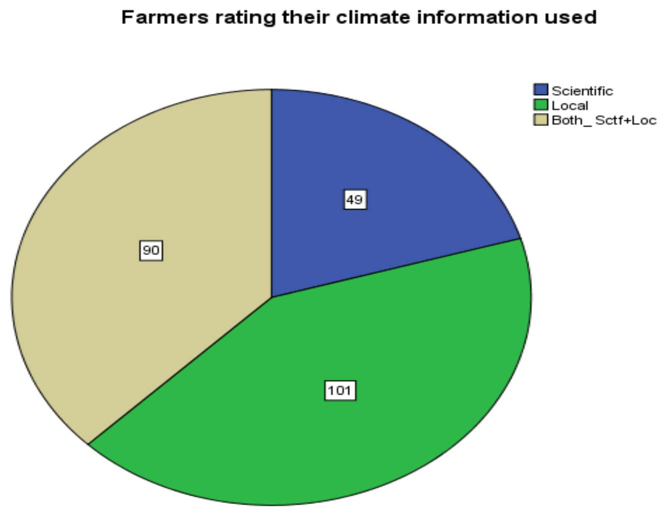
Under this objective, are taken into account the following aspects of the research: communication, interaction, adaptation, education and network analysis.

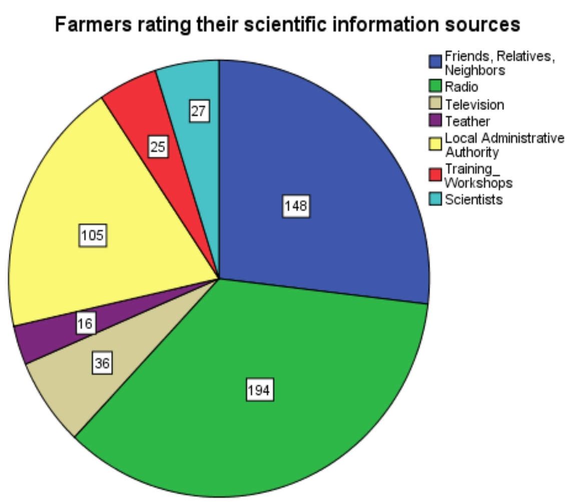
Because as the research deals with farmers' access to climate information that could enhance their adaptive capacity, then taking into consideration all potential channel, actors that could be a source of climate information to farmers is relevant. The comparison will be at three levels which are the region, village size, and WASCAL APTE21 membership.

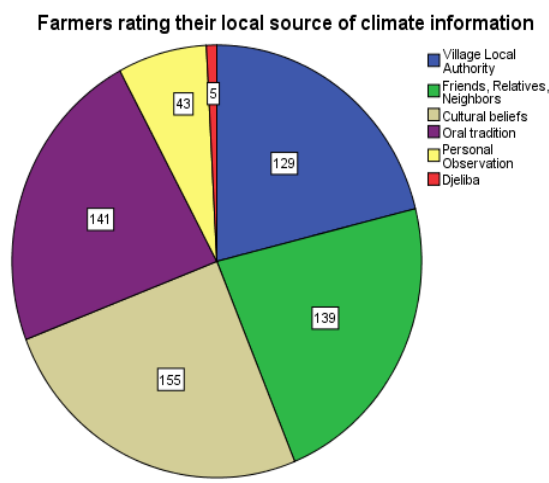
4.2.1. Section A: Similarities and differences of the results

At the regional level, the research found on communication perspective that both local and scientific climate information is communicated to farmers in Ouahigouya and Dano as discussed a little in objective one. The sources of information are almost the same when the two regions are compared but with some slight differences at villages level that will be discussed in following lines. With regards to the communication of the climate parameters or events taken into account in this research (rain, temperature, windstorms, droughts, and floods), rain comes as the most important climate event communicated at both side both from local and scientific source and radio comes as the major source of climate information.

The following diagrams show farmers rating of the type of climate information used, their respective sources of scientific and local climate information.







As shown with color contrast, farmers rated high their reliance on local climate information because 101 respondents out of the 240 of the combined two areas said they use local climate information.

Out of the same total number, 194 respondents said they receive more scientific climate information form the radio comparatively to what they gain from scientists' visits, workshops or training sessions.

Two communication professionals respectively from Ouahigouya and Dano said the same thing via the interviews: “Our radio [local radio] synchronizes with RTB[9] [Radio Television du Burkina] during its air time dedicated for news and weather forecasts broadcasting.”

In all workshops data, farmers ranked Radio first to be the source from which they get weather information. Specifically, farmers reported they are communicated more weather information during the rainy season and rain, winds are more taken into account.

In term of interaction, farmers explained that at both sides, there is a network of extension service workers specifically from decentralized government agencies which accompany them with agro meteorological information provision and following up. From the list of actors that interact with farmers and from which they receive climate adaptation related – capabilities and information, there is the decentralized service of agriculture, the corresponding service of environment and forestry. They mentioned the local and public decentralized administration authorities (such are the head of the province, Haut Commissaire, the head of administrative department, the Prefect, the Mayor at the head of the commune) through whom administrative information transit before to be disseminated either by themselves or their representatives at the local or village level.

Farmers reported the intervention of some projects the recent example is the interest of the WASCAL APTE 21 Project in the two areas.

At the local level in the respective study areas, farmers commonly reported on their reliance on local actors are information sources.

[9] RTB is Radio Television du Burkina which the main National Radio and Television Service in Burkina Faso. RTB is the merging of RN “ Radio Nationale = National Radio Office” or RB ”Radio Burkina” and TNB “Television Nationale = National Television office of Burkina”

For instance, in case of rain shortage, farmers reported from both side the use of traditional practices to ask for rain, and this is a task of the elderly of the village led by the Chef du village (Chief of the village) and or le Chef de Terre (Chief of land), who are opinion leaders and respected resource person, listened and followed in the respective four villages. To these actors, the local administration representatives who are the President du CVD (the head of the village development committee), his advisors (generally two or more), play the essential role of bridge in term of information flow and dissemination between their communities and the immediate local and hierarchical administrative entity (the commune). These actors serve as climate communicators and alert farmers with any climate information they are asked to convey. With new technologies of information and communication, scientific practices in alerting the population rely on phones, radio, and television.

In the WASCAL APTE 21 Project's Villages, free line phones are distributed to farmers who record essentially rain information (height in mm) after each event and send it to the immediate focal point of the project who communicate this information to the managing team of the project.

4.2.2 Section B: Discussion of the results

The study areas different in terms of the availability and diversity of scientific climate information. The populace of Ouahigouya is exposed to the audience of several local radios than the one in Dano, having only one radio station.

In addition, whilst the WASCAL APTE21 project selected a working village at both sides to disseminate climate information, the Ouahigouya was exposed to a similar climate information dissemination project (Project ACCIC from CILSS) which ended in 2015 and which did not include the area of Dano. The area of Dano itself being part of the WASCAL research Basin in south west Burkina is more exposed to WASCAL research activities than the Northern Burkina.

Ouahigouya is at the same time the capital city of the region du Nord, the +

- Discussion of the similarities

The similarities of results in the above results explained the usual way of being in the communication sector. In fact, scientific climate information is mainly communicated via radio programmes even if the air time is not enough. Weather forecasts from the meteorological service always follow the news sessions on the radio. A journalist at Ouahigouya explained that during the ACCIC Project, the radio he is working in was charged to disseminate the agro meteorological bulletin in the local language to farmers, though, at the same time they broadcast in synchronization what is said on the RTB. This double role was really helping the auditors to be informed on climate.

In terms of local information sources, as discussed in objective one, farmers interpret weather conditions from observation of some features in the environment. This traditional knowledge is conveyed by generation one after the other. The reason is the availability and their proximity to this source in their daily life because “we were born and found that it what our grandparents were using, and it always works for them, and I still believe in them” said a farmer in the Focus group discussion.

The similarities in terms of adaptation measures are the adoption of stones bunds construction, the use of local grass specie as a fence to prevent the farm from wind blowing impacts. The scientific name of that grass is *andropogon gayanus* according to an interviewee from the provincial service of forestry in Dano.

Farmers also reported the use of early maturing cultivar from both sides. Farmers knowing existence and availability of these new cultivars might have been possible through interaction and communication efforts of scientists to make their finding known.

70 days maturing Maize cultivar | stone bunds in Dano | Andropogon gayanus in Ouahigouya

Source: Author snaps.

- Discussion of the differences

The availability of some radios Stations in Ouahigouya, coupled with the availability of a meteorological station could explain farmers' good exposure scientific information than the one at the south in Dano.

In opposite, the WASCAL research basin located in Dano, especially with the regular climate related research activities conducted in that area could also highlight population exposure to climate information (concepts in various research thematic) than Ouahigouya. One project APTE21 project's member in Ouahigouya supported that in these words: "We are in the same project, but I think those in Dano are doing far better than us because climate change research is still new here".

Ouahigouya represents at the same time the capital city of three administrative entities in Burkina Faso. It is the capital town of the Region du Nord, at the same the capital city of the Province du Yatenga and the commune of Ouahigouya.

Looking at the distribution of the decentralized extension workers in the following sequence, regional, provincial, departmental and even communal, Ouahigouya gathers more extension professionals may respectively target the same populace. This could better expose farmers to climate knowledge in the condition of frequent interaction.

In summary, if farmers explained their different access level to climate information, with all the potential factors, features and actors that could be the source, specifically climate information that is scientific and more available on conventional channels of communication such media (audio, visual or both) need to be more accessible to farmers. The media is one component of climate information dissemination network.

The stakeholders providing climate information found on both side of the study area could be considered as part of the same network which good functioning is inherent to interaction. From this interaction are disseminated agro meteorological information which enhances farmers' adaptations capabilities to climate change. From what farmers reported, the adaptation measures differ from the Nord to the South which can be explained by the respective country climatic profile in SP/ CONEDD (2014).

In Ouahigouya the adaptation measures farmers reported to have known through their interaction with scientist are mainly rainwater harvesting and management system. The practices they have reported are the Zai, the half-moon techniques which are proper to the type of milieu of Ouahigouya. The below pictures illustrate how Zai pits and half-moons are built by farmers.

Zai and Half-moon Combined

Zai Pits

Half-Moons

Source: Author Snaps

These are soil and water conservation techniques adopted by Ouahigouya farmers from there interaction and communication with scientists and specifically, agriculture extensions services workers.

In Dano, the farmers reported having adopted adaptation measures such are agroforestry, stone bunds construction, compost or manure preparation. To those salient measures, with the WASCAL APTE21 intervention, a capillary rise vulnerable farmer got skills and information from the Project local managing team. The picture bellow shows the evidence.

The plot used to farm rice

Plot used in mixed cropping of Maize and cowpea

WASCAL APTE21 project intervention pictures in Dano

Source: Barro & Kone, 2017

These pictures explain the story of a farmer whose farm was vulnerable to capillary rise. In 2016, these plots were abandoned because judged to be in a flooding prone land. With the intervention project in 2017, the same plots were identified and the diagnostic revealed capillary rise.

The solution was to drive the water away from these plots. The technology used was to drain excess of water by channels. The results were satisfactory as illustrated by these pictures below after the project technical support.

The Plot used to farm rice

The Plot used in mixed cropping of Maize and cowpea

Source: Barro & Kone, 2017

This is just one of the example of agro metrological information or support that is provided by the WASCAL APTE 21 in Dano.

A former member of the ACCIC Project in Ouahigouya working currently at regional agriculture department explained that one of his roles was to be the bridge between the sources of agro meteorological bulletin received from the Radio. This interaction works between him and the source of the bulletins that he conveyed (after simplifying the contents) to the journalist, passes it on the radio in French and Moore (local language).

The WASCAL APTE21 Project besides engaging Farmers in communicating rain gauges data to the project, convey them agro meteorological information through interaction with farmers.

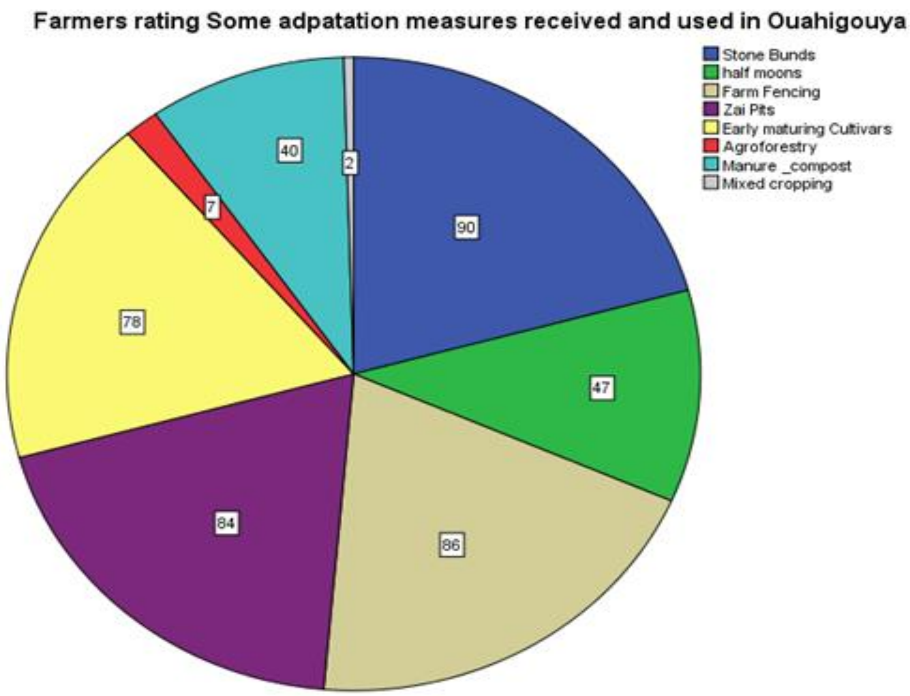
From Barro and Kone (2016), the interaction with farmers in this project led them to discover a problem of capillary rise in a member farmer's field. Advice and support were provided to these farmers, who finally could adapt to the situation.

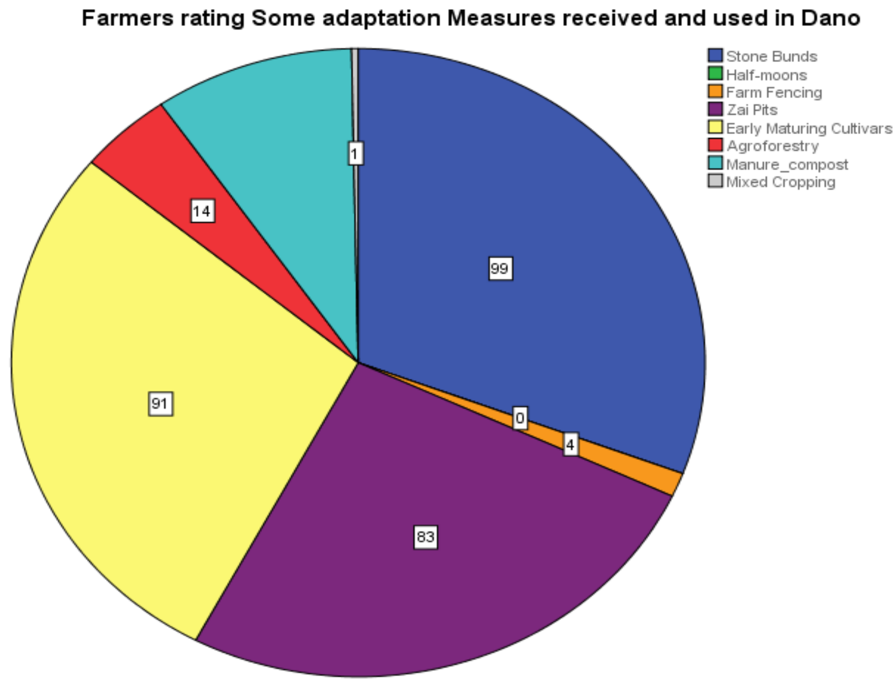
The research found that there is an effort of communication of climate information added to the ones of the Radio Television du Burkina. With the activities of project ACCIC from CILSS-AGRHYMET and the ongoing WASCAL APTE 21 project. The effort is notably noticeable with the agro meteorological and the follow up an activity that engages farmers to stay in a two way communication system. Farmers communicate their challenges to scientist through their interaction with them on the field. During the ACCIC project, the meteorological bulletin was produced and the content explained to end users farmers. Likewise, the APTE 21 Project also makes effort in providing a bulletin (Ag info) which is produced by the technical team of the project in collaboration with the Meteorology Service. Agro meteorological information is provided which is explained by the managing team to farmers to help them take precautions to avoid or minimize any risk, lost or damage in the farming activity.

The research found that all two projects are run by external fund and the lifetime depending on the funds availability. A media professional explained that climate information communication if of a free of charge communication activity. The information is provided free of charge to farmers. Because of that, when the information generation cost is not assured, the information itself cannot be available. Consequently, climate information network itself could be only active when information generation conditions are met.

To enhance more adaptation, it is imaginable that effective communication, the interaction between scientists with their findings and farmers with theirs needs to take place. To start with, objective three discusses first effective communication, the stakeholders that in a network of climate information dissemination provides climate related adaptation capabilities to farmers.

In summary, the graph below shows the finding in farmers' adaptation measures received from their interaction with scientists.





However, it seems that climate information and its related adaptation measures are more accessible to Framers through a face to face interaction. That can be explained by the low level of literacy, especially women in the rural areas who are in large number illiterate. Information messages transmitted via mediums like print media are quite more reserved to an audience who can read and write. Even audio visual programmes contents need to be simplified to the level of understanding of the lay men at the grassroots. It is for this reason that project climate information's and dissemination activities which involved farmers and extension workers in physical and visual interactions are found in the research to add more value into farmers' climate adaptive capacities. (In reference to the mid-term outcomes of the APTE21 project in Dano).

4.3. Results and discussion under objective three

Objective three *is to understand and propose an integrated strategy to effectively communicate climate information on rainfall, droughts, windstorms, and floods to farmers in Burkina Faso*

Under this objective are discussed how to effectively communicate climate information to farmers.

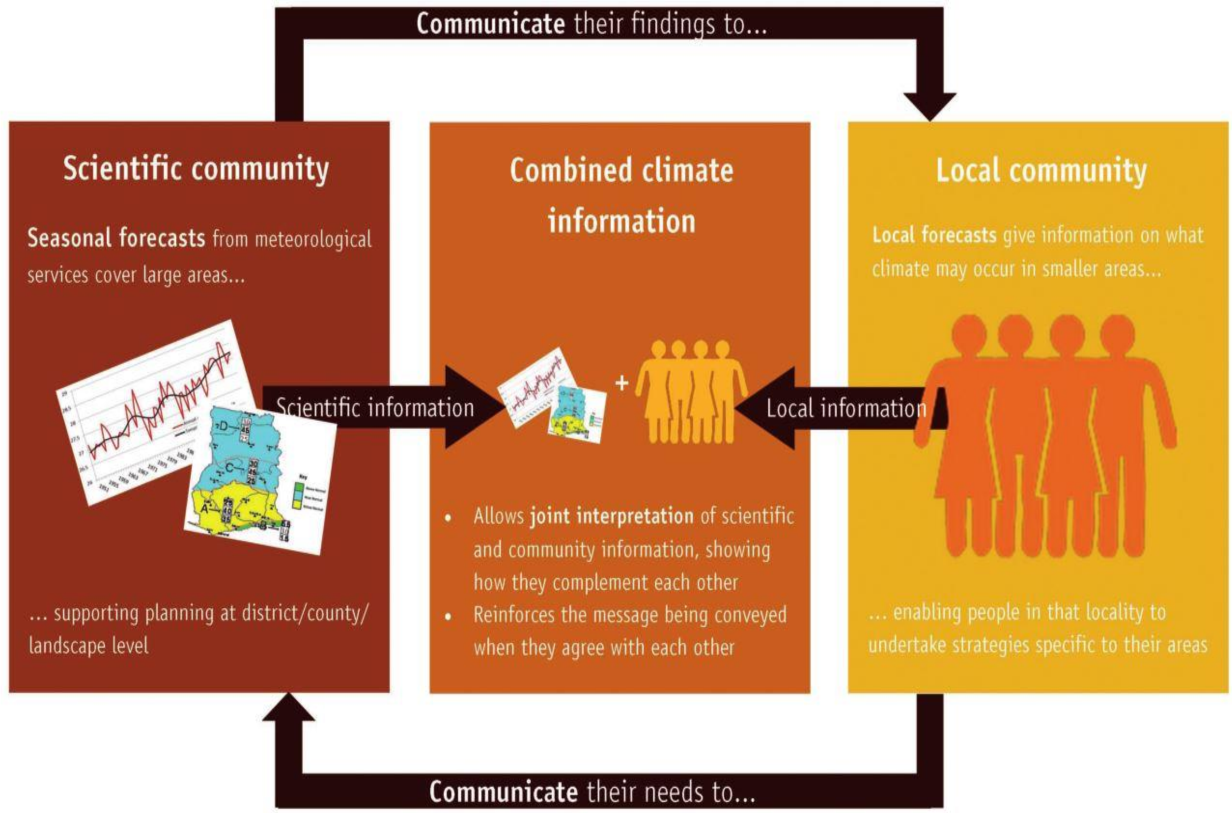
Effective communication, interaction, stakeholder network analysis, and education are the concepts that are developed under this objective. In section A, will be presented both similarities and differences in field work results in effective communication, climate information stakeholders' interaction network analysis. In section B, will be discussed the field results in the similarities and the differences, the relation between gender, education level and climate information access will be discussed.

If climate information is communicated, this is only possible through actors, who become could be seen as members of the same network.

The works of Ambani and Percy (2014) and Lunenburg (2010) exposed the conditions to be fulfilled in effective communication. Effective communication occurs when the targeted message sent to the receiver is understood as meant by the sender. From this perspective, effective communication is inherent to interaction and feedback is an indicator to show if the message (information) communicated is received and understood as aimed by the sender. That is the reason why "communication channels between producers and users need to be accessible, effective, timely and bidirectional" according to Ambani and Percy (2014, p.13).

The figure below is used as a reference to explain and analyze effective communication in climate information communication in this work.

Figure 14: Illustrative graph of two ways interactive communication between scientist and farmers.



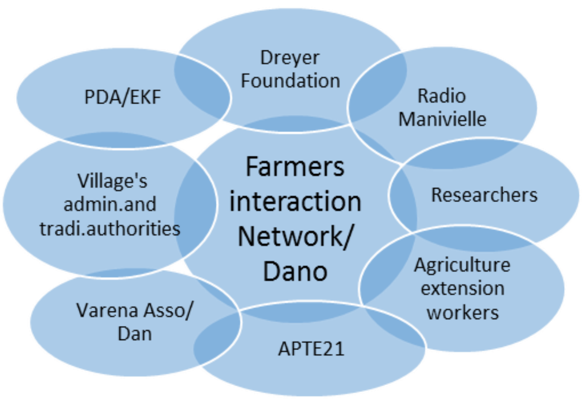
Source: Ambani and Percy, 2014.

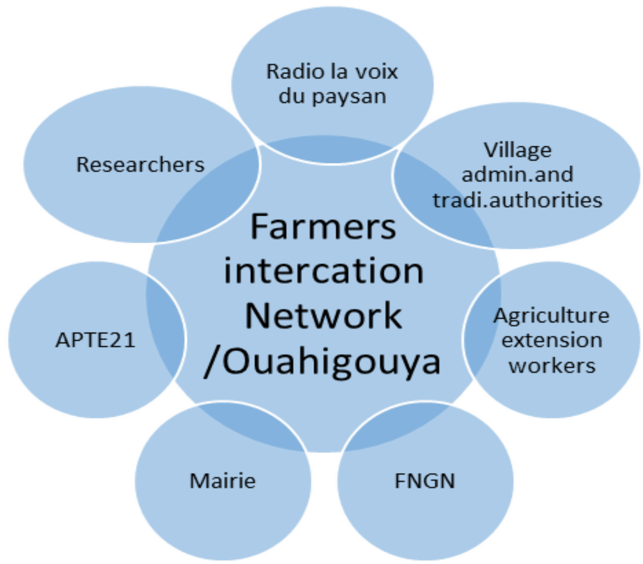
However, as seen in objective one, scientific and local climate information interaction is weak from the trend analysis and the relation that the research tried to establish between the two types of knowledge. Out of for Mann-Kendall trend test analysis, only one show a positive trend with the equivalent observation in the survey data. However, the similarities in the two areas show the presence of a set of stakeholders that are source scientific climate information of climate information.

The description of APTE 21 ongoing activities according to one of its managing staff in Dano developed that they particularly add on information in giving rainfall information, information on dry spells and appropriate advice that could to help farmers increase their adaptive capacities.

The information is communicated weekly. But the big challenge is that few farmers are involved in this dissemination network and that is also hinder interaction.

The stakeholders' maps differ between Ouahigouya and Dano as following in the two adjacent graphs.

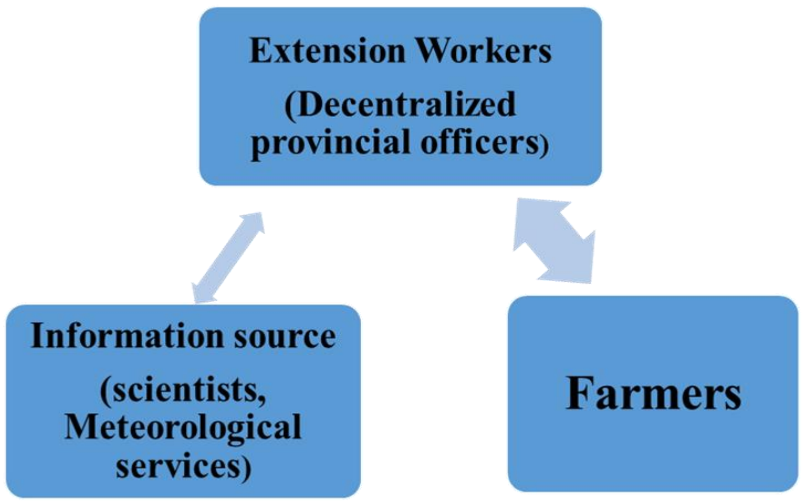




It is remarkable that the stakeholders' map is more loaded in Dano than in Ouahigouya even if the previous analyses show that Dano populace is less exposed to Radio programmes rated as the major source of climate information source. This supports in reality, the relevance of these actors' interaction to provide climate information and its relative adaptation capabilities to farmers specifically with the agro meteorological advice that follow its dissemination

However, a part of some projects like APTE 21 and the CILSS's ACCIC/DANIDA project (completed in 2015) farmers from both sides reported to receiving scientific climate information and advice through a regular interaction with extension workers (mainly from agriculture and environment provincial decentralized directorates.)

Both Sides main scientific climate information source / Actors interaction analysis



No direct farmers-meteorological services interaction was reported. The meteorological information is made available on radio stations and disseminated as a bulletin to extension workers who in their interaction with farmers explain its content. Physical interaction with Extension workers projects staffs, traditional and village administrative authorities seems to enhance farmers' climate information access and working skills building. In addition, projects perform well in conveying information and knowledge, short life time constraints hinder to achieve more.

How could scientific climate information access be for women with a low education level?

This aspect is highlighted in Chapter five as part of the recommendations from this research findings. It means the more farmers are connected to any of these actors, when interaction takes place, climate information the more some derivable adaptation capabilities could be enhanced specifically when the communication between scientists and farmers is effective, or at least a two way information flow.

However, it can be assumed that there is a need to educate, train the farmers for a better understanding of climate scientific information because as the official language being French, the contents may still stay not accessible for those who cannot read and write.

Farmers were first asked to state their willingness to join climate education programs. They were in the same series of questions asked to rank were can be the desired place to learn about climate information and knowledge.

Table 22: Farmers' rating their preference for climate change education channels

Learning Prefrence	Schools	Senzitization_ campaign	Adult_learning	Formal_informal _edu	Media	Social-Media-network	Radio_prog
Total	88	200	131	48	83	8	134
Frequencies	**36.67%**	**83.33%**	**54.58%**	**20.00%**	**34.58%**	**3.33%**	**55.83%**

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter contains three section. The first section covers the summary of the four previous chapters, the second section is on the conclusion and the recommendations are the third section.

5.1. Summary

5.1.1. Chapter one

As the main goal of this research is to determine a strategy to effectively communicate climate information and adaptation knowledge to in Burkina Faso, under this chapter, the focus was to introduce the study protocol. The country background climate information was described along with the respective climatic conditions of the two regions of the research. The research objectives of the study was identified, the scope and limitations explained.

5.1.2. Chapter two

This chapter covers the empirical review and the theoretical review. Under the empirical review, the background climate information of Burkina Faso, the summary of some climate information from official document such are the NCs, NAPAs, NAPs. Some related studies linking climate change and agriculture, climate change adaptation and communication related studies were consulted to help in better understanding the potential areas that the study will develop on in the following chapter (specially serving as reference for the discussion section). Some legal instruments and methodological sources were consulted and summarized in this chapter. In addition, in theoretical review, in this chapter, were explore the available communication and network analysis theories that could support the development of some section in following chapters (methodology and results and discussion chapters.)

5.1.3. Chapter three

In this chapter, the focus was essentially to explain the process through which the objectives of the study could be achieved. In other terms, this chapter contains the methodological approach of the research. The comparative approach is the main approach and help in the analysis process of the research finding in the next chapter. The employed the mixed methods and both qualitative and quantitative data collection instruments were used. The criteria of the selection of the study areas villages and sampling methods and process were described. In summary, 4 workshops with 87 participants in total were organized, 240 survey questionnaires were administered in four villages. 38 key informant interviews conducted from village with farmers to national level professionals. The data analysis process is also described. Quantitative data are processed and analyzed with statistical tool, Excel and Statistical Package for Social Science (SPSS) version 20. The interviews and the Workshop information are organized per thematic and similarities and differences are outlined. The results and discussion are developed in Chapter four.

5.1.4. Chapter four

The finding from all research instrument are presented and discussed under each objective. The statistical information was summarized in figures and graphs. Some illustrative pictures were also used to support the results and discussion. Four Mann- Kendall trend tests computed from the data National agency of meteorology of Burkina Faso. The climate parameter was rain and temperature and a trend graph (Histogram) was drawn from SPSS and the results were compared to Mann-Kendall trend test. Thematic like communication, effective communication, interaction, adaptation and network analysis were discuss through the contents of Workshop and key informant data. From statistical summaries are drawn illustrative charts to support the write up.

5.5 Some Key findings

- Farmers considerably rely on their local weather and climate events forecasts.
- The relation between local and scientific climate information is weak from the statistical test results.
- Local and Scientific climate information can be related to creating a correspondence between events, the timing, and the signs in the environment.
- Climate information followed by agro meteorological advice enhances farmers' adaptive capabilities.
- Funds availability is key in disseminating climate information because even of the free of charge nature of its delivery because information implies cost that needs to be supported.

- Farmers do not understand the probabilistic nature of scientific forecasts and complained about their accuracy. The generation and accuracy of some weather measurements could depend on the meshing of the network and land coverage of the synoptic meteorological stations, which the Farmers might not have understood.
- Communication and extensions services professionals reported delays in receiving meteorological bulletin which is conveyed to them via a hierarchical and administrative network and path of information circulation.
- Media and extensions workers reported being more generalist few specialized in the climate area. The broadcasting activities are driven by news, hot topics, which gives less time allocation to climate information diffusion in the grid of programs.
- No direct information flow was captured between Farmers and the sources of scientific climate information (meteorological services). In the climate information network, farmers are information reported both study sites to be receivers of information in a one way information circulation way and this information in most of the cases transit to intermediaries before reaching to them. This way of information circulation shows a weak and slow interaction between farmers and scientists.
- Out of the four selected villages of the study, farmers benefit from Extension workers, with more of their presence in Ouahigouya than Dano. However, the Small size villages also a member of the WASCAL APTE21 project were found more exposed to climate adaptation information and measures. This can be explained by the agro meteorological provided by the project to farmers.
- Women with a high proportion of none education have low access to climate scientific information.

5.2. Conclusion

The research was conducted in region du Nord and Region du Sud Ouest of Burkina Faso. The villages of the study areas were selected based on the criteria of their size and their membership to the Ongoing WASCAL APTE21 Climate information dissemination project.

Prior studies in climate communication studies and climate adaptation helped to discover a similar and former climate information dissemination network in West Africa, through ACCIC, a project piloted by Centre Regional AGRHYMET and ended in 2015. The network analysis theory adopted from (Denny, 2014) helped to understand the type of interaction, information flow direction between climate information sources and its end users (farmers). The major type of interaction between climate information sources and farmers could be explained by the principle of transitivity. Information and climate related knowledge before to reach to the farmers, transit to an intermediary before to be disseminated to the farmers.

In summary, four workshops with 87 participants were organized and data were collected using a Focus Group Discussion animation guide. 240 survey questionnaires were administered respectively 80 in each non WASCAL APTE21 Project intervention Village (NWPIV, one in each region) and 40 in each WASCAL APTE21 Project selected and working village (WPIV, one in each region). A Key informant interview guide was submitted to 38 persons among which 24 (6 per village from both sex) were Farmers and 14 were professionals from provincial, regional to national levels.

The research found the relation between scientific and local climate information is statistically weak.

The Mann-Kendall trend analysis test results from rainfall and temperature time series data over the past 30 years collected and computed on SPSS show one out of four which fits with observed information on the same climate parameters with farmers in the survey data. However, some contents of the survey questionnaires, the workshops, and the key informant interview present the potential relation, the relevance of integrating scientific and climate information.

Farmers' climate related adaptation capabilities are enhanced through their interaction with climate information and knowledge sources. At the local level, farmers rely on their traditional environmental knowledge to interpret, understand and forecast the weather conditions. Their interaction with scientific climate information sources shows them as a member of a network in which knowledge or information transits from their sources to intermediaries before to reach to them. The research found that climate information and dissemination projects provide agro meteorological information which really supportss farmers in appropriate decision making in their farming activity.

A contrast is established between villages with climate dissemination project intervention and villages with none. Villages' interaction with climate information project brings more climate information and related adaptation knowledge closer to their farmers through an effective interaction. The Challenge is that these projects operate with limitations of a short lifetime, resources and coverage area.

On a gender and education perspectives, with 95, 2% of women with no education level in the the rural area, their access to scientific climate information can be low.

In discussing the way forward to better communicate climate information and relevant adaptation knowledge to farmers, first and prior to all strategies is to enhance a better level of receptivity of this information, which could be facilitated by education.

5.3. Recommendations.

The results of the research revealed farmers' high reliance on traditional knowledge and source of climate information can be explained by the reason that there is still a gap to fill in the information dissemination practice. In reality, scientific climate information access is still low especially with 65, 4 % that without any literacy level. The problem of its accuracy and the delays in its delivery can be coupled with financial resource availability for its generation. Therefore, the section is divided into short term, mid-term and long term recommendable actions according to the level of priority.

The following is recommendable for short term:

Scientists and local communities should be in harmony with climate information communication.

In short term: Scientists, communication experts, and farmers must develop together a comprehensive corpus of a combined climate information language translated into the major spoken languages of Burkina Faso. This could serve as a baseline and reference document for both climate information communicators and its users.

Farmers need to better understand climate scientific information and this could pass by the improvement of the channels and the frequency of its delivery. Radios broadcast generally weather information after news sessions. The time allocation is short and not all farmers possess one.

To the air time diffusion, farmers who stated their interest to be informed and educated on climate issue need to be organized and trained in the group. They could also have access to climate information through sensitization campaigns.

The success stories of projects like ACCIC and the WASCAL APTE21 project in conveying coupled weather forecasts and agro meteorological information should be adopted in climate communication nationwide. The areas of the two projects are the two regions of the study area in Northern and the South West Region Burkina Faso.

In mid-term: Initiate mechanisms of stakeholders' engagement from local to national levels and develop inclusive communication learning activities with farmers. Successful climate information communication which is inherent to an interaction may lead to enhanced climate related adaptation skills for farmers.

Fund raising and its availability for communicators capacity building to solve the difficulty of the free of charge nature of climate information which brings media (generalist) to look for marketable information into other agenda (political, news of the day, hot topics) rather go for free communicable climate information.

In the mid-term plan, as climate information communication need resources and time, it is necessary that resources and infrastructures for its generation be made available. In term of infrastructure, for instance, Dano is located in between two synoptic stations which provide data on its locality. The meteorological station of Gaoua located at 96, 5km in air distance is the one from which data on climatic parameter like wind, temperature provided. This can pose a problem of accuracy because of the distance and the meshing of the coverage zone of the meteorological synoptic station's zone. To have more precision, it could be advisable to cover the territory of Burkina at least on province basis (including) Dano with more infrastructure and equipment of weather and climate parameters measurement and data storage. In term of resources, it is advisable that priority is given to the budgetization of climate information and dissemination.

There is an effort of communication of the National Agency of Meteorology with its partner's such researchers, extension workers, and the Radio Television du Burkina, who deliver weather forecast and agro meteorological information to the public free of charge. But as information generation and dissemination call for resources, supporting with funds could help achieve more. The sector of climate information communication should be considered as a reference and a priority to adapt to climate change and variability impacts, because prevention is cheaper than reparation, and being informed can help to adjust and get prepared and prevent or to adapt.

The study did not capture any early warning system in place as part of the strategies of climate information communication. Consequently, it is also relevant to set this early warning plan with very simplified contents effectively usable by farmers.

In long term, integrating local and scientific climate information communication in a common strategy of communication could be relevant, farmers involving and engaging. This is important because “the best development outcomes are achieved when issues are addressed holistically” according to Keith Howells. Therefore the suggestion of (Nyong et al., 2007, p. 795) to “create a mechanism of dialogue between local populations and climate change professionals” quoted in Suldovsky (2017, p. 19) sounds relevant to achieve that goal.

There is a need to build the capacity of climate information disseminators. An entity like climate information communication team or committee is advisable to be added to the list or network Communicators of extension service workers in interaction with their respective audience.

Interaction in communicating climate information can successfully be enhanced when stakeholders are consulted and engaged.

For that reason, it is suggestible to gather the climate communication experts and information users in regular consultations platforms that could lead to a formalization of a network and collaboration. To get stakeholders engaged, I suggest finally, in the long run, to have a climate information communication charter, which could outline the policies and regulations to be followed by parties achieve more the information delivery and its related enhanced adaptation capabilities for end users in Burkina Faso.

In long term: Capitalize, document, mainstream and replicate successful projects stories and experiences in climate information dissemination in national climate information communication strategies with the support of decision makers.

A charter of climate information communication that could keep stakeholders in an interactive communication from their respective roles is relevant to be adopted because prevention may be cheap than reparation.

Finally research activities in climate communication, integration of farmers and scientist knowledge, communication enhanced climate adaptation studies could of high interest and relevance to developing a strategy of climate information and communication strategy.

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Appendices

Data collection Tools

Workshop/group discussion (with farmers) _ Aly Diarra _FGD / Tools for workshop animation. Guide (1 = What; 2 = How; 3 = Why?)

Introduction (10 minutes)

- *Registration of participants*

- *Welcome word*

- *Explanation of the workshop program*

- *Invitation of participants to open interactions and sharing of knowledge*

- *Common meal and refreshment + explanation of the continuation of the study (surveys)*

- *Choice of secretaries and spokespersons for group work.*

A) **Environmental Knowledge** [20 minute brainstorming]

An indication to participants: Let everyone take the floor and tell us something about the face of the village. (Round table)

1) Can you describe your environment (the physical environment, the contours and boundaries of the village and all that is remarkable)? (4 minutes)

2) What are the geographical features of your environment? (in terms of rainfall distribution, type of soils, nature of the area: mountainous or irregular terrain, lowlands, uplands, soil type, weather conditions, water point, winds, floods, humidity, freshness, etc.) (4 minutes)

3) How was your environment: 5 years ago? 10 years? 20 years? 30 and more? (4 minutes)

4) What environmental changes did you observe and why? (After the change list provided, we will ask the time that the change takes place) (4minutes)

5) What are the major socio-economic activities dependent on environmental resources (expected reactions: hunting/impacts, agriculture/impacts, energy/impact on flora, etc.)? (4 minutes)

B) **Climate change and agricultural activities**. [Recorded]

First group work (two groups) Participants group discussion (30 minutes)

(Activity on craft paper)

Activity 1: Can you draw the map of the village? (Contours, infrastructure or remarkable elements that can allow anyone to recognize the village)? And tell us what are the weather conditions that you usually live there) *5 minutes*

Activity 2: Here are some time references from the past: 5 years ago? Ten years ago, twenty years ago, thirty years ago and more. Tell us what changes you have observed in the physical and climatic conditions within their community based on each benchmark of the past. (Please write on the sheet) *5 minutes*

Activity 3: Can you tell us what types of knowledge about climate and climate change you have access to? *5 minutes*

Activity 4: Tell us how you use climate information in terms of frequency. What type (s) of knowledge or climate information do you use and say why? When do you use each of this information above and why? (if they are numerous) *5 minutes*

Activity 5: What types of Climate Information Forecasts (expected reactions: global and partial forecasts) are communicated to you? What Comments on Forecast of Climate Information Received? *5 minutes*

Activity 6. What type of climate information do you need for your agricultural activity according to the agricultural / crop calendar? What exactly do you need climate information? The beginning of the rainy season, rainfall, drought, strong winds, floods? What are your other needs in climate information and why? When is access to climate information necessary and useful? Why? *5 minutes*

Mini restitution of each group by its representative/ *Reporter* (5minutes / Group = 10 minutes)

C) Generalities on communication (plenary discussion) (Recorded 20 minutes)

1) By which sources do you have information in general?

2) Are you a member of a communication platform or network? How is communication done? (Unidirectional channel [from top to bottom]; [one-way circular network]; two ways [from top to bottom and bottom to top]; [two-way circular networks] + any other relevant information)

3) What are the channels of communication through which climate information comes to you and why?

4) By what type of climate information communication do you communicate with each other the most?

5) In your opinion, is the best channel the most appropriate for giving you climate information and why?

6) In your opinion, is the information received complete? Not complete? Global? Specific? Relevant? Useless? Clarify your opinion.

D) Analysis of the communications network and climate change stakeholders (participatory activities / (network analysis) # Group activity

(Activity on craft paper) (Recorded 45 minutes).

Activity 1: Channels of Climate Information Communication

What are the channels of climate information communication that you use? Can you tell which three channels you use the most and why?

Activity 2: Types of Climate Information and Relationship (Prior to Defining Climate Information)

What is (are) the Content (s) of the climate information communicated to you? What do you know about scientific climate information? Local?

Can you tell us by listing three points respectively?

a) Similarities between scientific climate information and local climate information?

b) Differences between scientific climate information and local climate information?

Activity 3: Source of climate information (write answers on craft paper)

Who are the people or institutions that provide you with climate information: a) Scientist? b) Local?

How often is climate information communicated to you? Was it the same thing in the past 5 years ago? 10 years? 20 years or 30 years and above? What comments do you make?

Activity 4: Prioritizing the source, preference or need for climate information

What are the most reliable sources of climate information? Information on climate change? Why?

Depending on the frequency of climate information communication, can you classify climate information actors or communicators in order of importance in your village?

When do you need climate information most? What do you need and why?

Activity 5: Knowledge of the network of climate information stakeholders

Can you make the diagram of the network of stakeholders of climate information communication (scientific and local) in your village?

Indications: you are in the center of the diagram. The closer an actor is, the more your interaction with him, and the longer an actor is, the further your interaction. Mark the direction of your interaction with arrows. (One way or both ways)

E) Climate Change Adaptation and Stakeholder Network Analysis (Participatory Activities Network Analysis)

(Activity on craft paper) (Recorded 25 minutes)

Activity 1: Sources of climate change adaptation knowledge related to climate information communication

Who are the actors that provide you with knowledge, skills or information on climate change adaptation through climate information?

What climate change adaptation measures do you have at the local level? How did you acquire them?

What climate change adaptation measures do you have locally or have learned from them and what do you use?

When do you need these actors or their support?

Activity 2: Interaction of stakeholders in climate information communication

How does information flow between you (farmers) and the rest of your source partners / or receivers of climate information?

If you are a member of a platform for exchanging or disseminating climate information, can you tell us?

How is the information produced? Who are the actors involved? What is nature and time scale that this information covers (depending on the agricultural calendar)?

How effective are your communication and interactions with these actors or platform?

Do these actors collect feedback or your needs to improve their interaction with you?

What do you propose to improve these interactions? Why?

Restitution of group work (Recorded 20 minutes)

Mini Assessment (5Minutes) & Conclusion (5Minutes) & Refreshment

The vote of Thanks!!!

Questionnaire Time (S/E):

Preamble:

This questionnaire is administered to collect information and data that will be exclusively used in the ongoing study for a master's research thesis on: "Climate-related adaptation capabilities of scientific and local climate information communication farmers in Dano and Ouahigouya, Burkina Faso**.**" Your contribution will make this study successful and the author. I assure you of the anonymity, confidentiality and the respect of research ethics throughout the manipulation of the information you will provide. All the data collected from this study will be exclusively used for the thesis work. You will be acknowledged into any global or partial element of publication from this data.

Thank you for your collaboration!

Generalities

1) Location

Province:……………………Department……………….Commune/village………………………

2) Identification of the respondent.

Name…………………………………………………………………….

Sex: (write 1 if Male, 0 if Female) [ ]

Age: (write the exact number) [ ]

Marital Status: (Stick only) a) Married [ ]; b) Divorced [ ]; c) Separated [ ]; d) Single [ ];

e) Widow [ ]; f) other (specify) [ ] ………………………………

3) Occupation

a) Are you a farmer? Code (1 = yes; 0 = No) [ ]

b) What is your main activity, the source of income?
………………………………………………………………………………

c) What is (are) your additional source (s) of income?
………………………………………………………………………

d) Which of the above cited activities take much more of your time?..

4) Level of Education (stick one choice at once)

a) Primary [ ]; b) Secondary [ ]; c) Tertiary [ ]; d) Arabic [ ]; e) Adult education (rural Alphabetization in local language) [ ]; f) other [ ] (specify) ………………………….

5) Household information and farming system (stick one at once)

a) What is your position in your household?

a) Senior/ head [ ]; b) junior/ head [ ]; c) Dependent [ ]; d) Seasonal Worker [ ]; e) other [ ] (specify) …………………

6) How many people under your responsibility in the households? ……….

7) Are you a partial or full time worker into the household farming activities? (Stick one choice at once)

a) Full time [ ]; b) partial [ ]; c) Other (specify) [ ]……………………………………………

8) Since when have you been a farmer? [ ] (in years)

9) What type of farming do you practice? Code (1 = yes; 0 = No) [ ]

1) Rain fed [ ]; 2) irrigated farming [ ]; 3) both [ ]; 4) Other (specify) …………………..

10) What are the predominant crops varieties you produce?
……………………………………………………………………………………………

11) Do you own the farm and the yields you harvest from it? Code (1 = yes; 0 = No) [ ]

I- About the environment and climate Change

1) What do you know about your environment?

………………………………………………………………………………………………
………………………………………………………………………………………………
………………………………………………………………………………………………

2) Some Changes? Code (1 = yes; 0 = No) [ ]

3) What do you think to be the cause(s) of this (ese) Change(s)?

Code (1 = yes; 0 = No) [ ]

a) God [ ]; b) Human [ ]; c) Nature [ ]; d) climate change; e) other (specify)…………

Reasons:
……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

4) Have you notice any change in the following events over the past…?

	last 05 years	**last years**	**last 30 years and above**	Can you list some of the causes	What are some of the impacts of climate change in your environment?
Prolonged dry spells				………………………… ………………………… ……	………………………………………… …………
Flood					
Mean temperature					
Precipitation					
Length of the growing Period (LGP)					
Violent winds					
Code: *1= Never happened; 2= No change; 3= Decrease; 4= Increase; 5= I Don't Know*					

5) Have you heard about climate change Code (1 = yes; 0 = No)

6) If yes, exactly what have you heard?
……………………………………………………………………………………………………
……………………………………………………………………………………………………

7) Does Climate change affect your farming activity (ies)? Code (1 = yes; 0 = No) [ ]

8) How? (Level of severity). (Stick only one choice at once)

a) Very less [ ]; b) less [ ]; c) none [ ]; d) severe [ ]; e) more [ ]

9) At which stage of the farming calendar did you experience these impacts in your farming practices? Code (1 = yes; 0 = No) [ ]

a) Plowing [ ]; b) sowing [ ]; c) weeding [ ]; growing [ ]; e) flowering [ ]; f) heading [ ]; g) maturation [ ]; h) harvesting [ ]; i) other (specify) [ ]

10) What climatic event affected your activities? Code (1 = yes; 0 = No) [ ]

a) Drought [ ]; b) flood [ ]; c) windstorm [ ]; d) rainfall (deficit) [ ]; e) temperature [ ]; other (please specify) [ ]……………………………………….

11) What is (are) the most drastic climate related-events that severely affected you or your community?
………………………………………………………………………………………………………
……………………………………………………………………………………………

13) When did that happen? (Year)……………………………………………

14) Were you informed or alerted about it/ them? Code (1 =Yes; 0 = No) 1 [ ]; 0 [ ]

A/ Communication (Generalities)

1) From where do you get information? Code (1 = yes; 0 = No) [ ]

a) Friends, Relatives, Neighbors [ ]; b) radio [ ]; c) Television [ ]; d) theatre [ ]; e) Community leaders [ ]; f) Groups or associations [ ]; g) print media [ ]; h) workshops sessions [ ]; i) Extension service agents [ ]; j) Local market [ ];

k) Other (please specify) [ ]

2) From where do you get climate information?

Scientific source? Code (1= yes [ ]; 0 = No [ ])	Indigenous source? Code (1= yes [ ];0 = No [ ])
Radio [ ]	Oral tradition (from dad to son) [ ]
Television [ ]	Djeliba [ ]
Newspaper [ ]	Theatre/ comedy [ ]
Article [ ]	Friends, Relatives, Neighbors
Study report [ ]	Chief or local authority [ ]
Online [ ]	Cultural beliefs [ ]
Mobile phone [ ]	Personal observation [ ]
Other (please specify) [ ] ……………………................................	Other (please specify) [ ] ……………………………………

3) On which type of information do you refer to in your understanding of climate events?

(Stick one at once)

a) Scientific [ ]; b) Local (Indigenous) [ ]; c) both [ ]

4) Why?
……………………………………………………………………………………………………

5) Are there some similarities between these two sources and types of climate information?

Code (1 = yes; 0 = No) [ ]

a) ……similarities in what?

The hazards or events they cover? [ ]; The Forecasts? [ ]; The descriptions? [ ]; The signs? [ ]; Communication? [ ]; Other [ ] (please, specify)? …………………………………

6) Are there some differences between these two sources and types of climate information?

Code (1 = yes; 0 = No) [ ]

a) ……differences in what?

The hazards or events they cover? [ ]; The Forecasts? [ ]; The descriptions? [ ]; The signs? [ ]; Communication? [ ]; Other [ ] (please, specify)? …………………………………

B/ Climate information Communication process

1) How does climate information reach to you or to your Community?

a) In one way (form sender to the receiver only without feedback from the receiver)

Code (1 = yes; 0 = No) [ ]

b) In two ways (sender gives information to receiver and collect back feedbacks from him/her)
Code (1 = yes; 0 = No) [ ]

2) Are you involved in the production of the climate information you receive from the sender?
Code (1 = yes; 0 = No) [ ]

3) How is the information communicated to you? (Stick only one choice at once)

a) Complete [ ]; b) Partial [ ]; c) Other [ ] (specify)……………………………………

4) What is communicated to you? (Stick only one choice at once)

a) Weather forecasts [ ]; b) Research publication [ ]; c) climate indigenous knowledge [ ]; d) Farming season/activities planning [ ]; e) other [ ] Specify please……………………….

5) If weather forecasts, what is exactly communicated to you? (***If the response is "weather forecast" continue if not go to next question)*** (Stick only one choice at once)

a) Lot of rain [ ]; b) deficit of rain [ ]; c) windstorms [ ]; d) dry spells [ ];

e) Floods [ ]; f) other (specify)………………………………………………………

6) What is the time coverage of the climate information communicated to you?

a) Global (covering the entire farming calendar) [ ]; b) partial (covering [ ]; c)frequent [ ]; d) weekly [ ]; e) daily [ ]; f) Other [ ] Specify………………………

C/ Climate information effective communication analysis

Effective communication: is when the intended message of the sender is well received, interpreted, understood and acted upon by the receiver/ listener.

1) Who are the persons/ which institutions that provide you Climate information?
Code (1 = yes; 0 = No) [ ]

a) Meteo [ ]; b) Mass media [ ]; c) researchers [ ]; d) extension workers [ ]; e) local authorities [ ]; f) Farmer learning centers [ ]; g) other farmers [ ]; h) other (please specify) [ ] ………………………………………….

1) What do they provide you on climate information/ Knowledge?

Code (1 = yes; 0 = No) [ ]

a) Weather forecasts [ ]; b) climate change [ ]; c) climate change impacts [ ]; climate knowledge [ ]; research findings [ ]; international climate change decisions [ ]; other (please specify) [ ] ………………………………………………………..

2) If it is weather forecast, what do they precisely provide to you?

a) Deficit of rain [ ];b) excess of rain [ ]; c) floods [ ]; d) dry spells [ ]; other [ ]

Specify…………………………………………………………

3) Do you provide back information on climatic event to these actors?

Code (1 = yes; 0 = No) [ ]

a) Meteo [ ]; b) Mass media [ ]; c) researchers [ ]; d) extension workers [ ]; e) local authorities [ ]; f) other farmers [ ]; g) other (please specify) [ ] ………………………………………….

4) What do you provide to them on climate information / Knowledge? Code (1 = yes; 0 = No) a) Weather (conditions) [ ]; b) climate change [ ]; c) climate change impacts [ ]; d) local or community based climate knowledge [ ]; e) Observations on climate [ ]; f) deficit/ excess of rain [ ]; g) other (please specify) [ ] ………………………..

5) How long did this interaction (exchange of information) take place between you and this network? (Stick one at once) a) one year [ ]; b) five years [ ]; c) ten years [ ]; thirty years and above [ ]; other (specify) [ ] …………………………………………………………………

6) How often does this interaction (exchange of information) occur?

(Stick one at once) a) not frequently [ ]; b) less frequently [ ]; c) frequently [ ]; d) more frequently [ ]; e) most frequently (at any time) [ ]

7) What do you think is missing in this interaction to make climate change information flow effectively in two ways (from sender to receiver and vice versa)?

……………………………………………………………………………………………………
……………………………………………………………………………………………………

8) What do you suggest in this interaction to make climate change information flow effectively in two ways (from sender to receiver and vice versa)?

……………………………………………………………………………………………………
……………………………………………………………………………………………………

D/ Climate-related enhanced adaptation capabilities through climate information communication

1) What was the climate information that was communicated to you? Multiple choices.

a) Rain deficit [ ]; b) rain excess [ ]; c) windstorms [ ]; d) high temperature [ ];e) other [ ] specify………………………………………………………………………………..

2) What are the actions you've taken after having received climate information to adapt to climate change impacts? Code (1 = yes; 0 = No) [ ]

a) Farm fencing [ ]; b) stone bunds [ ]; c) Half-moons [ ]; d) Zai pits [ ]; e) early maturing cultivars [ ]; f) intercropping [ ]; g) agroforestry [ ]; h) other [ ] (specify)…………………………………………….

3) How relevant/ helpful was the information you received on these adaptation measures? (Stick only one choice at once)

a) Not relevant [ ]; b) less relevant [ ]; c) relevant [ ]; d) more relevant; e) Most relevant [ ]

Explain ………………………………………………………………………………………..

4) What was the time scale of the climate information communicated to you? (Stick only one choice at once)

a) Covering the entire season [ ]; b) Partially covering the farming season [ ];

5) How efficient was the adoption of these adaptation measures to your farming practices?

Code (1 = yes; 0 = No) [ ]

a) Not efficient [ ]; b) less efficient [ ]; c) efficient [ ]; d) more efficient; e) most efficient [ ]

Comments? …………………………………………………………………………………

6) Nelson Mandela said: 'Education is the weapon you can use to change the world'

Your Comments?

....
....

7) Do you believe in climate change education as a way to combat its impacts in your community? Code (1 = yes; 0 = No) [ ]

8) How can we achieve climate change education? Code (1 = yes; 0 = No) [ ]

a) In schools only [ ]; b) Mass sensitization [ ]; c) free adult learning [ ] ; d) formal and non-formal education [ ]; e) Mass media [ ]; f) social media [ ]; g) community based programs [ ]; h) academia [ ]; i) training/ workshops [ ];j) Other (specify) [ ]…………..

9) Which place do you give to the communication of scientific and indigenous knowledge to address climate change impacts? Code (1 = yes; 0 = No) [ ]

a) Not efficient [ ]; b) less efficient [ ]; c) efficient [ ]; d) more efficient;

e) Most efficient [ ]

10) Did you get or employ some climate-related adaptive knowledge or skills that you've received via climate or climate change information communication? Code (1 = yes; 0 = No) [ ]

11) To which climate event was this information, skills or knowledge related to?

Code (1 = yes; 0 = No) [ ]

a) Drought [ ]; b) Rain fall deficit [ ]; c) flood [ ]; d) windstorm [ ];

e) Temperature [ ]

12) What are the climate related adaptation measures in your farming activity you've got or employed via climate or climate change information communication?

Code (1 = yes; 0 = No) [ ]

a) Stone bunds [ ]; b) Half-moons [ ]; c) Zai pits [ ]; e) Manure / compost [ ]; f) Farm fencing [ ]; g) Early maturing cultivars [ ]; h) Complementary irrigation [ ]; i) inter/mix cropping [ ]; j) Agro forestry [ ]; k) other (specify) [ ] ………………….

13) Did these skills, knowledge and information enhance your adaptation capacity to the impacts of climate change on your farm? Code (1 = yes; 0 = No) [ ]

14) Explain in few words why?

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15) How useful were these skills you've received? Code (1 = yes; 0 = No) [ ]

a) Not useful at all [ ]; b) less Useful [ ]; c) useful [ ]; d) more useful [ ]; the most useful [ ]

III/ Actors interaction and network analysis in Climate information communication

1) Do scientists usually visit you on your farm? Code (1 = yes; 0 = No) [ ]

2) What are their interests in you? Code (1 = yes; 0 = No) [ ]

a) Counseling/ advice [ ]; b) data collection [ ]; c) experiments [ ]; d) Communication [ ]; e) workshops/ training [ ]; f) other (specify) [ ] ………………………………..

3) What is you interest in scientists' interaction with you? Code (1 = yes; 0 = No) [ ]

a) Findings [ ]; b) Technological support [ ] ; c) innovation [ ]; d) consultation [ ]; e) workshop /training [ ] ; f) other (specify) [ ] …………………………………….

4) What climate related knowledge, findings, skills, adaptation measure or information you've got from your interaction with the scientists? Code (1 = yes; 0 = No) [ ]

a) Water harvesting and soils conservation techniques [ ]; b) early maturing cultivars; c) climate friendly technologies (bio fertilizers) [ ]; d) intercropping [ ]; e) weather forecasts [ ]; f) agricultural seasonal calendar [ ]; g) Other (specify) [ ] ………………………………………

5) Do you think there is a relation between indigenous knowledge and scientific climate -related knowledge, findings, skills, adaptation measure or information you are using from the past to date? Code (1 = yes; 0 = No) [ ]

6) Can you give some explanations?..

…………………………………………………………………………………………………….

7) What is/ are the common source (s) of climate information used or present in your community? Code (1 = yes; 0 = No) [ ]

a) One to one [ ]; b) radio emissions [ ]; c) Television [ ]; d) Theatre/ comedians [ ] e) Local authority [ ]; f) Training/workshops [ ]; g) Scientists [ ]; h) other (specify)…………………………..

8) What is/are the reliable source (s) of information when it comes to learn about climate and climate change? Code (1 = yes; 0 = No) [ ]

a) One to one [ ]; b) radio emissions [ ]; c) Television [ ]; d) Theatre/ comedians [ ] e) Local authority [ ]; f) Training/workshops [ ]; g) Scientists [ ]; h) other (specify)…………………………..

9) Can you give me the list the actors (institutions, groups or individuals) with whom you exchange on climate change matters?

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……………………………………………………………………………………………………

10) How do you usually interact with them? Code (1 = yes; 0 = No) [ ]

a) In a one to one exchange [ ]; b) via your leader (farmer association); c) online (internet) [ ]; d) phone calls [ ]; e) in group (plenary sessions) [ ]; f) other (specify) [ ] ………………………………………………………………….

11) Which one of these channels of interaction do you rely on the most?

Code (1 = yes; 0 = No) [   ]

a) In a one to one exchange [   ]; b) via your leader group (farmer association); c) online (internet) [   ]; d) phone calls [   ]; e) with the entire group (plenary sessions) [ ];

f) Other (specify) [   ] ……………………………………………………………….

12) Do you believe in indigenous knowledge to support scientific findings on climate change? Code (1 = yes; 0 = No) [   ]

Why?...
....

14) Do you think that indigenous knowledge count in developing strategies to combat Climate Change? Code (1 = yes; 0 = No) [   ]   Why?

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15) What is your own judgment on the field of communication in general, and more specifically on climate change information communication in your community?

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16) In Burkina in General?

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17) What do you think need to be done to improve Climate information communication in your Community?

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18) In Burkina Faso in general?

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19) What do you think or suggest being the responsibilities of:

a) Scientists?

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……

b) Local communities?

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……

20) We are at the end of this questionnaire, there any additional things, observations or ideas you want to make for the improvement this questionnaire? What are your final comments or closure words?

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……

Thank you for your kind collaboration!!!

Province…………………………Department………………….Commune/village……………….

Phone contacts: Surveyor’s Name: Date:

Key informant interviews guide_ Institution Staff/Workers/Officers _ by Aly Diarra
(To be recorded)

1) What importance does climate change have in your work? Justify your opinion.
2) What are the sources of information that make you aware or learn about climate change?
3) What are the types of knowledge climate change that are communicated to you?
4) Where are these types of knowledge emanating from?
5) How do these types of knowledge reach to you?
6) How do you communicate or disseminate climate information to your audience? (if the source of information only)
7) Are they (information users/ audience) involved in the information production and its dissemination? Justify your opinion.
8) Can you please indicate some of the contents of the information packages you disseminate to your audience?
9) What is the time coverage of the climate information you produce or disseminate to end users?
10) From your own opinion, which of the global or partial forecast is useful for better adaptation options to farmers? Why?
11) How often do you contact your audience to share with them climate information?
12) Do you receive feedbacks from the receivers? Via which channel?
13) Do you think the contents you disseminate to end users are well understood? Give some comments.
14) Do the contents you provide to end users enhance their adaptation capabilities to climate change impacts? Comments?
15) How do you see the future of the field of communication, and more specifically the one of climate change information communication? What can be done to improve climate information communication to end users?
16) Do you have any additional relevant information on scientific and indigenous knowledge on climate change before we end this interview?

Key informant interviews guide_ Farmers _by Diarra Aly (To be recorded)

1) What importance does climate change have in your work? Justify your opinion.

2) What are the sources of information that make you aware or learn about climate change?

3) What are the types of knowledge climate change that are communicated to you and what are their sources?

4) How do these types of knowledge reach to you? How do you prefer them to reach you? (Before, during or after a farming season). Explain why?

5) What are the types of climate information that are helpful to you regarding the farming your farming activities following the farming calendar?

6) Are you involved in the information production and its dissemination? Justify your opinion.

7) Can you please indicate some of the contents of the climate information packages communicated to you?

8) What is the key weather component (hazard) which determine the most your farming conditions (success and failure)? Explain why?

9) When do you prefer to get climate information in your farming activity? (before the rainy season, at the rainy season beginning, during the rainy season, or after)

10) From your own opinion, which of the global or partial forecast is useful for better adaptation options to farmers? Why?

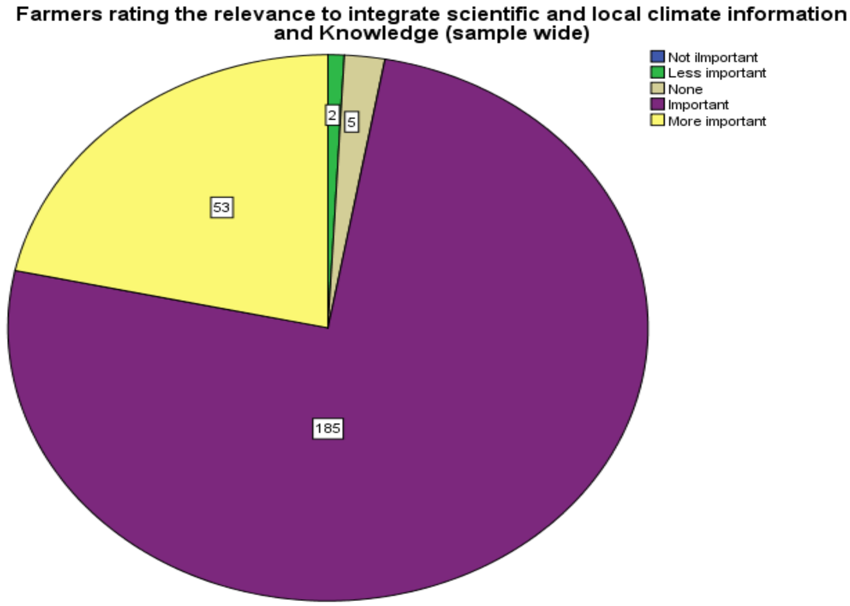
11) How often are you contacted by your climate information source? Do you provide feedbacks to your climate information source (if applicable)? If yes, via which channel?

12) Does the climate information communicated to you enhance your adaptation capabilities to climate change impacts? Comments?

13) Articulating Scientific and indigenous climate information in a climate change information communication could better help farmers to adapt to climate change impact, what is your opinion about that?

14) What can be done to improve climate information communication to end users?

15) Do you have any additional relevant information on scientific and indigenous knowledge on climate change before we end this interview?



Some illustrative tables indicating farmers' preferences in climate education and information dissemination channels.

Climate information &Education

		Effectifs	Pourcentage	Pourcentage valide	Pourcentage cumulé
Valide	No	5	2.1	2.1	2.1
	Yes	232	96.7	96.7	98.8
	5	3	1.3	1.3	100.0
	Total	240	100.0	100.0	

Radio Program

		Effectifs	Pourcentage	Pourcentage valide	Pourcentage cumulé
Valide	No	106	44.2	44.2	44.2
	Yes	134	55.8	55.8	100.0
	Total	240	100.0	100.0	

Sensitization Campains

		Effectifs	Pourcentage	Pourcentage valide	Pourcentage cumulé
Valide	No	40	16.7	16.7	16.7
	Yes	200	83.3	83.3	100.0
	Total	240	100.0	100.0	

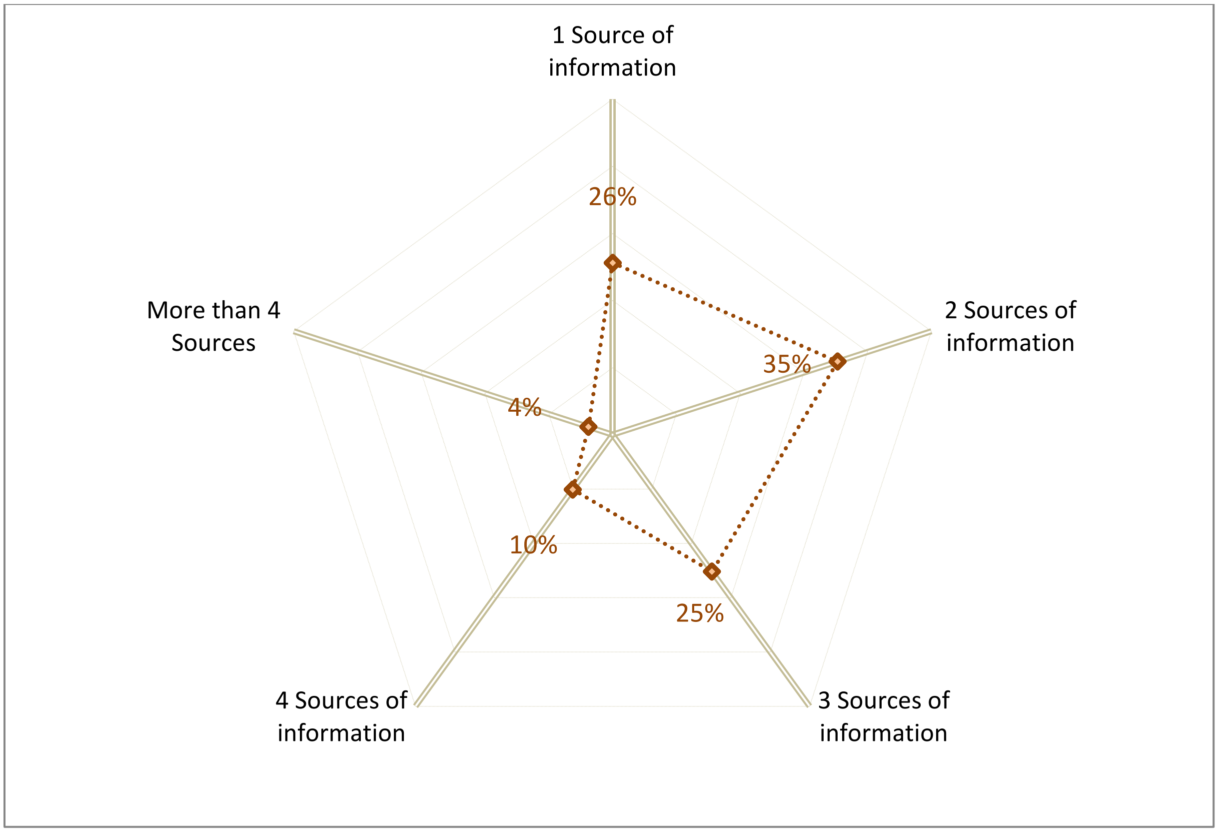


Figure 15: Distribution of farmers according to the number of the source of information

This Figure displays the distribution of farmers according to the number of the source of information use. The results reveal that about 26 % of farmers interviewed use only one source of information, while 35 % of them use two sources of information.

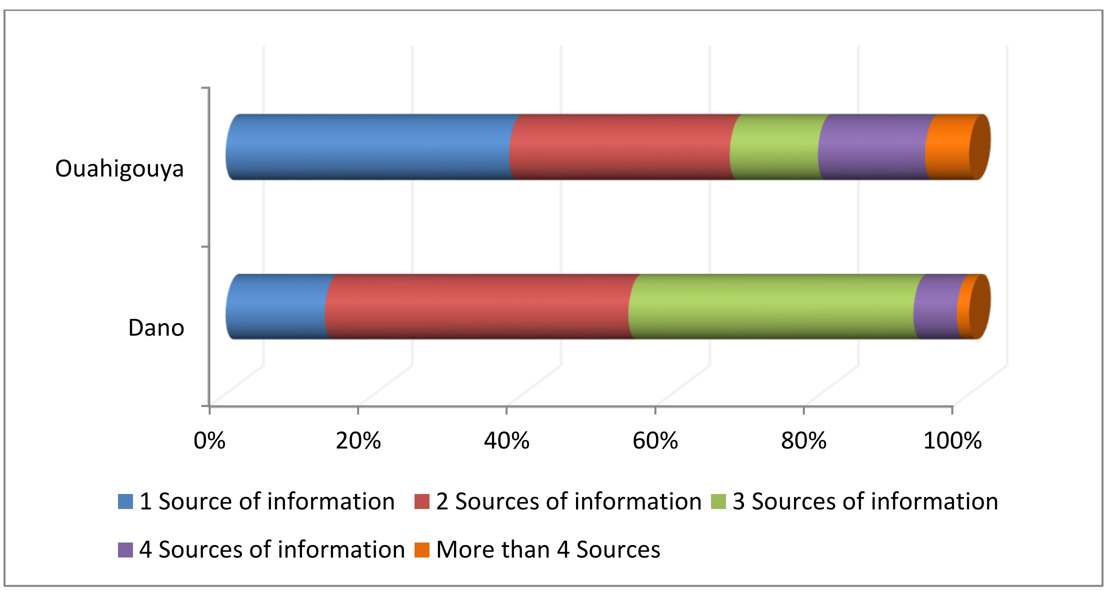
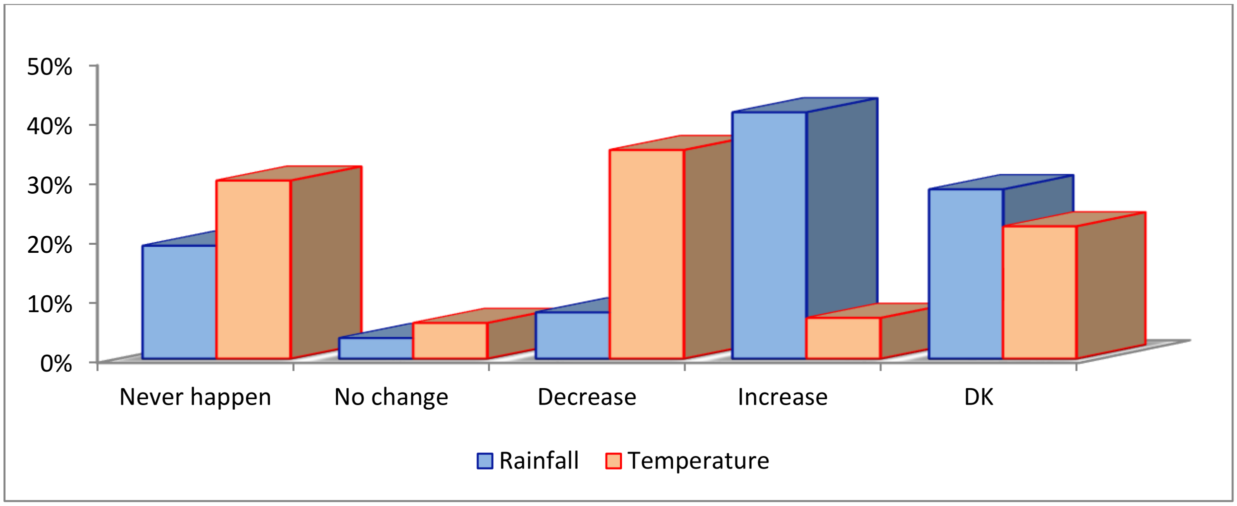
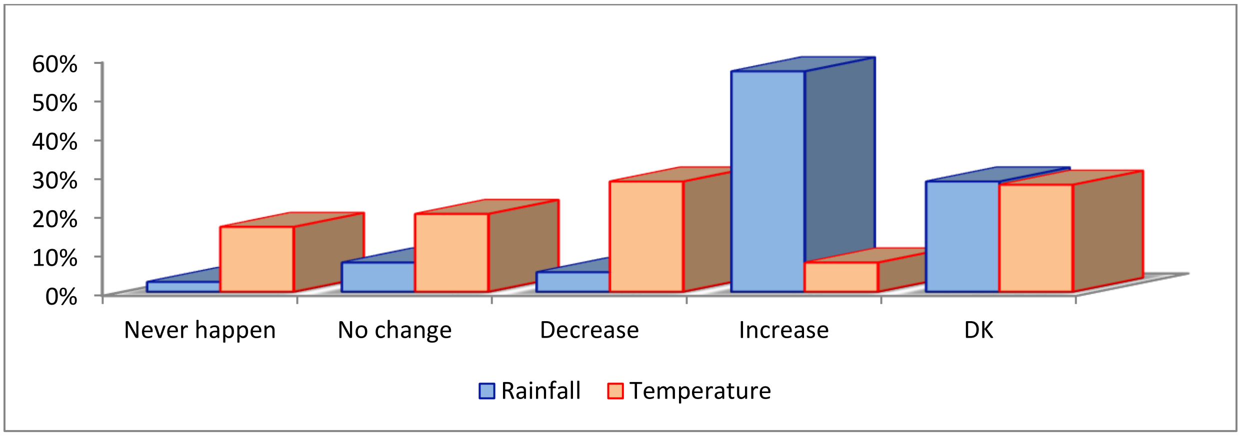


Figure 16 illustrates the summary of the total number of scientific information sources used by farmers per study area; each segment in the bar represents the number information source used by the farmer. the first segment (coloured in blue) shows the proportion of farmers using only one source, while the second part (coloured in red) depicts the proportion of farmers using two sources; and the third (in green), the fourth (in purple)and the fifth segment (in orange) indicate respectively how many farmers use three, four and more than four sources. As observed about 38% of respondents in Ouahigouya use only one source of scientific climate information; while in Dano, it is relatively low (about 13%). The red color shows farmer reliance on local climate information associated to the scientific source and the percentage is higher in Dano than Ouahigouya.

- **Farmers' perceptions of climate evolution in Ouahigouya over the past 30 years**



- **Farmers' perceptions of climate evolution in Dano over the past 30 years**



Correlation between gender and the use of climate information

This section seeks to investigate the relationship between the gender of the household head and the use of climate information according to the source of information. Examining these relationships would help to determine what channels gender linkages affect the use of climate information. It is important to note that all the above variables are nominal or categorical variables. The phi-correlation test is more appropriate. The phi coefficient of correlation for binary variables suggested by Yule (1912) is a measure of the degree of association between two binary variables. It shows whether or not differences between proportions are statistically significant. A phi coefficient of 0 indicates independence (no association) between variables; a phi coefficient of 1 indicates complete dependence (association) between the variables. The null hypothesis is given by H0: no relationship between the gender of the household head and the use of a given climate information.

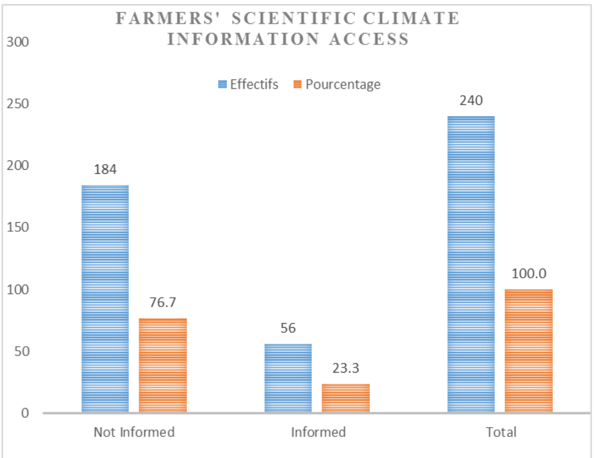
Regarding the type of climate information used, three types of climate information users can be distinguished: farmers who use exclusively information from local source only; those who use the scientific information only; and those using both.

Table 1: Correlation between gender and the use of climate information according to the source of information

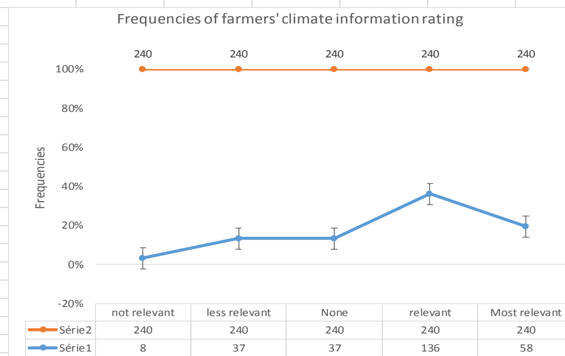
		Dano	**Ouahigouya**	**All**
Type of Climate info used	Local information only	**0.296*** **	**0.205** **	**0.250*** **
	Scientific information only	**0.209** **	-0.086	0.014
	Local & Scientific information	**-0.374*** **	-0.164	**-0.256*** **
Scientific Climate information source	FRN	-0.072	-0.098	-0.089
	Radio	**0.360*** **	0.071	**0.218*** **
	TV	0.032	**0.149* **	**0.105* **
	Theater	0.00	**0.253*** **	**0.126* **
	local adm. authorities	-0.067	0.004	-0.034
	Training and workshops	0.134	0.096	**0.113* **
	Scientists	0.036	0.109	0.082

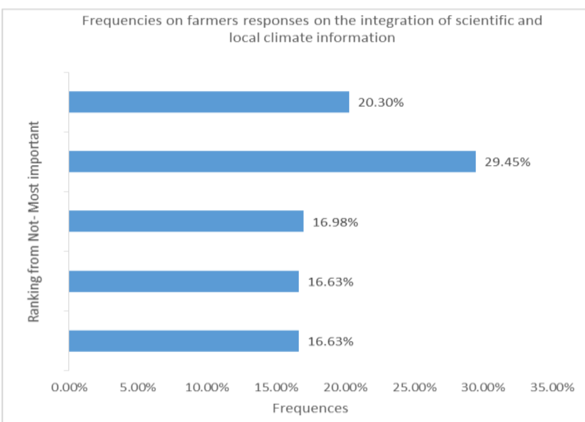
Notes: ***, **, * Showing significant at 1%, 5%, and 10% probability level, respectively

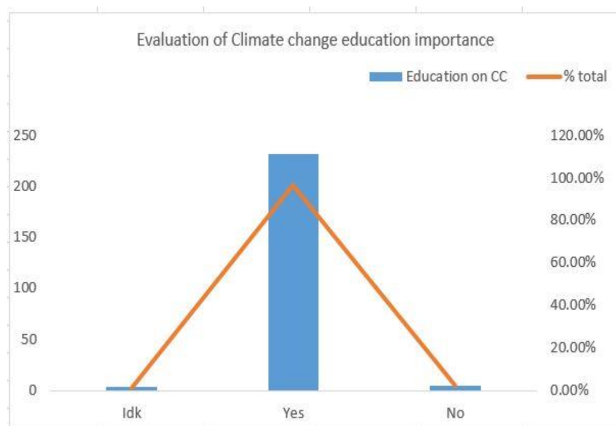
The results in Table 1 below indicate a disparity between the two study areas. In Dano the results indicate that the use of climate information regardless to the source is statistically different (at 1% level of probability) between the male- and female-headed households; while in Ouahigouya only the use of climate information from the local source is statistically different between the male- and female-headed households. In the light of these results we can conclude that the use of climate information from scientific source seems to be more *gender-neutral* in Ouahigouya than in Dano; in other words, men and women use equally climate information from the scientific source.

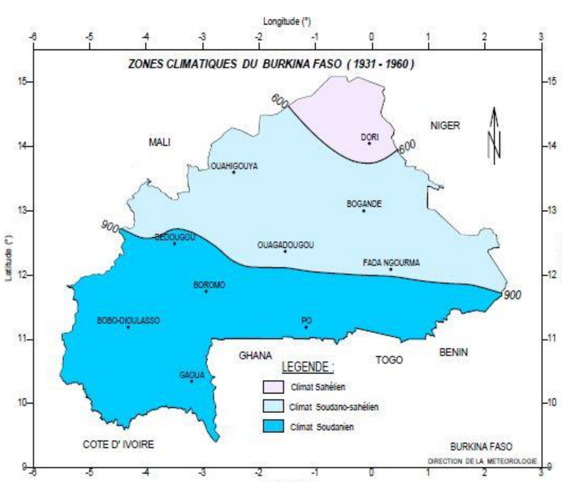


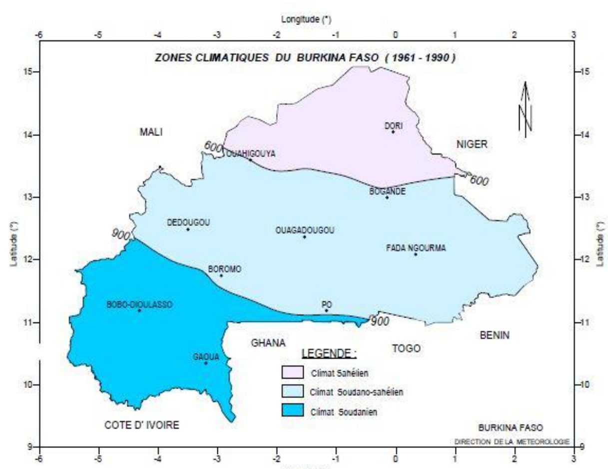
	not relevant	less relevant	None	relevant	Most relevant
Frequencies	8	37	37	136	58
Population	240	240	240	240	240





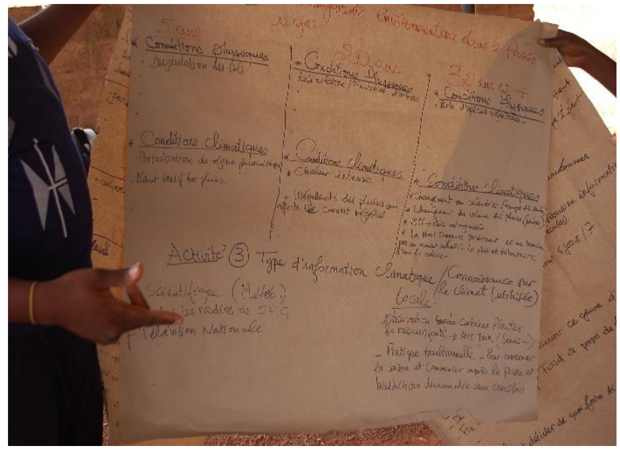






Source: SP/ CONEDD, 2014, Maps of Isohyets regressions from North to the south.

Some Field Work Pictures



Workshop picture in Bembela_ Study area 1_ Ouahigouya

Workshop Pictures in Bolembar_Study area 2_ Dano.