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ECONOMIC ANALYSIS OF CLIMATE CHANGE INDUCED RESOURCE SCARCITY AND ARMED CONFLICTS IN NIGER

PhD. RESEARCH DISSERTAION

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DEDICATION

This PhD. Dissertation is dedicated to:

ALLAH (SBW),

My parents Late Elh. Garba Hima &

Hadjia Maimouna Oumarou

and to my wonderful wife (Mrs.) Nafissatou D. Bello.

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ABSTRACT

This dissertation aims to contribute to our understanding of armed conflicts' triggers between actors (State and Terrorists; Farmers and Herders) in Niger and how to resolve such conflict(s) under climate change. The relationship between climate change and violent conflict is complex. Researchers find that conflicts are increasingly concentrated in the poorest portion of the world's countries. Niger as one of the poorest countries is ran-fed agriculturally based economy. Though, climatic conditions are neither necessary nor sufficient for conflicts to occur, but changes in climatic conditions could have a measurable impact on the probability and intensity of conflict, holding other conflict-related factors fixed. The empirical challenge addresses by this dissertation is to quantify this effect in Niger. The work aimed specifically to i) Estimate the impact of climate variability and associated agricultural income losses on the likelihood of outbreaks of armed conflict; ii) Analyse the effect of environmental resource constraints on farmer-herder conflicts escalation in Niger and iii) Evaluate conflict management and resolution techniques. To tackle the objectives of this dissertation, we employed quantitative techniques using primary and secondary data. The theoretical model developed by Chassang and Padro-i-Miquel (2009) is used to illustrate potential channels of violent conflict between actors. In the original model, the authors considered two actors who have to decide whether to engage in costly conflict and redistribution when bargaining fails. For the specific objective two, we used a Heckman two stages model with primary data (collected on 3000 households). In studying conflict resolution, we used qualitative (Isak analytical tools allowed us to evaluate conflict resolution techniques) techniques. The analysis supports the argument that agricultural resource is affected by climate variability. Our results suggest that climate variability, measured as deviations in temperature and precipitation from their past (1990-2016), affects armed conflict through agricultural income. When Instrumental variable method is applied, we find support in our data for the argument that climatic variability affects conflict onset not only through agricultural income changes. The findings also suggest that bad governance affect positively and significantly the probability of conflict escalation. In summary, results suggest that climate variability affects significantly conflict in Niger through agricultural income and even directly (when using instrumental variable method). Climate change in environmentally fragile Sahel communities is one key factor

driving transnational terrorism and inter-ethnic fighting, both of which remain serious downside risks to security in Niger.

Key words: Climate Change, Resource Scarcity, Farmer-Herder, Armed Conflict, Niger

RESUMÉ:

Cette thèse a pour objectif de contribuer à notre compréhension des déclencheurs de conflits armés entre acteurs (État et terroristes ; Agriculteurs et éleveurs) au Niger et de la manière de résoudre ces conflits dans un contexte de changement climatique. La relation entre le changement climatique et les conflits armés est complexe. Les chercheurs ont constaté que les conflits sont de plus en plus concentrés dans les pays les plus pauvre du monde. Le Niger, l'un des pays les plus pauvres, est alimenté par une économie basée sur l'agriculture. Bien que les conditions climatiques ne soient ni nécessaires ni suffisantes pour que des conflits surviennent, des modifications de ces conditions pourraient avoir un impact mesurable sur la probabilité et l'intensité des conflits, en maintenant immuables les autres facteurs liés au conflit. L'enjeu empirique de cette thèse est de quantifier cet effet au Niger. Le travail visait plus particulièrement à i) évaluer l'impact de la variabilité climatique et des pertes de revenus agricoles qui en découlent sur la probabilité de déclenchement d'un conflit armé ; ii) analyser l'effet des contraintes de ressources environnementales sur l'escalade des conflits entre agriculteurs et éleveurs au Niger ; et iii) évaluer les techniques de gestion et de résolution des conflits. Pour atteindre les objectifs de cette thèse, nous avons utilisé des techniques quantitatives utilisant des données primaires et secondaires. Le modèle théorique développé par Chassang et Padro-i-Miquel (2009) est utilisé pour illustrer les canaux potentiels de conflit armé entre acteurs. Dans le modèle original, les auteurs considéraient que deux acteurs devaient décider s'il fallait engager des conflits coûteux et redistribuer leurs efforts lorsque les négociations échouaient. Pour l'objectif spécifique n ° 2, nous avons utilisé un modèle de Heckman à deux étapes avec des données primaires (collectées sur 3 000 ménages). Pour étudier la résolution des conflits, nous avons utilisé des techniques qualitatives (les outils analytiques d'Isak nous ont permis d'évaluer les techniques de résolution des conflits). L'analyse appuie l'argument selon lequel les ressources agricoles sont affectées par la variabilité climatique. Et au retour, les résultats suggèrent que la variabilité climatique, mesurée par les écarts de température et de précipitations par rapport à leur passé (1990-2016), affecte les conflits armés par le biais des revenus agricoles. Lorsque la méthode de la variable instrumentale est appliquée, nos données corroborent l'argument selon lequel la variabilité climatique affecte le déclenchement des conflits, non seulement à travers les variations du revenu agricole mais aussi de manière directe. Les résultats suggèrent également que la mauvaise gouvernance affecte positivement et significativement la probabilité d'une escalade de conflit. En résumé, les résultats suggèrent que la variabilité climatique a un impact significatif sur les conflits au Niger par le biais du revenu agricole et même directement (en utilisant la méthode de la variable instrumentale). Le changement climatique dans les communautés sahéliennes fragiles

du point de vue environnemental est l'un des facteurs clés du terrorisme transnational et des combats interethniques ou intergroupes, qui demeurent tous deux de graves risques pour la sécurité au Niger.

Mots Clés : Changement Climatique ; Rareté des ressources ; Conflits Armés ; Niger

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ABBREVIATIONS

ACLED: African Conflict Location and Events Data

CEN-SAD: The Community of Sahel-Saharan States

CFGCT : Centre de Formation en Gestion des Collectivités Territoriales

ECOWAS: Economic Community of West African States

ENCOP: Environmental Conflict Project

INS : Institut National de la Statistique

GDP: Gross Domestic Product

GECHS: The Global Environmental Change and Human Security

PRIO: Peace Research Institute of Oslo

UNDP: United Nations Development Programme

WAEMU: West African Economic and Monetary Union

WANEP: West African Network for Peacebuilding

WDI: World Development Indicator

GENERAL INTRODUCTION

1. Background

Niger is a Sahelian landlocked country, located in West Africa, whose geographical position, climate and natural environment are harsh. Rainfall is low and characterized by strong inter-annual and space-time variability. This directly affects the agricultural and pastoral production. Niger's economy is heavily dependent on agriculture (farming and raising animals). Exacerbated by climate change, freshwater and access to land scarcities are creating security concerns in the country. Visible signs that show intensification of water scarcity and grazing land include the river Niger, hitherto flowing running dry, wells going deeper to reach water, lakes (Chad, Komadougou, Dallol-Bosso) shrinking causing problems for herders, diminishing rainfall and shrinking arable lands for farmers. Water is a major resource needed for agriculture, and it is decreasing as a result of changes in global climatic conditions. The country's soils are generally not very deep, with low water retention capacity and low organic matter content. The agricultural lands (both for crop and pasture) are becoming further degraded from year to year because of traditional farming methods (tillage) and population growth, notably near the urban centres (Bello & Maman, 2015). The country is characterised by low per capita income, bad governance, bad neighbours, a high population growth rate, weak institutions and it is a landlocked country having only 12 % of its total surface as arable land. Urbanization and population growth are highly contributing to shrink the arable land. Climate change inducing freshwater scarcity is another threat to crop production and pasture availability. Indeed, Sahelian countries are experiencing population pressures, soil degradation, more intense and variable drought cycles, and shifts in agricultural practices (Jones-casey and Knox, 2011). These climatic factors and the weak effort of the state to satisfy national basic needs contribute respectively to the expansion of conflicts between farmers and herders and violent terrorism in the country.

According to the national institute of statistics (*Institut National de la Statistique*, INS), from 1960 to 2010, 80%, on average, of the active population of Niger was primarily employed in agriculture, which accounted for 40% of the country's GDP (INS, 2010). Farmers and herders, who are the main agricultural practitioners, make significant contributions in meeting the nutritional needs of the country, thus contributing to food

security. They are almost wholly dependent on water and land resources to sustain their vocations. In recent times, access to water and grazing land has become more competitive and has led farmers and herders into violent conflicts on a regular basis (CFGCT, 2016). This is a worrisome trend because historically both have for long periods, sharing the same fields for farming and grazing with a manageable level of tolerance and accommodation.

The goal of any country is to foster economic growth and development on a peaceful basis. If climate change results in reduced rainfall and higher temperature that jointly causes droughts, and reduces access to the natural capital that sustains livelihoods, poverty will be more widespread (Bello and Maman, 2015) and the potential for conflict greater.

The national vision of eradicating poverty and allowing the population to have access to its abundant resources (Uranium, Oil, Coal, very divers animal husbandry) and create opportunities under a sustainable environment may be hampered by terror and climate change. According to Fetzek and Mazo (2014), the roles of environmental stress and resource availability are indirect, as they aggravate or amplify the effects of drivers such as poverty, inequality, ethnic tensions, corruption, weak or bad governance or institutions, regime type, high population growth, rising expectations, economic shocks, and history of past. Therefore, there is a need to understand the mechanism through which conflict may occur in the country (as a result of climate change) prevent it, and design mechanisms to solve conflicts if they happen.

In Niger, farmers and herders live in communities together, and interact on a daily basis. This cohabitation network and cooperation among farmers and herders on both community and household level is common in the Sahel (Audu, 2013). More importantly, farmers and herders often interact on a mutual economic relationship of several types: i) patron-client relationships, ii) as landlord and tenant, iii) as sellers and buyers of milk, manure or grain, or as iv) livestock owner, trader and herder (Turner, 2004).

The livelihoods and life chances of communities in Niger are linked to: the complexity of the activities they must engage in - to insure access to resources; the nature of conflicts and co-operation between and inter-ethnic groups; the inconsistent role of

weak government in assisting or constraining their livelihoods; and the negative discourse surrounding farmers or herders that still circulates in some communities and development policy circles. Indeed, it has been purported that in the society that herders are trouble makers and at the same time herders accuse others to minimise their effort in society. Rural livelihood and its complex land-use system have changed markedly over time in Niger, culminating in present-day tensions and conflict in the country.

2. Traditional and New Theories on Conflicts

a) Traditional Theories on Conflicts

"*The efforts of men are utilized in two different ways: they are directed to the production or transformation of economic goods, or else to the appropriation of goods produced by others*." [Vilfredo Pareto]

Correspondingly, there are two ways of making a living. The first aims at producing useful goods and services for exchange with other producers. Alternatively, you might try to appropriate a larger slice of whatever is being produced. These are summarized in economic theory by production and consumption theory and by predation and conflict theory.

Conflict theory shares with exchange theory the central analytic paradigms of optimization on both individual and societal levels of analysis (Congleton, 2002). The key difference is that the social interactions dealt with in exchange theory are a source of mutual advantage, whereas in conflict theory, any advantage gained by one party must come at the expense of its rival (i.e. it is a zero-sum game). Our research work will be based on the economic theory of conflict.

Three effects of climate change (natural disasters, sea-level rise, and increasing resource scarcity) are frequently assumed to lead to loss of livelihood, economic decline, and increased insecurity either directly or through forced migration (Theisen, Gleditsch, and Buhaug, 2013). Interacting with poor governance, societal inequalities, and a bad neighbourhood, these factors in turn may promote political and economic instability, social fragmentation, migration, and inappropriate responses from governments. Eventually this produces increased motivation for instigating violence as well as improved opportunities for mobilization.

The simple scarcity (or neo-Malthusian) model of conflict assumes that if climate change results in a reduction in essential resources for livelihood, such as food or water, those affected by the increasing scarcity may start fighting over the remaining resources. Homer-Dixon, (1994) distinguished between three kinds of environmental scarcity that can increase the risk of violent conflict: (i) Environmental change, which refers to "a human-induced decline in the quantity or quality of a renewable resource that occurs faster than it is renewed by natural processes"; (ii) Population growth, which "reduces a resource's per-capita availability by dividing it among more and more people"; and (iii) Unequal resource distributions, which "concentrates resource in the hands of a few people and subjects the rest to greater scarcity", and which often results when "property rights that govern resource distribution ... change as a result of large-scale development projects or new technologies that alter the relative values of resources". Researchers sought to answer two questions: first, does environmental scarcity contribute to violence in developing countries? Second, if it does, how does it contribute?

The topic of natural resource scarcity, environmental sustainability and degradation under the climate change phenomenon has been addressed by several theoretical formulations. This dissertation will be based on the theory of the Tragedy of the Commons, and the Neo-Malthusian theory of environmental scarcity and conflict.

i) Theory of the Tragedy of the Commons

The theory of the Tragedy of the Commons states that when a resource is collectively owned by a group of people, each will exploit the resource, overusing it, ignoring the group's collective interest, and thus ultimately destroying the resource. The theory was postulated by Hardin (1968). He explained the 'tragedy' by using the example of a pasture which is open to all to use. This open pasture is used by herdsmen to allow their cattle to graze, and each herdsman will continue to add cattle to the pasture so as to expand the amount of proceeds coming from their herd. The Commons dilemma stands as a model for a great variety of present resource problems such as freshwater scarcity and pollution, land degradation, and the depletion of non-renewable energy sources. So, regarding Hardin's theory, the earth's atmosphere is the 'common'. The 'tragedy' is the damage done to the atmosphere that causes global warming, climate change and scarcity

of environmental services shared by all. Simply put, as the resources become scarcer, competition and conflict over them will increase.

ii) The neo-Malthusian Theory

The neo-Malthusian theory predicts that world population would soon exceed the resource base and lead to serious environmental destruction, widespread hunger and violent conflicts. Homer-Dixon is the most influential scholar of the neo-Malthusian position. Indeed, with other scholars like Kaplan (1994) they argued that resource scarcities can cause violent intrastate conflict under unfavourable conditions. Homer-Dixon (1999) used three hypotheses to link environmental changes with violent conflict. First, he suggested that decreasing supplies of physically controllable environmental resources, such as clean water and good agricultural land, would provoke conflicts. The second hypothesis stated that large population movements caused by environmental stress would induce "group-identity" conflicts, especially ethnic clashes. The third hypothesis suggested that severe environmental scarcity would simultaneously increase economic deprivation and disrupt key social institutions, which in turn would cause "deprivation" conflicts such as civil strife and insurgency.

Looking at these theories, our study will therefore, be conducted to identify the main triggers of conflict in general and triggers of the specific farmer-herder conflict in Niger. The study will also discuss how possible it is to solve and probably to prevent such conflict in the country.

b) New Schools of Thought on Conflicts

i) The Toronto Group around Homer-Dixon

Homer-Dixon examined the circumstances under which environmentally-induced stress causes conflicts both intrastate and inter states. In order to find out how conflicts induced by environmental problems progress, the author has conducted a number of qualitative case studies on conflicts in developing countries where, a close link between environmental stress and conflict was assumed. This scholar and his colleagues have concentrated their studies on environmental problems that can be caused by the scarcity of renewable resources and environmental changes. Many types of environmental

change were looked at: climate change, depletion of the stratospheric ozone layer, deforestation, agricultural land degradation, degradation of water resources, and fish stock depletion. The scarcity of renewable resources is the central focus in the research of this school. Though there is no evidence of a direct link between resource scarcity and conflict escalation, in their studies they indicate that environmentally-induced resource scarcity, in combination with political, economic and social factors, can lead to the destabilization of states and societies, thus conflict. Furthermore, they argue that the destruction or scarcity of environmental resources has already contributed to a dynamic of violent conflicts in many developing countries (Homer-Dixon 1991, 1994, 1999).

ii) The Zurich Group around Bächler and Spillman

According to Bächler and Spillmann (1996), the Environmental Conflict Project (ENCOP) report is based on qualitative case studies focusing on developing countries that had to deal with both environmental problems and armed conflict. The basic assumption behind the ENCOP is that environmental change may lead indirectly to conflict by intensifying the existing potential for socio-economic conflict to the point of violence escalation. The argument of this school is that conflicts are primarily socially or politically motivated and not due to an irreversible consequence of environmental change. Their aim is to differentiate between typologies of conflicts that are triggered by particular kinds of environmental degradation to its socio-economic consequences and the affected parties to the conflict. The following categories of conflicts were summarised, based on an analysis of 40 environmental conflicts:

- ✓ Centre-periphery conflicts
- ✓ Ethno-ecological conflicts
- ✓ Regional, cross-border and demographically-induced conflicts
- ✓ Migration conflicts
- ✓ International water conflicts
- ✓ Conflicts arising from distant sources

These categorisations show how contextual factors other than the impacts of resource degradation ultimately determine whether competing actors will seek collaboration, or fight. Therefore, for environmental stress to cause conflict there must be lack of societal mechanisms for regulating conflict, an instrumentation of environmental degradation for group-specific interests, group identities, and the influence of past conflict.

Two additional approaches have been developed, based on the criticism of the previous schools. We have the group of scholars around Gleditsch, whose work is based on quantitative studies, and Matthew's Global Environmental Change and Human Security (GECHS) project that focuses on the adaptive capacity of human societies.

iii) The Oslo Group around Gleditsch

To criticize the previous schools (Toronto and ENCOP), Gleditsch in 1998 did an independent quantitative study at the International Peace Research Institute of Oslo (PRIO). The aim was to break down the complexity of qualitative models and to provide a correction to their deficiencies regarding the selection of case studies, mainly directed to countries with conflicts over resources (Gleditsch, 1998). According to Gleditsch, robust conclusions on whether environmental resource scarcity causes conflict can only be drawn when studies compare scarcity leading to conflict and abundance leading to peace. He argues that an abundance of resources is more likely to lead to armed conflict, because rebel groups, for example, draw their funding from the exploitation of natural resources. Gleditsch emphasizes strongly that environmental stress is only one of several variables that may contribute to the escalation of conflict. To summarize the thought of this school, while environmental factors such as deforestation, soil degradation and water scarcity increase the risk of violent conflict within states, the crucial explanations of conflict escalation remain: economic and political factors (Hauge and Ellingsen 1998; Gleditsch and Paul 2001).

iv) The Irvine Group around Matthew

The Global Environmental Change and Human Security (GECHS) project headed by Matthew has been set up at the Centre for Unconventional Security Affairs hosted by the University of California in Irvine. By considering human security as a theoretical starting point, Matthew has examined the impacts of environmental change on individuals and societies. The school aim to foster a new theoretical orientation focused more on the long-term adaptability of humans and societies and extending the range of methods and instruments used. To do so, they suggest that researchers should be engaged in interdisciplinary cooperation, making use of research on conflict and cooperation and carrying out microanalyses. This school argues that shortcomings on the nexus are: quantifiable empirical research regarding the relevance of demography as a factor, analysis of whether resource abundance or resource scarcity hold the greater

risk of conflict, and finally whether environmental degradation might actually promote cooperation rather than cause conflict (Matthew, Brklacich, and McDonald, 2003).

c) Agreement

Despite fundamental differences between schools of thought regarding the nexus of environmental stresses and conflict, there are considerable points of agreement about the main research findings:

- ✓ Multi-causality: All approaches emphasize the multi-causality of the observed conflicts. There is a consensus that environmental degradation is always only one of several paths through which conflict happens, and that environmental degradation rarely is the decisive factor.
- ✓ Locality: There is also consensus about the locality of the conflicts induced by environmental degradation. Indeed, they are predominantly intrastate conflicts; even when they can be categorized as cross-border conflicts, they are generally not classical interstate conflicts but rather regionally limited clashes at the sub-national level, such as between states that border on the same rivers or lakes.
- ✓ Problem-solving capacity: All schools emphasize on the central role of a state's or society's problem-solving capacity with regard to the emergence and management of conflicts. In places where political and societal institutions are weak, there is a higher probability for actors to be unable to prevent conflict. Crisis hotspots are therefore assumed to be located in countries and regions considered weak in terms of their problem-solving capacity.

To summarize, there has been no evidence that environmental stresses are the direct cause of conflict, and there have been no "environmental wars" manifesting the most extreme form of interstate conflict. To date, there is no evidence to suggest any unambiguous causal links between environmental change and violent interstate conflict. However, it certainly cannot be ruled out that environmental degradation can have destabilizing impacts on several parameters that may lead to conflict. Therefore, a link between environmental change and violent conflict remains a plausible possibility worth studying especially in poor countries such as Niger.

d) Fundamental Critique

Environmental security analysis has been criticized by several scholars as being part of the North-South discourse, and the inappropriate "colonization of environmental problems" by security discourse (Barnett 2000; Dalby 2002). According to these critics, theories on environmental security suggest that the underdeveloped South poses a physical threat to the prosperous North, in that population explosions, migration and resource scarcity necessarily lead to disputes over distribution and conflicts of interest that can be solved only by military means. According to Barnett, the industrialized world is under suspicion of exploiting such scenarios of threat in order to attack the 'uncivilized South' and to close off their own borders. In this view, environmental security is committed less to the security of people on the ground than to the national interests of the industrialized world. The real causes of environmental problems, as well as the large-scale injustices that always exist in the global use and distribution of natural resources, are hidden in favour of shoring up the global political status quo.

3. Problem and Justification

This study seeks to deepen our understanding of how climate change can trigger armed conflict between actors in Niger. Conflicts are increasingly concentrated in the poorest portion of the world's countries. For about three (3) decades Niger is facing many insecurity problems starting from rebellion, terrorism (Boko Haram, AQMI) to repetitive conflict between farmers and herders. Though climatic conditions per se, do not cause conflict (Burke, Hsiang, and Miguel 2015), but changes in climate parameters can alter the conditions under which certain social interactions occur and thus have the potential to change the likelihood that conflict occurs. Indeed, climatic conditions are neither necessary nor sufficient for conflicts to occur, but changes in climatic conditions could have a measurable impact on the probability and intensity of conflict, holding other conflict-related factors fixed (Burke et al., 2015). The key empirical challenge addressed by the literature to date has been to quantify this effect.

Future environmental changes may place further strains on poor countries, possibly reducing the prospects for conflict resolution and sustained economic growth. According to Homer-Dixon, (1995) poor countries will be the first to experience conflict caused by environmental degradation. Indeed, in these countries, poverty is a hindrance for acquiring sufficient capital for finding solutions to environmental problems, thus there will be a destruction of the resources as management lacks, and

this will accordingly lead to poverty. Another reason is that poor countries are even harder struck because they do not have the means to curb population growth, which will lead to more resource stress. Because population is growing and environmental damage progresses, in line with the Malthusian chorus, policymakers in these weak states will have less and less capacity to intervene.

In recent times, freshwater scarcity in Niger, as reported by the media to have increased the prevalence of conflicts between farmers and pastoralists – because they are among those whose sources of livelihood is threatened the most. Competition for access to the diminishing freshwater resources often pitched both groups against each other. The predisposition of people to fight are obvious if we define conflict in Collier & Hoeffler's, (1998) terms. Given the characteristics of the country, it is part of the bottom billion as defined by Collier (2007)[1]. Indeed, the countries of the bottom billion are defined as low-income countries that were caught in one or other of four development traps. The traps are explained in the Book titled the Bottom Billion. Farmers and Herders living in Niger must cope with variations in pasture conditions and climatic uncertainties. These uncertainties create perpetual disequilibrium between stocking rates and annual rangeland productivity (Brigitte and Simon 2001). These phenomena create potential areas of conflicts between farmers and herders in Niger with every group projecting its interests in resource allocation, access, management, and control.

The nexus between climate change and conflict is complex. Indeed, to date, the literature about this research area is mixed and inconclusive (e.g., Bernauer, Böhmelt, and Koubi 2012; Nordås and Gleditsch 2015; Meierding 2013; Gleditsch 2012; Scheffran, et al, 2012; Theisen, et al. 2013). Several studies aim to explain how climate variability (such as drought, flood or temperature changes), via its impact on agriculture output and on macroeconomic performance, affect conflict. Without being exhaustive we can cite Miguel, et al. (2004), Hendrix and Glaser, (2007), Ciccone, (2011) and Koubi, et al. (2012). Many authors claim that climate change's adverse effects are robustly linked to the risk of conflict while some fail to find a connection between them. There is no single, dominant view of how climate change and conflict interact but the perspective that scarce natural resources drive conflict features prominently in policy and reportage on contemporary conflicts. The two most prominent perspectives on the correlation between climate change and conflict are there:

[1] See appendices giving list of countries belonging to this category

(i) Perspective one: climate change is worsening resource scarcities and generating new conflicts and security challenges. This perspective argues that climate change will cause conflict through intermediary impacts such as the breakdown of social relations and institutional failures (see Sachs 2008);

(ii) Perspective two: Climate change does not cause conflict. The effectiveness of governance and institutions to respond to climate shocks and variability will determine the likelihood of conflict and/or collaboration around resources (see Kevane and Gray 2008; Barnett and Adger (2007).

According to Ofuoku and Isife (2009) farmer-herder conflict is a problem worth to be studying in economics because it has several socio-economic effects: i) Reduction in output and income of crop farmers as a result of the destruction of crops by cattle, and indiscriminate bush burning. Farmers can lose part or the whole of their crops. This means reduced yields which translates into low income on the part of the farmers who take farming as a major occupation. This tends to negatively affect their savings, and credit repayment ability, as well the food security and economic welfare of urban dwellers that depend on these farmers and herders for some food and milk supply.

Niger is one of the poorest countries as shown in the recent (last position from 2008-2015) Human Development Index (HDI) classification. Thus, any efforts to address armed conflicts will go a long way to ensuring food security. The losses occasioned by armed conflicts may not be compensate by schemes such as subsidizing food price, redistribution programs or by developing crop insurance given the poor nature of the country. Economic productivity in areas with predominantly rain-fed agriculture, such as Niger, could be inherently sensitive to climate variability and extreme weather events such as drought. Accordingly, the opportunity cost of joining violent action to compensate potential losses would decrease in periods with unfavourable climatic conditions. To redress their grievances individuals may be motivated to join and/or support an active opposition movement or a terrorist organization, thus increasing the likelihood of violence escalation. For Farmers and Herders, resource scarcity such as freshwater and land access may lead to deadly conflict for fighting over the remaining resources.

4. Expected value-added

This dissertation will make several contributions to the existing literature. First, and perhaps most importantly, our contribution will be on the method used in studying the climate change and conflict nexus. We employ the theoretical model, developed by Chassang & Padró, (2009) to illustrate potential channels of violent conflicts. We believe that the innovation is about relaxing some assumptions of the original model, and by well defining the objectives of the agents. Second, to date, and to the best of our knowledge, there is no specific economic study of conflict in Niger, though there is a lot of divergent and inconclusive literature on the entire world, for Sub-Saharan Africa, for East Africa, and so on. This disaggregation is one of the key recommendations from the existing literature (e.g. Burke et al., 2015). Third, the dissertation contribute to the microeconomic strand of the empirical literature that has been dominated by cross-country studies (e.g., Blattman & Miguel, 2010). Also, our work will differ from Maystadt & Ecker, (2014), because we consider not price shocks as transmission mechanisms. Rather, we use income from agriculture (cropping and livestock), because conflict is occurring mainly in Niger between these actors and not within farmers' communities or herders among themselves. Importantly, the cross-country nature of previous studies, leaves regional (subnational) heterogeneity unobserved and thus limits the ability to derive context-specific recommendations for effective strategies and national policies of conflict prevention (Maystadt & Ecker, 2014) . In contrast, we analyse the heterogeneity at the administrative region level. Another important contribution is the primary data we collect from farmers and herders which is reported in the literature to be rare.

5. Policy Relevance

This dissertation aims to contribute to our understanding of armed conflict's triggers under climate change. Though we are not expecting to provide an exhaustive description of this complex areas, we are expecting to contribute in a complementary way to what has been done by researchers. The work adds to national efforts to pave the way for improved policy design and implementation for the country. The work states clearly the economic view of what are triggers of armed conflict in Niger. Thus, suggests some measures to prevent or resolve conflict in Niger which helps avoiding

loss of lives and economic damages. Indeed, the national Sustainable Development Strategy and Inclusive Growth (SDDCI-2035) is not achievable with violent conflicts.

6. Research Questions, Objectives and Hypotheses

a) Research Questions

The main research question of this thesis is: How does resource scarcity due to climate change causes armed conflicts in Niger?

The specific questions are:

Q1: Do losses of agricultural income fuel armed conflicts in Niger?

Q2: Do environmental resource constraints have an effect on farmer-herder conflict?

Q3: What mechanisms do actors adopt to resolve conflicts?

b) Research Objectives

The main objective of this dissertation is to determine how resource scarcity due to climate change causes violent conflict in Niger.

Specifically, we aim to:

1) Estimate the effect of climate variability and associated agricultural income losses on the likelihood of outbreaks of violent conflict.
2) Analyse the effect of environmental resource constraints on farmer-herder conflicts escalation in Niger.
3) Evaluate conflict management and resolution techniques.

c) Research Hypotheses

Hypotheses 1: Climate variability and associated agricultural income losses do not have significant effect on the likelihood of occurrence of conflict.

Hypotheses 2: Scarcity of environmental resources increases the probability of violence between competing groups.

Hypotheses 3: Conflicts are resolve even when actors interest are opposed.

7. Methodology Brief

To tackle the objectives of this dissertation, we employ quantitative and qualitative techniques using primary and secondary data.

The theoretical model developed by Chassang and Padro-i-Miquel (2009) is used to illustrate potential channels of violent conflict between actors for the first specific objective. In the original model, the authors considered two actors who have to decide whether to engage in costly conflict and redistribution when bargaining fails. For the primary data (collected on 3000 households), we used a Heckman two stages model to solve the second specific objective. The qualitative data (interviews of key NGOs and local authorities and farmer-herder communities) were used through Svenson's (2014) method and helped us analysing our results and for policy recommendations.

8. Organization

This dissertation is structured as followed: After this general introduction, the chapter one presents the stylized facts on climate change and conflict nexus. The chapter two presents the analysis of violent conflict in Niger using modified model of Padro-i-Miquel (2009) and panel data from the Armed Conflict Location and Event Data Project (ACLED). Our point is to underscore key fault lines in the field with respect to methods and findings. In order to narrow out scope somewhat in this chapter, we focus largely, but not exclusively, on the quantitative literature. In chapter three, we present the analysis of the specific farmer-herder conflict using the primary data and a Heckman two stages model. The chapter four presents the evaluation of conflicts resolution techniques. Finally, we have in the last section of the dissertation a general conclusion and caveats

1.0. CHAPTER ONE: CLIMATE CHANGE AND ARMED CONFLICTS NEXUS

1.1. Introduction

The central purpose of conflict economics is to promote an understanding of the economic nature, causes, and consequences of conflict (Anderton and Carter, 2009). This chapter presents and develops different factors reported to cause armed conflict in general. It describes the statistics of conflicts in Niger and concepts linked to climate change.

1.2. Concepts of Climate Change and Conflicts

Studying the nexus between climate change and conflict is highly debatable probably because of differences in defining concepts and methods used. The following concepts are defined in order to have a comparison basis when results are presented.

a) Natural Good/Services:

Natural goods are tangibles derived from a natural resource to sustain directly human livelihood. Land is a natural resource on which crops are grown for livelihood and food provision. It is also used to grow pasture and forage for animals. On the other hand, natural services are intangible and derived from the natural characteristics of the ecosystem structure and functions, and include the flow of energy and materials, nutrient storage, distribution and cycling, provision of wildlife habitat, biomass production, and air for breathing. In the short run, an unsustainable exploitation of natural resources may produce more natural goods, but in the long run it will ultimately lead to declining services and deteriorating health of the resources and drastic reduction in the volume of natural goods produced.

The utility from the goods and services must flow and be enjoyed across the different strata of society, or by all the actors that depend on the resource directly or indirectly. Conflicts often arise when the activity of a party or an actor in the common pool resource severely compromises the quality or quantity of the common resource to the point that the other actors cannot fulfil their livelihood or welfare aspirations. Any

situation where a part of a common pool resource being enjoyed by a group is destroyed or compromised by another group in the way to fulfilling its own livelihood aspirations constitutes a recipe for human insecurity (Fasona & Olorunfemi, 2016).

b) Property Rights

The sustainability of natural goods and services depends to a large extent on the ownership of and access to common pool resources. Therefore, it is important to have a regulator (the government or institutions) in resource governance. Grafton et al., (2004) posit that a property right exists over an asset whenever a recognizable entity is able to exclude, at least partially, others from either using it or enjoying a flow of benefits of its usage. Property rights can be individual rights or shared between individuals and groups.

Environmental sustainability depends on who holds property rights over assets, and the nature of these rights. By definition, public goods, unlike private goods, are inherently non-rival in use. In the Sahel, the land-use system is very complex. Indeed, a piece of land that is a grazing area in the dry season may become a farmland during the wet season. Land and pasture, like many other environmental assets in Niger, are neither pure public goods nor private goods, but common pool resources where exclusion is difficult. However, one group's use of the resource reduces the ability of the other to either use or enjoy it. This is the case of farmers' and herders' relationship regarding land and freshwater usage. In Niger, there are many factors contributing to conflict potential: poor land management, lack of land administration procedures, absence of property rights (private rights for individual lands, community rights, state rights, or a mix of these right regimes). This state results in a tragedy of the commons where individual users consider only their private costs and not the costs their actions imposed on other resource users.

c) Conflict

One of the reasons for the divergent literature regarding climate change and conflict is the definition of conflict, and its sense in studies. Indeed, conflict needs to be defined in context. Under a climate change scenario, stresses, strains, and confrontations will characterize human relationships at all social levels. The majority of the extant literature on studying the climate change and conflict nexus anticipates that climate change will make resource scarcer and so produce conflict ("competition") over access to land,

water, and other resources. However, interpretations differ over whether such competitions will end in destructive violence or constructive cooperation. There is also debate on whether the main triggers of conflict and violence are climate change related, or political, and if political, what to do about them. Whereas many economists tend to view all conflict as a threat, conflict-transformation professionals often view conflict as constructive (e.g. Groper, 2008). For instance, Gopin, (2009) summarizes this positive-minded position succinctly: "Conflict itself is often quite constructive in human relations, it leads people toward shared goals, greater efficiency, greater justice, and greater trust. It is the destructive aspects of conflict, such as the verbal and physical abuse of the parties, that is the most damaging, and which creates a cycle of retaliation. Third party intervention is required to break that cycle or spiral of retaliation".
Thus, conflict can be positive or negative in its impacts, which may turn violent or not, depending on pre-existing conditions, current contexts, and outlooks favouring hopelessness versus hopefulness.

The Armed Conflict Database has been developed by the International Peace Research Institute of Oslo, Norway, and the University of Uppsala (PRIO/Uppsala), Sweden. In this database, an armed conflict is defined as follows: "an armed conflict is a contested incompatibility which concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths." However, in our work we consider conflict to be the use of force (fighting) between farmers and herders, terrorism or even rebellion resulting in loss of human lives or resource damage. We believe that such conflict does not have to result in many deaths to be harmful to the social cohesion or to a weak economy in short and long run. We use interchangeably the terms of conflict, armed conflict, or violence, to qualify the conflict between farmers and herders, terrorism or rebellion.

Use of armed force: use of arms in order to promote the parties' general position in the conflict possibility, resulting in deaths or resource damage.
Arms: any material means, e.g. manufactured weapons but also sticks, stones, fire, water, etc.

d) Climate Change

Climate change refers to the long-term trends and processes in weather change reflected in recent years in hotter temperatures ("global warming") and more-severe weather patterns. Conditions are most intensively studied and authoritatively reported to policymakers by the Intergovernmental Panel on Climate Change, a joint scientific effort of the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO), established in 1989 in the wake of the Brundtland report. These changes are reflected by more-destructive storms, particularly those involving battering of land masses and human habitations with water from wind-blown rains and wind-swept seas, and also, in some regions such as Sahel, more-widespread, more-frequent, multiyear, and more-destructive droughts. According to Brown & Crawford, (2008) (2007) researchers are increasingly reporting climate change as a "security threat" associated with political destabilization, which undermines state capacity to cope in response to severe weather, flooding, drought and land degradation, or other climate-related changes.

e) Freshwater and land-use issues

Freshwater scarcity, drought, desertification, flooding, and land degradation are all concepts, measurements, and determinations of status that, like famines, have cultural-political dimensions. Access to water is increasingly conceptualized and negotiated as a legal, political, and cultural right, and patterns of water utilization are judged according to norms of environmental and social justice. Climate change adds additional concerns about sustainability, competition, and conflict over the resources.

For their economic livelihoods, herders and farmers are reported to fight because of changing land use systems, land access and freshwater scarcity. In addition, with the decentralization in the country, state bureaucrats play commercial politics and allow some interests to enclose what had been collective lands and restrict access to water in some areas. As a result, multiple social levels of conflict surround access to land and water livelihood resources, which are being and will be reduced further by climate change.

It appears that conflicts contribute to resource scarcity. For instance, conflicts include more deforestation, land degradation, water pollution, groundwater contamination, and unsustainable extraction. These become "resource scarcity" sources of conflict in the

next round. The next section presents the thought of different schools about the relationships between environment and conflict.

1.3. General Characteristics of Niger

Niger is a Sahelian landlocked country whose nearest point to the sea is about 700 km. It covers a surface area of 1,267,000 km^2. It is located between the longitude 0°16' and 16° East and the latitude 11°1' and 23°17' North. Three fourth of the country's land area is occupied by deserts.

The country's economy is mainly based on agriculture, especially cropping and cattle breeding. Soils are generally poor, and the area potentially suitable for crop production, estimated at 15 million hectares, represents 12% of the country's total surface area. Urbanization and population growth are contributing to shrink the arable land. Climate change is also another threat to land productivity. Together these phenomena create potential areas of conflicts between farmers and herders in Niger with every group projecting its interests in resource allocation, access, management, and control. Even the arable lands are mainly covered by dunes, not very productive and sensitive to water and wind erosion. The potential of irrigable land is estimated at 270,000 hectares, of which 140,000 hectares in the Niger river valley. The population was estimated at 16, 267,255 in 2012 (General census, December 2012) and is expected to be 20 million by 2018. Mainly rural, the population draws most of its non-agriculture income from natural resource exploitation. The growth rate of the population is one of the highest in the world, about 3.7 % in 2016. This population growth, combined with difficult climatic conditions (droughts, floods…) and inadequate and not very rational use of natural resources has led to ecological imbalances expressed by the deterioration of livelihoods.

Three climatic zones are observed in Niger:

- The Sahel and Sudan zone that represents about 1% of the country's total surface area, and receives an annual rainfall ranging from 600 mm to 800 mm. It is suitable for agriculture and livestock production;
- The Sahel and Sahara zone that represents 12% of the country's surface area and receives an annual rainfall average ranging from 150 to 300 mm. It is suitable for nomadic livestock;
- The Saharan desert zone, which covers 77% of the country's surface area and

receives less than 150 mm of rainfall per year. People practice irrigated farming.
(Sources: (UNDP/ GEF report on the environmental state in Niger Republic and the National Meteorological Department, 2005).

The soils cultivated in Niger have a widespread organic matter and phosphorus deficiency. They are affected by a continuous fertility decrease, a trend toward acidification, sensitivity to water and wind erosion, poor water retention capacity, and alkalinisation and salinization. It must be noticed that 80% to 85% of the lands suitable for cultivation are sandy, and only 15% to 20% are hydromorphic and slightly clayey (Institut de Recherche Agronomiques du Niger (INRAN), 2005).

As regards to water resources, despite its dry climate, Niger has important ground and surface water resources which represent the main water supply of the country. However, the hydrographical network is relatively modest compared to the situation in other West African countries. The major constraint is the accessibility to these resources, because the exploitation conditions are often difficult. At this very moment, this difficulty does not allow the creation of necessary optimum conditions to the satisfaction of people's needs, livestock and other economic activities. The ground water renewal rate is estimated at 2.5 billion m^3 per year. The non-renewable ground water resources are estimated at 2000 billion m^3. The surface water resources are estimated at about 30 billion m^3 per year.

1.3.1. Precipitations' Trend in Niger from 1921-2016

The following figure 1 represents the evolution of precipitation means over the national territory from 1944 to 2012. From this graph it is clear that on average, precipitation trend is decreasing at national level.

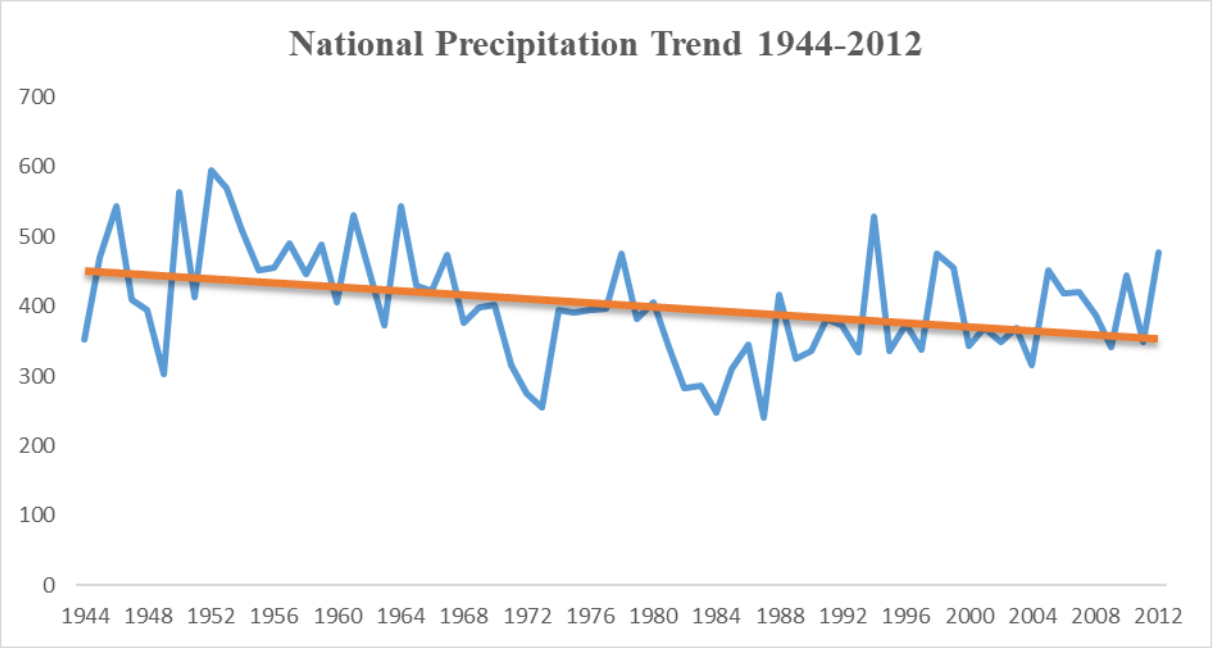

Figure 1: Precipitation Trend 1944-2012

Source: From INS database 2016

To read thoroughly the trend, we draw the figure 2 to represent anomalies and to see years of abundant or deficit precipitation. One can see that serious precipitation anomalies started in the 70s and from then it has become repetitive. The worst period of precipitation deficit is the one of 80s. However, some years registered a very high amount of precipitation and they collide with years of flood in the country.

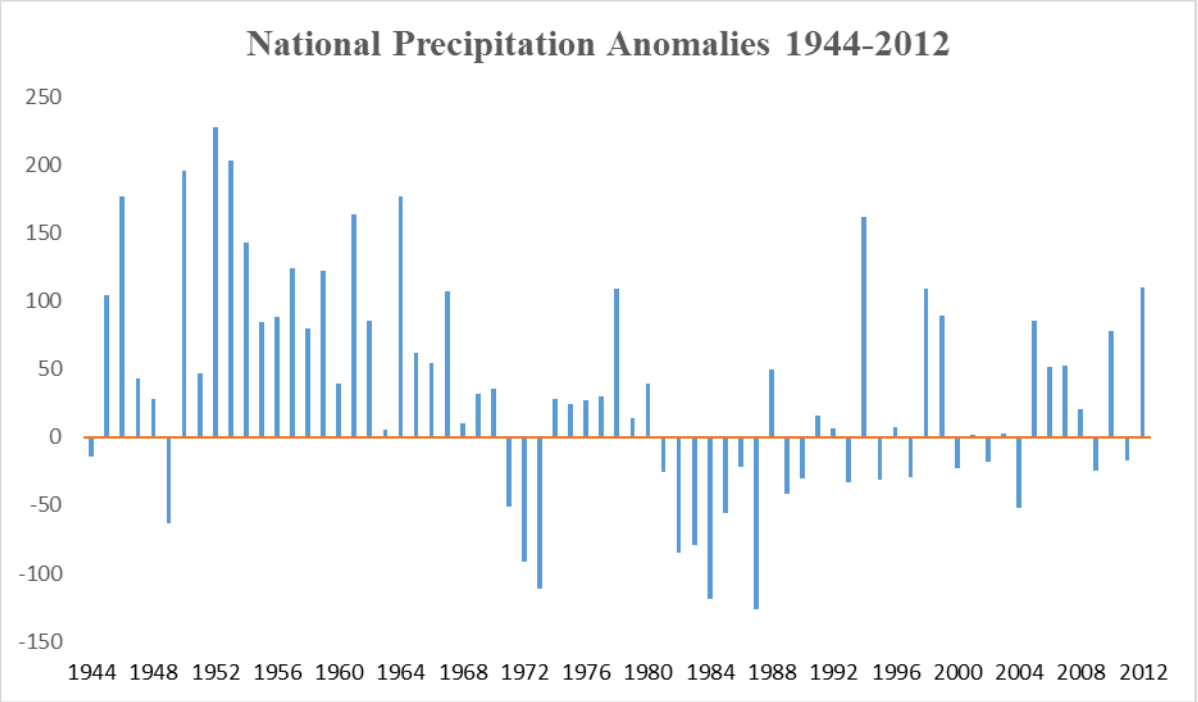

Figure 2: Precipitation Anomalies 1944-2012

Source: From INS database 2016

1.3.2. Livestock and Crop Production in Niger

Despite the difficult climatic conditions of the country, there considerable resources in terms of livestock and crop diversity. Unfortunately, both crops and livestock are relying on rainfall and its characteristics.

a) Livestock Production

According to Kamuanga, et al. (2008) livestock contributes about 35 % of Nigerien agricultural GDP. The Cattle population is estimated at 9.214 million head, giving about one head of cattle for each two people. The livestock production system is predominantly pastoral with 26 and 38 % of the households engaged in pastoral, and agro-pastoral production systems respectively (see Table 1). The average herd size is 11 and the maximum size is 122, and cows represent 40 % of the herd size. Livestock productivity in the country is low. Indeed, the average daily milk production per cow in Niger is only 1.4 litres, a level which is even less than the overall average of 1.6 litre per day per local breed cow in the Sahelian region (Desta, 2002). The low productivity is a result of low and highly variable rainfall, poor rangeland management, and poor livestock breeds. Improved pasture management represents only 4% of the grazing system, suggesting that the use of degraded grasslands dominates the production

systems (Bokar, et al. 2016). Otte and Chilonda (2002) estimated the milk off-take per lactation of about 185 kg in the Arid and Semi-Arid Lands (ASAL) and 750 kg in the sub-humid and humid areas.

Table 1: Livelihoods of rural communities, adoption of pasture management and breeds productivity and composition of livestock

Household Characteristics	Statistic
Own livestock (% of the total of rural communities' livestock)	97
Practice rotational grazing (%)	2.24
Milk production per day per cow (litters), 3 months after calving	1.4
Own cross-bred cattle (%)	2.1
Household production systems (% of agricultural households)	
Crop production only	37
Agro-pastoral	38
Pastoral	26
Households using improved pasture management (%)[a]	4
Shoats (goats and sheep) herd size	16
Cattle herd size (number of heads)	13
Cattle off-take (head of cattle)	0.16
Herd composition of cattle (%)[b]	
Ox	3
Bull	15
Cow	40
Young Bull/Young	12
Heifer	12
Calf	19
Milking cows	19
Adult cattle	58
Improved breeds (cross-breed or exotic breeds	11

Notes: [a]Improved pasture management include rotational grazing and managed natural regeneration. No farmer reported planted pasture.

[b]Calves =< 1 year, young males and heifers = 1-3 years, males =< 3 years (not specified whether bulls or oxen), cows => 3 years

Source: Bokar, et al. (2016)

- **Livestock Production per Region 1990-2016**

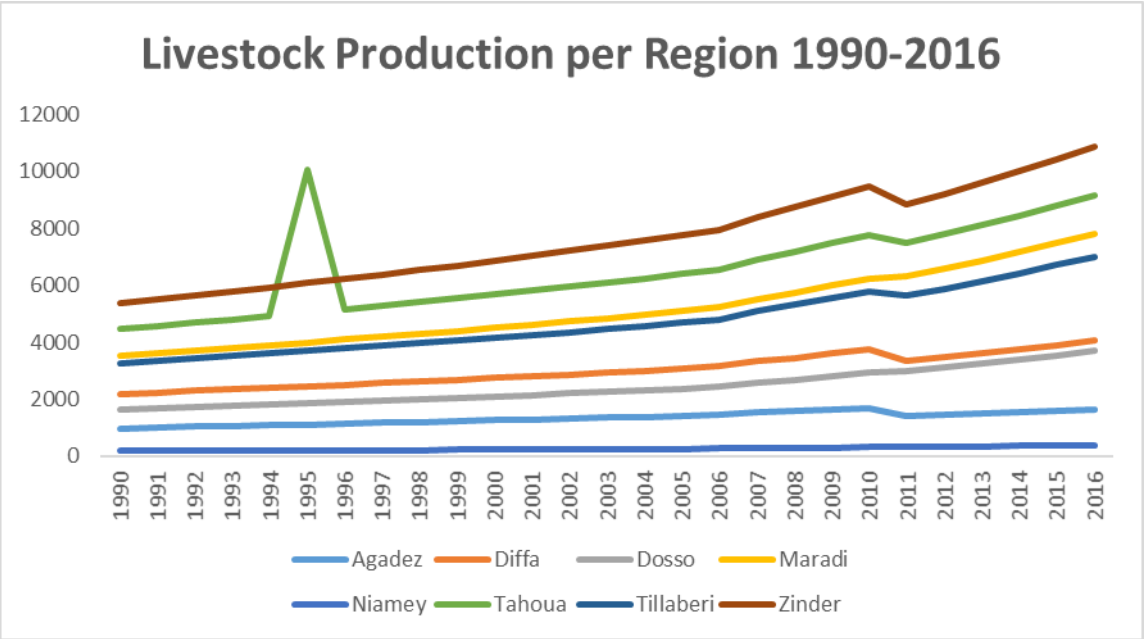

Figure 3: Livestock Production per Region 1990-2016

Source: From INS database 2016

b) Crop Production

The three most important crops in Niger are: millet, cowpeas and sorghum, and they account for 94 % of cropland area (see Table 2). Other crops, namely maize and rice are not widely grown in the country due to their high-water requirements. However, their consumption has been increasing, probably because staple diet crops are not sufficiently yielding, and because of urban tastes change. For example, per capita net rice imports increased from 8 kg in 2000 to 11 kg in 2011 (FAOSTAT, 2014). Actual yield achieved by farmers are very low, especially for cowpeas, sorghum and maize, where yields are less than 50 % of the potential. This means that the country could enjoy much better yields and food security by using different technologies and innovations. According to Tabo, et al. (2009), micro-dosing and moisture-conservation technologies are among the agronomic practices that could be used to simultaneously increase yield and reduce high risk production in the Sahelian region.

Table 2: Cultivated area and actual and potential yield of major crops in Niger

	Cropland area (1000 ha)	Share of total cropland (%)	Actual yield (Tons/ha))	Yield potential (Tons/ha)	Actual yield as % of potential (%)
Millet	7100	44.4	0.5	1.0	50
Cowpeas	4900	30.6	0.2	0.8	25
Sorghum	3100	19.4	0.3	1.0	30
Rice	13	0.1	1.9	3.0	63
Maize	13	0.1	0.9	2.0	45
Total	15126.5	94.5			
Total cropland area	16000	100			

Source: Extracted from Bokar *et al*. 2016

In Niger, yields are so far below the potential because of many reasons. First of all, agriculture is of rain-fed type, and irrigation is not developed even along the Niger river. This may be explained by the lack of technologies and financial resources to invest in growing crops with good yields. Secondly, the land ownership is not giving room to potential investors to use the land in a productive way. Lands are mostly not commercialized and not under cooperatives, and owners are not financially capable to use them. Another reason is the gender issue. Indeed, women are hardly having access to land while they constitute good users and well organised (cooperatives) groups. Probably because of culture and very weak understanding of religions.

- **Crop Production Per Region 1990-2016**

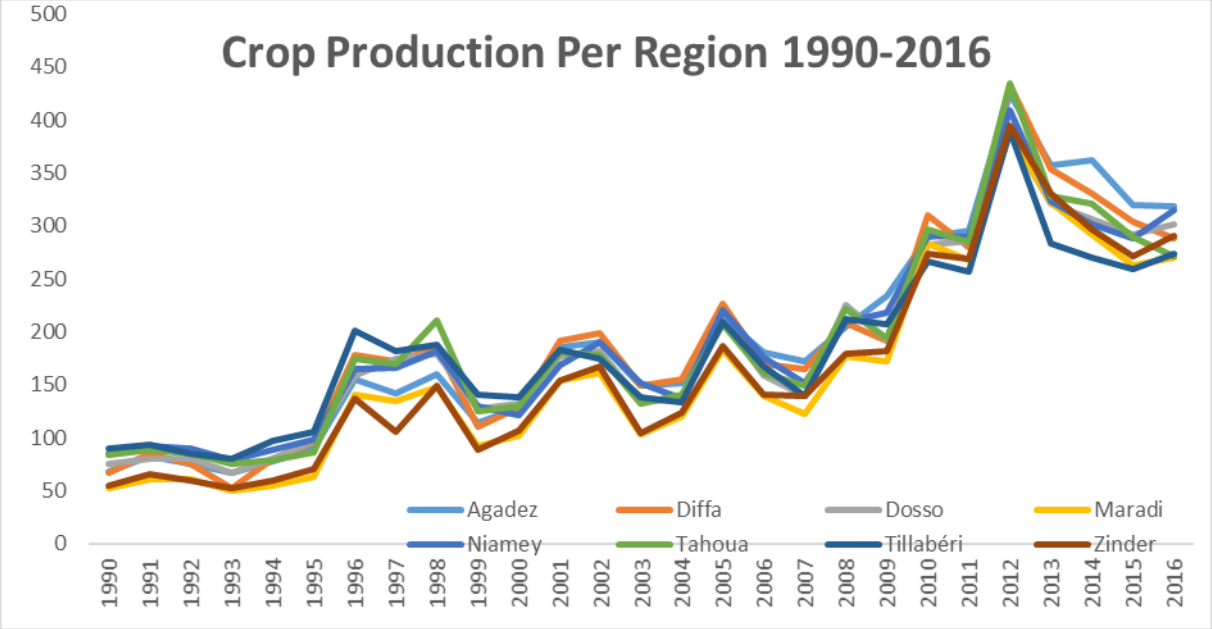

Figure 4: Crop Production Per Region 1990-2016

Source: From INS database 2016

1.4. Different Type of Conflicts

According to Seydou (2008), conflict in Sahel can be classified as follow:

- Intra personal conflicts: They are internal fights from a person to make choice, decisions in building project or achieving some objectives or obeying to societal principles. Such conflicts have consequences on the relations with others and the society.

- Inter personal conflict: It opposes two individuals because each has his needs, his desire and his values to defend. Such conflicts are very frequent and mostly sprayed to inter group or intra group conflict.

- Intra group conflict: This is conflict occurring between individuals from the same group (political, professions…). It originates mostly when there is a failure in managing natural resources.

- Inter group conflict: It opposes two different group of people. Here, collective action to defend common identity is prefer upon individual value. This is the type of conflict more frequent and farmer-herder conflict fails in.

Though conflicts are inherent to every day's life in society, its high frequency and damages linked should be understood and resolve. In recent decades, the repetition of different types of conflict in Niger is worrisome. The country faced many rebellions (1995, 1997, 2007), uncountable deadly fight between farmers and herders (e.g. June 2017 in Diffa lasting with 107 deaths, …) and terrorism (AQMI, Boko Haram, …).

1.5. Causes and Consequences of Armed Conflicts

We defined above conflict in this dissertation to be either Terrorism, Rebellion or Farmer-Herder clashes. The following sections are highlighting the reported causes of armed conflict in Niger.

1.5.1. Causes of Terrorism in Niger

Terrorism is often used in conflicts to provoke a disproportionate response from the state (Lake 2002). This so-called "political jujitsu" is one tactic used to provoke a

brutal or repressive response from the state in the hope that moderates in society will be forced toward the extremist camp and away from negotiations with the state (Kearns and Young, 2013). Rebellion group also uses such tactic to build coherence in a community and facilitate recruitment. The type of terrorism in Niger is in contrast with (Goodwin, 2006) hypothesis. The latter author hypothesizes that civilians (accused to complicit with government) are likely to be targets of terrorism when they are of a different ethnic or religious group from the rebels. Indeed, in Niger, given the bad colonial demarcation of borders, almost you have the same ethnic composition between Nigeria side (MAIDUGURI) and Niger side (DIFFA). Also, the same religion belief (Islam) because those areas belong to the former *Kanem-Borno* Empire. So, it makes it difficult to understand why civilians are targeted by Boko Haram.

In October 2017, we conducted a field work on over twelve groups (Focus Group Discussions) in Diffa region and many interviews from resource persons and *Imams* to understand the terror in the region. At national and even sub-regional level, it should be recalled that the sect holds an unfortunately commonplace speech of injustice of political leaders, bad governance, plot of the Western through the multinationals against our people and younger generations not educated and very poor are easily attracted.

For the terror group to come in Niger, it had many advantages:

- The laxity of the government vis-a-vis the young and radicalised people of Diffa who preached exactly the same philosophy as the sect did at its beginning in Nigeria. Since 2004, some Imams and resource persons announced the toughening of some youth of their environment and their enrichment without any legal base. But at each warning, the government authorities took this information like "jealousy" between marabouts or simply that "the old" generation of Imams does not want the competition of the "young scholars". This branch of the sect in Niger was known under the direction of Ali Sayadi (24 years) at the time and the economic branch was directed by Kaka Bounou (39-40 years).These two persons were not challenged for long while at the same time in Nigeria, Boko Haram took Malam-Fatouri (2 km from Bosso in Niger);
- The assassination of the Libyan Guide, Muhammar Khadhafi, is also a significant cause of the advent of the sect in Niger. Between the end 2011 and the beginning of 2012, there were more than 80 000 Niger citizens returning back who fled Libya to take refuge on the territory. At the same time, several thousands of ex-combatants

from Niger who had joined Libya to fight for Khadhafi in 2011. With very limited skills and without a real system of reintegration these young people were exposed to any proposition. Thus, on April 22, 2014, the Hausa service of the BBC announced that Boko Haram is doing a solid masses recruitment in Niger.

- The creation in Niger of the refugees' camps in 2014 to receive the victims fleeing (from *Baga, Malam-Fatouri* and *Damassak* in Nigeria) the massacres of Nigerian army and Boko Haram. As one does not know who flees what, then many combatants of Boko Haram threw their weapons to return in the camps of the refugees with the victims. Those puppets constituted after a great source of information for the sect to attack Niger.

- Diffa is the oil extraction region of the country. Since 2012 crude oil is being extracted and despite that, the young people of the region though they are less skill but they do not benefit even with simple occupation. They feel frustrated to see their grounds being used to some individuals benefits at their expense. Thus, the unemployment of the young people constitutes a major cause of the acceptance of Boko Haram.

The first attack of Boko Haram in Niger, goes back to February 2015. By attacking Bosso department, the sect aimed at destroying the economic lung of all the zone, namely the Lake Chad and Komadougou (a river in Niger on more than 195 km). Along these waters people developed vital activities (culture of sweet pepper called "RED GOLD", fishing, culture of rice…) for the population and their cattle. But actually, the worst consequences of the attack were the answers of the government such as:

- Total prohibition of the use of motor bicycles, which are transport means,
- Closing of the schools and health centres in areas known as sensitive,
- Villages clear off (more than 108 villages and hamlets were erased in 48 hours by the government) along the Lake and the Komadougou,
- Total prohibition to sale or to purchase fuel for any reason,
- Curfew including for the pregnant women and patients from 7 pm to 6 am,
- Prohibition of purchase and sale of artificial fertiliser (Iré) while the zone is irrigated based,
- Arrest, torture and sequestration on the basis of libellous denunciation,

- Extra-legal execution, of the citizens and many were killed just because they do not know areas and ways prohibited,

These measurements were largely counter-productive. They even worsen the corruption of the local authorities and create a non-denunciation behaviour of the population which in turn benefits the terrorists. Refugee communities and displaces often become prime recruitment grounds for terrorists' organizations targeting the country of origin or own nation. These people (migrants and/or displaces) often have a grievance against the government from which they fled or which forced them to move. Moreover, because they have lost their possessions (lands, ancestral inheritances, goods etc) and their homes, young and unskilled people among them have few opportunity costs for joining a militant faction. Indeed, taking up arms can promise a better quality of life than living in a squalid refugee camp and can also provide people with a sense of purpose and belonging (Cunningham, et al. 2013).

1.5.2. Causes of Rebellion in Niger

This type of conflict occurs also for economic and political reasons in Niger. The country faced such unrest many times (Rixta, 2000): Tuaregs rebellion from 1989-1995, the Toubou rebellion from 1994-1998 and the MNJ (*Mouvement des Nigeriens pour la Justice*) rebellion in 2007. According to Mekenkamp, et al. (1999) and Miguel (2004), the recent civil war in Niger has commonly been attributed to the increasing poverty of the pastoral Tuaregs, who were hardly hit by droughts in the 1970s and 1980s, which killed many of the cattle that are their livelihood. The possibility of armed conflict escalation was largely diffuse by the mass emigration of Tuaregs to Algeria and Libya in search of better living condition. However, it was the repatriation of thousands of Tuaregs to Niger in the late 1980s and their dissatisfaction with the government's "Aid to the Repatriated" income compensation scheme, compounded by severe negative rainfall shocks in both 1989 and 1990 that triggered a new round of conflict. Five or seven years after 1990 were also years of falling rainfall, and the civil conflict between the Tuaregs and the state continued to simmer during this period. The rebellion finally ended in 1998. According to these authors, the fact that Niger experienced increasing rainfall in three out of four years between 1998 and 2001, made possible the peace to finally stuck.

1.5.3. Causes of Farmer-Herder Conflict in Niger

This type of conflict is the more frequent and results in many deaths and economic damages. For instance, in November 2016 in Tahoua[2] region of Niger twenty (20) people were killed and forty-three (43) got injured after conflict escalation between farmers and herders. In the same line, 10 people were killed and thirteen (13) injured in November 2014 in Konni[3] (Tahoua region). In Tillabery[4] region during 2010 more than fifty (50) herders were killed when conflict escalated between herders from Mali and Niger herders. In 1991, more than one hundred (100) people passed because of violence escalation between farmers and herders in Maradi region of Niger (Boureima, 2000). On the 20th November 2017, about thirty-four (34) people were killed including the head of *Maijirigui* village[5] in Maradi region.

According to Daniel (2003) conflict causes can be classified as inherent and proximate causes based on the degree of their contribution to the prevalence, recurrence as well as intensity of conflict as a phenomenon. Inherent causes are causes, which create the material conditions for conflict in a dynamic process. Proximate causes are the psychological conditions resulting in behavioural changes for conflict. For scarcity to lead into conflict;

- it has to be sufficient enough to threaten livelihoods of both communities,
- it has to be perceived and deeply felt as a phenomenon, and
- it has to impact the psychology of both conflicting parties.

As everywhere in the Sahel, Daniel (2003) has shown that conflict between farmers and herders in Ethiopia is caused by:

- Shortage of arable land: Shortage of land for cultivation is the result of the decline in land holding size of farmer households.
- Shortage of grazing areas: farmers are taking measures to adapt to the decreasing productivity by expanding their holdings to adjacent grazing areas. Such practice is known as land use change. Herder are also experiencing scarcity of animal feed sources, due to range degradation and increase in animal and human population.

[2] https://goo.gl/zpn8h
[3] https://goo.gl/wR4HM5
[4] https://goo.gl/nzc6JY
[5] https://goo.gl/MhEi4m

- Rapid Population growth: The total number of populations is tremendously increasing, thus decreasing the per capita land holding for production.

Some other types of conflicts in Niger close to the one of farmer-herders are: conflicts between farmers-farmers; between herders-herders, between fishermen-fishermen; and between fishermen and herders. Boureima (2000) classified such conflicts in Niger with their causes in table 1 as follow:

Table 3: Conflicts types and causes in Niger

Actors in Conflicts	Causes of Conflicts
- **Farmers-Farmers** (Same family, Same community, Same profession)	- Bad land delimitation - Denial in paying land rent - Denial in recognizing land hereditament, contracts, land donation from ancestors - Refusal to obey to court decision
- **Herders-Herders**	- Resource access (well, pasture, water points…) - Sinking of private wells, - Introducing of animal diseases in a common grazing area - Grazing area cultivation by sedentary herders - Refuse to obey to usages and customs - Animal theft and robbery - Bad interpretation of land tenure system,
- **Herders-Fishermen**	- Empoisoning of water points - Adverse impact of fishing materials (blood, hook, chemical product) on animal heath - Damages of fishing materials by animals

Turner, et al. (2011) argued that in the Sahel zone proper, the political economy behind farmer–herder conflict involves five points:

i)The unfair legacy of colonial policies that generally accorded greater power to the village-based authority (dominated by farming interests) and disregarded pastoralists' claims to commonly-held pastures and water points (Le Bris, et al. 1982 and Niamir-Fuller, 1999). Even most of postcolonial tenure reform policies

accord greater rights to ‘users’ of land (Ngaido, 1996), at the expense of the grazing rights of pastoralists.

ii) Unlike precolonial states, colonial and post-colonial governments gave few importance to and protection to major transhumance corridors linking populated areas in the south with rangelands to the north (Niamir-Fuller, 1999).

iii) Importantly, the rapid population growth and soil exhaustion (van Keulen & Breman, 1990) combined with a series of the boom–bust cycles of cash-crop (groundnut and cotton production) (Moseley, 2005) has led to anarchic expansion of cultivated area, which in turn reduce the availability of rangeland and transhumance corridors in cropped zones to the south (average of 450–650 mm of rainfall/year).

iv) Another reason is the climate variability and its change. Indeed, from the early 1970s, recurrent cycles of drought (e.g. 1974, 1977, 1983, 1984, 1991, 2001, 2005 in Niger) have worked in favour of those whose income is buffered against the predictable price swings against and for livestock during droughts and inter-drought periods respectively (Turner and Hiernaux, 2008). According to Bonfiglioli (1990), for about three decades, ethnic/caste groups whose identities are tied to livestock husbandry have increasingly relied on farming to satisfy their basic needs.

v) Though emigration is common in the Sahel, some authors (Painter, et al. 1994 and Pedersent, 1995) argued that its intensity and direction has changed. Indeed, emigration of unskilled people to gain menial work in plantations, mines, and cities to the south has increased as households have not been able to support their needs on farming and livestock rearing alone.

This regional political ecology crates two situations: On one hand, increased prevalence of livestock during the growing season increases the probability of conflict with farming. On the other, there is greater chance for herders and farmers to share common livelihoods and interact more closely in everyday life. However, some authors (Faure 1995 and Blundo, 1997) argued that the optimism of cooperation is not likely because the indirect actors in the conflicts, specially the corruption of local authorities and government officials.

1.6. Climate Change, Resource Scarcity and Conflicts

Given its arid climate, recurrent droughts, and repetitive humanitarian crises, the Sahel is closely linked in the public mind to the threat of climate change (Julie et al. 2014). Recently, the fear that the Sahel might become a zone in which terrorism takes root and grows has increased. The question also arises whether there is any relationship between climate change and conflict, if so, what might be done to enhance resilience and prevent or mitigate conflict.

Barnett (2003) argued that to empirically investigate the climate-conflict linkages in greater detail, it has to be at the sub-state level in countries where governance systems are in transition, levels of inequality are high, social-ecological systems are highly sensitive to climate change adverse, and with large scale migration. In this regard and given Niger's economy dependency on rain-fed agriculture and on transhumance animal rearing, it is key to understand how the likely linkage between climate change and conflict at national level. The author suggests that the focus on pastoral conflict as the dependent variable is salient if we seek to discern the local influence of resource variability on interactions between primary resource users. Wirth (1998) stated that ''At an intuitive level, it is reasonably obvious that in some cases certain kinds of environmental stresses might somewhat exacerbate the risk of armed conflict''. The salient questions, however, are which types of cases, what kinds of stresses and how probable the risks?

We therefore pose a very specific question for our second objective based on our interest in conflict early warning: do environmental resource constraints have an effect on farmer-herders conflict? As Robbins (2012) the later question does not deny that local and global political economies play an important role in driving the environmental degradation and resource scarcity that persistently plague communities). We then hypothesized that the depletion and/ or degradation of natural resources increases the probability of violence between competing groups (Homer-Dixon, 1994, 1999).

Turner (2004) describes that the availability of rainfall, vegetation and forage is ay nevertheless be sufficient to prompt migration and influence competitive behaviour between groups. However, Meier, Bond and Joe (2007) suggest that environmental variability drives pastoral migration and competition over dwindling resources critical to livelihoods, which in turn may lead to the use of violence to secure these resources.

The Widespread concern about the social impacts of climate change, has reinvigorated environmental security portrayals of social conflict within resource-dependent communities (Homer-Dixon, 1999). Reduction in the availability of resources is considered to lead to greater resource competition and conflict.

The "*access to resource*" framework is one of the great contributions of early political ecologists (Blaikie, 1985; Blaikie and Brookfield, 1987) in order to understand the decision-making process of smallholders with respect to natural resources. This framework, is useful for understanding the material roots of resource-related conflict (Figure 1). "Access" refers to the ability to make effective use of a natural resource to support livelihood practices. In turn, access is affected by changes in the physical availability of the resource due to its use by others and/or by environmental change. It is also shaped by social factors such as formal or informal use rights to the resource; ability to extract the resource given capital or labour constraints; and the ability to benefit from resource extraction as shaped by market structures. Changes in "resource access" incorporate physical and social changes and in so doing, can provide insights into their interaction within particular settings.

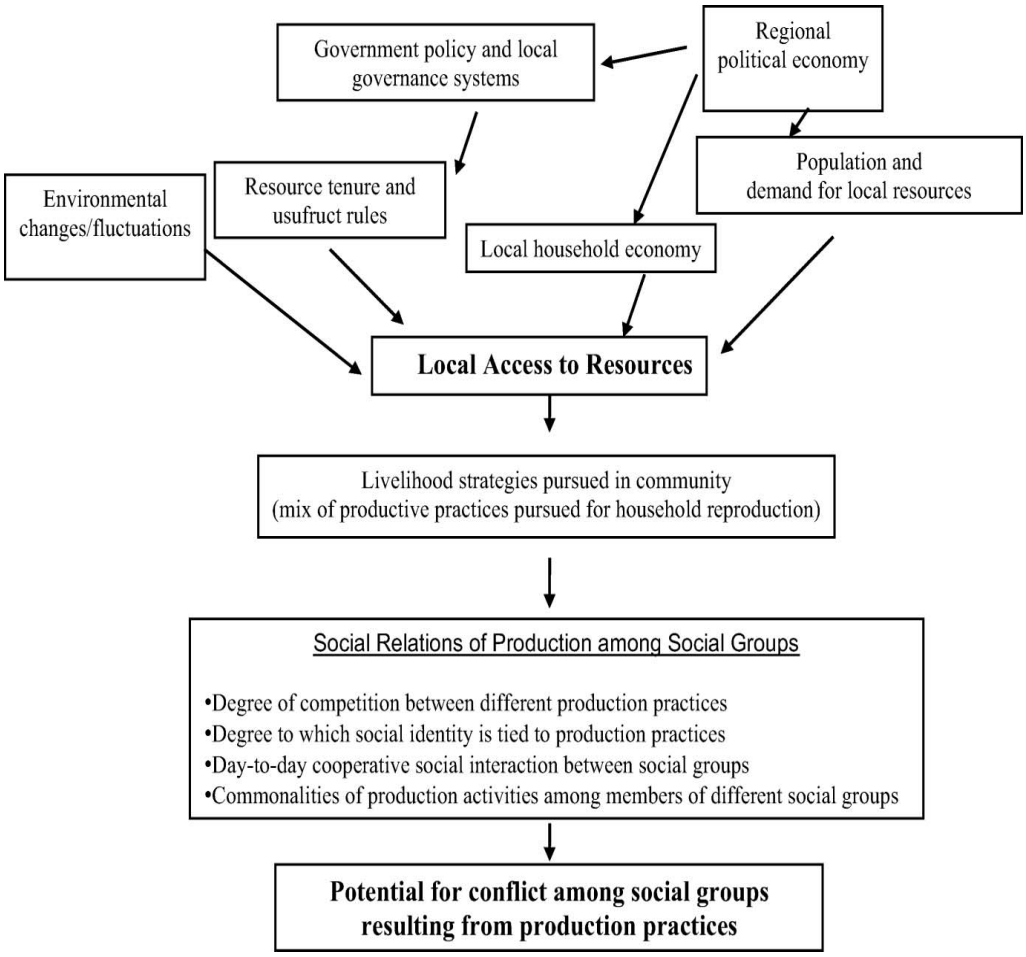

Figure 5. Political ecology approach utilised for analysing resource-related conflict. Physical and social changes shape the distribution of access to productive resources which affect both the livelihood strategies of community members and every day social relations among social groups.

According to Turner et al. (2011) peoples' access to resources influences their livelihood strategies and, in so doing, the material roots of competition between farming and herding also changed. Conflict related to resources does not simply arise from increased competitive pressure driven by physical scarcity of resources. Even if the specific conflict between farmers and herders often involved livestock damaging crops field due to negligence of a herder or a new field blocking a livestock corridor. But these triggering events are commonplace and do not lead per se to conflict unless they are seen to violate ideological commitments. Resource-related conflict is more often motivated by perceived violations of resource-access norms such as: (i) historical precedent in usufruct rights; (ii) perceived commitments to some equitability of access to commonly-held resources; and (iii) the right to pursue the livelihood that is tied to one's social identity.

1.7. Climate and Resource Scarcity Relations in Niger

Given the natural geographical position of Niger, its climate and natural environment are harsh. Rainfall is low and characterized by strong inter-annual and space-time variability in the country. Niger's economy, as many developing countries, is heavily dependent on agriculture (farming and raising animals). According to the national institute of statistics (*Institut National de la Statistique*, INS), from 1960 to 2010, 80%, on average, of the active population of Niger was primarily employed in agriculture, which accounted for 40% of the country's GDP (INS, 2010).

Figure 6 shows how much important precipitation is in determining the country's income from agriculture. From these statistics, one can easily understand that income curve followed almost the same pattern than the precipitation's one. Whenever precipitation is low (below the average), the agricultural income is also below the average over the period considered. However, sometimes precipitation goes beyond the average and the income remains below the average, probably because of damages link to flood and lost after harvest.

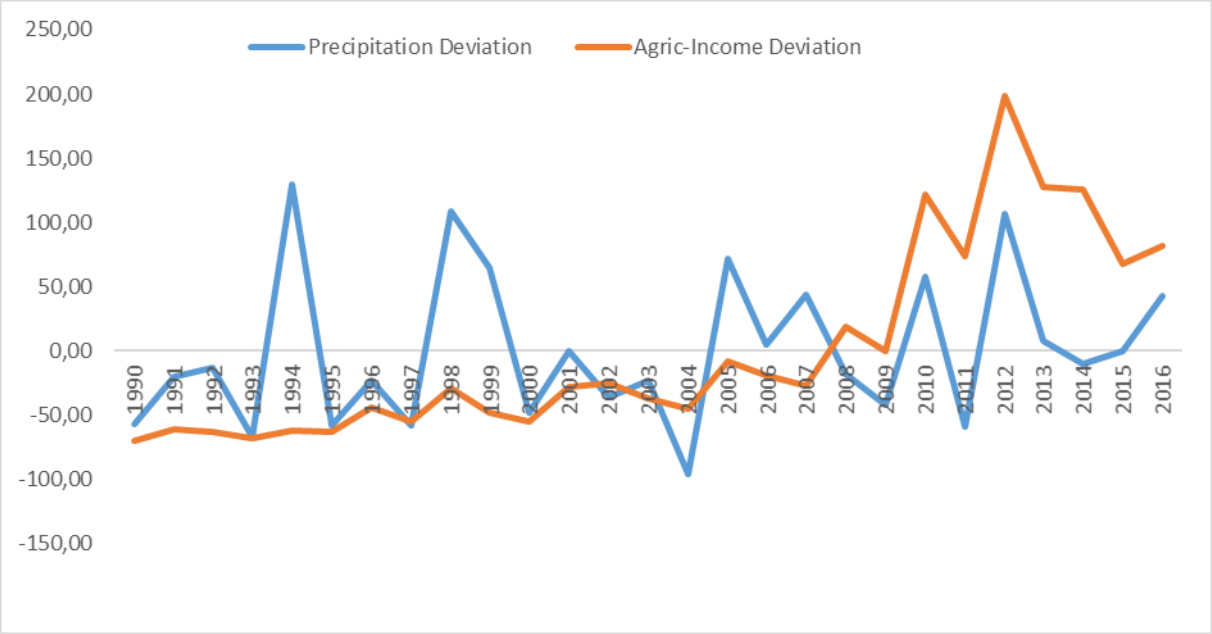

Figure 6: Precipitation and Resource Scarcity

Source: Based on INS Climate data and Data from Ministry of Agriculture

1.8. Climate and Armed Conflict Relations in Niger

In general, precipitation variation is a recurring feature of climate in Niger, and it affects all form of livelihoods and all regions of the country. The consequences of climate variability vary from one region to another depending to the economic stability, level of preparedness and to the resilience of the affected communities, country bordering the region, and to the access to the humanitarian assistance of the region.

The following descriptive statistics in figure 7 help us to read how much role climate parameters played in conflict escalation in Niger. The relationship between climate variability and armed conflict is complex but can be traced within certain limits, through agricultural production /supply changes, which may lead to food price inflation and increase vulnerability of rural population. With the hypothesis that vulnerable people tend to be frustrated and more accessible to be recruit for violent organization, it is possible that in Niger conflicts being explain by precipitation decrease because agriculture is of rain-fed type. However, from figure 7 we can also see that precipitation abundance fit period of conflict therefore the hypothesis of cornucopian seems to be satisfied in the case of Niger.

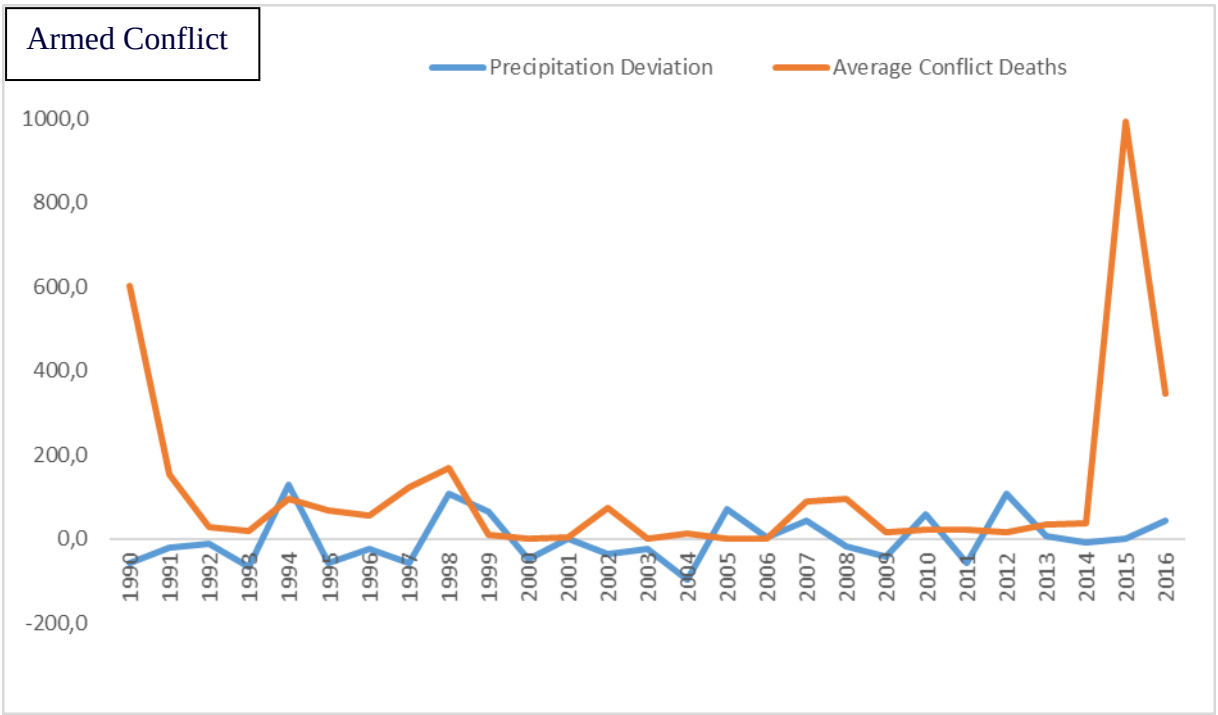

Figure 7: Precipitation and Number of Deaths due to Conflicts

Source: Based on ACLED dataset and INS Climate data

In the early 1990s, a decrease of precipitation coincides with a decrease of conflict escalation. Such relation is explained in the literature as a result of cooperation between actors instead of fighting. The decrease of precipitation from 1994 to 1997 coincides with an increase of violence and this is conformed to the result found by Miguel (2004). Importantly, from 2012, precipitation is chowing a decreasing trend and conflict escalation went at its highest pick in the country. Therefore, it is worth to study in depth using more sophisticated tools causes of conflict in Niger.

1.9. Resource Scarcity and Conflicts Relations in Niger

The relationship between climate change and conflict has been at the centre of research recently. Wirth (1998) stated that ‘‘At an intuitive level, it is reasonably obvious that in some cases certain kinds of environmental stresses might somewhat exacerbate the risk of armed conflict’’. The salient questions, however, are which types of cases, what kinds of stresses and how probable the risks?

We therefore look through the figure 4 whether environmental resource constraints have an effect on armed conflict in Niger? As in the literature, the later question does not deny that local and global political economies play an important role in driving the environmental degradation and resource scarcity that persistently plague communities. In this section, we used descriptive statistics to read Homer-Dixon (1994, 1999) hypothesis of that the depletion and/ or degradation of natural resources increases the probability of violence between competing groups.

In general, from the figure 8, whenever the agricultural income is below the average conflict escalate over that period. After 2009 when income went beyond the average, we observed a decrease of death (close to zero) due to conflict. From 2012, agricultural income has a decreasing trend and conflict escalation went at its highest level in 2015. In reading this figure, we can expect that in Niger, resources have a role in explaining conflict escalation in Niger.

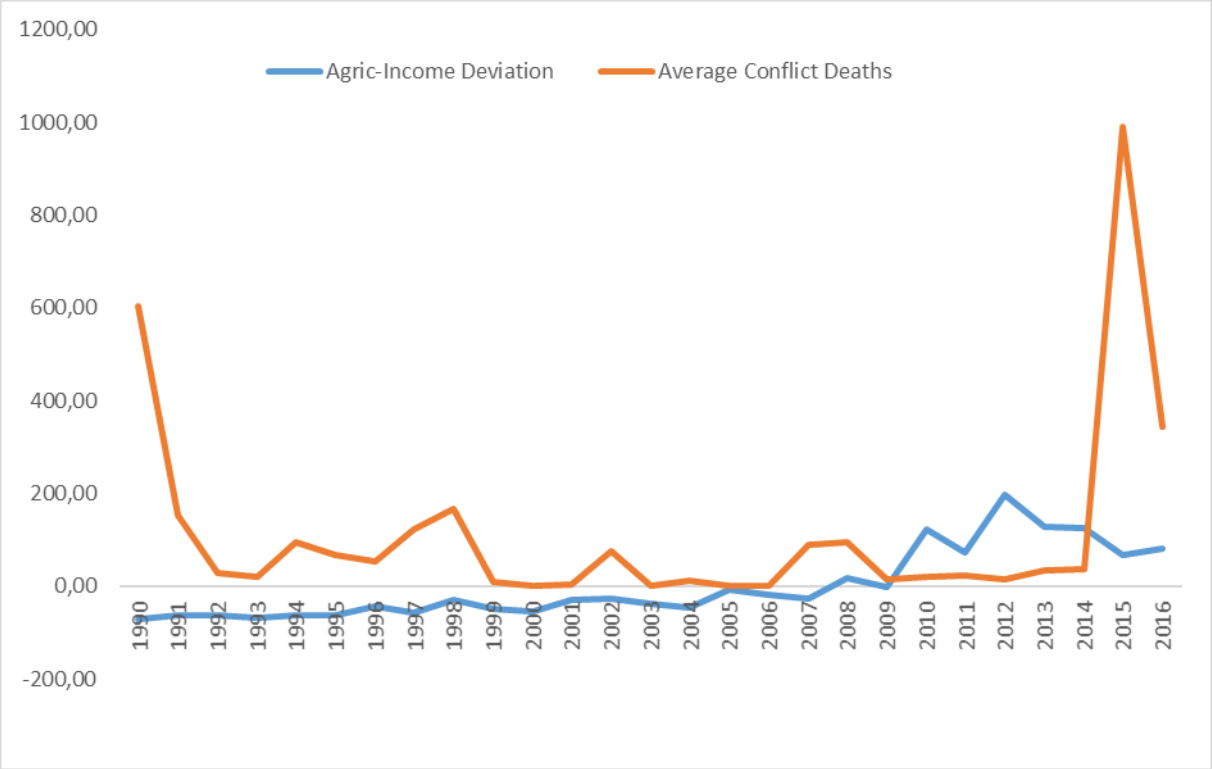

Figure 8: Resource Scarcity and Armed Conflicts

Source: Based on ACLED dataset and Data from Agricultural Ministry

1.10. Governance in Niger and in its Neighbours

Collier and Hoeffler claim (2004) that countries with bad governance and surrounded by bad neighbours are more likely to register violence escalation compare to countries with good governance and good neighbours. We used data from the World Bank dataset of governance to understand through descriptive statistics the case of Niger. The following figure 9 shows that the entire seven (7) countries bordering Niger are badly governed. Indeed, we used the Government Effectiveness indicator which captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. The estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.

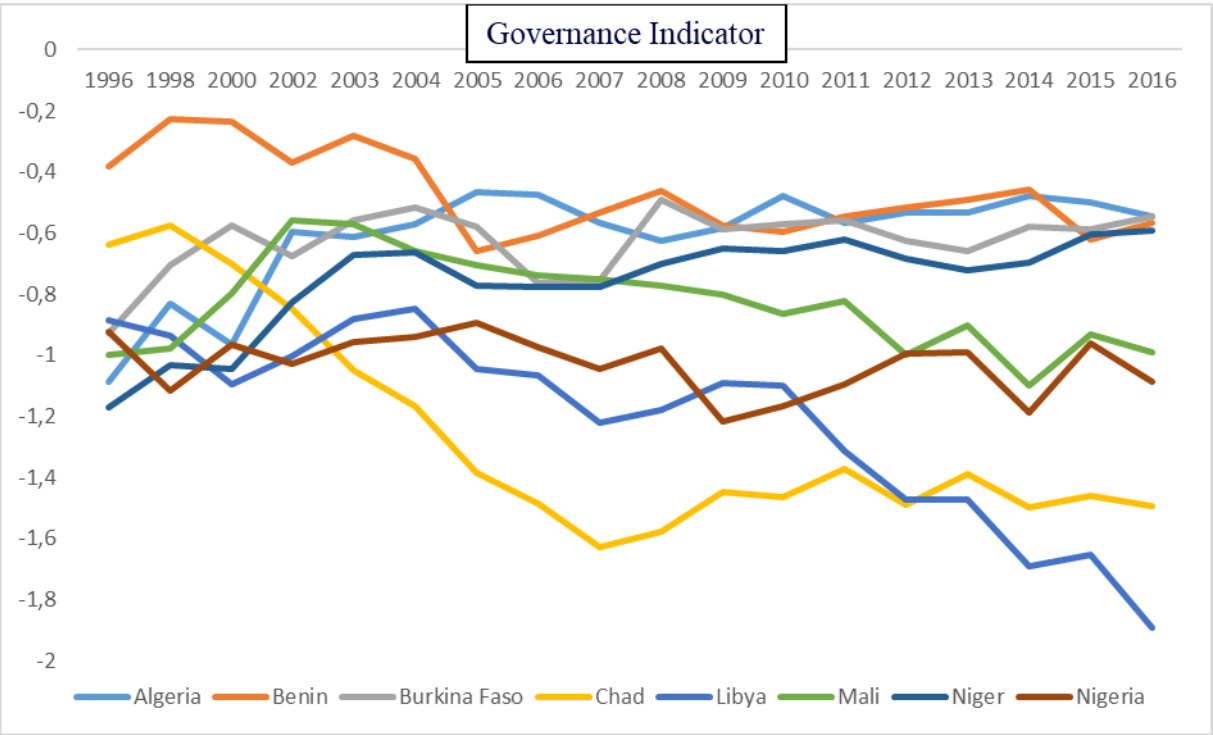

Figure 9: Governance in Niger and in its Borders

Source: Based on World Bank dataset (2017).

We also read the political stability of Niger's bordering countries using the World Bank dataset. The figure 10 below is the description of the Political Stability and Absence of Violence/Terrorism for the seven (7) countries. This indicator measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. The estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. It is only Benin Republic which is politically stable during the period considered. This means that Niger and its neighbouring countries are politically instable and badly governed. From the literature, these indicators are part of triggers of armed conflict in a given country.

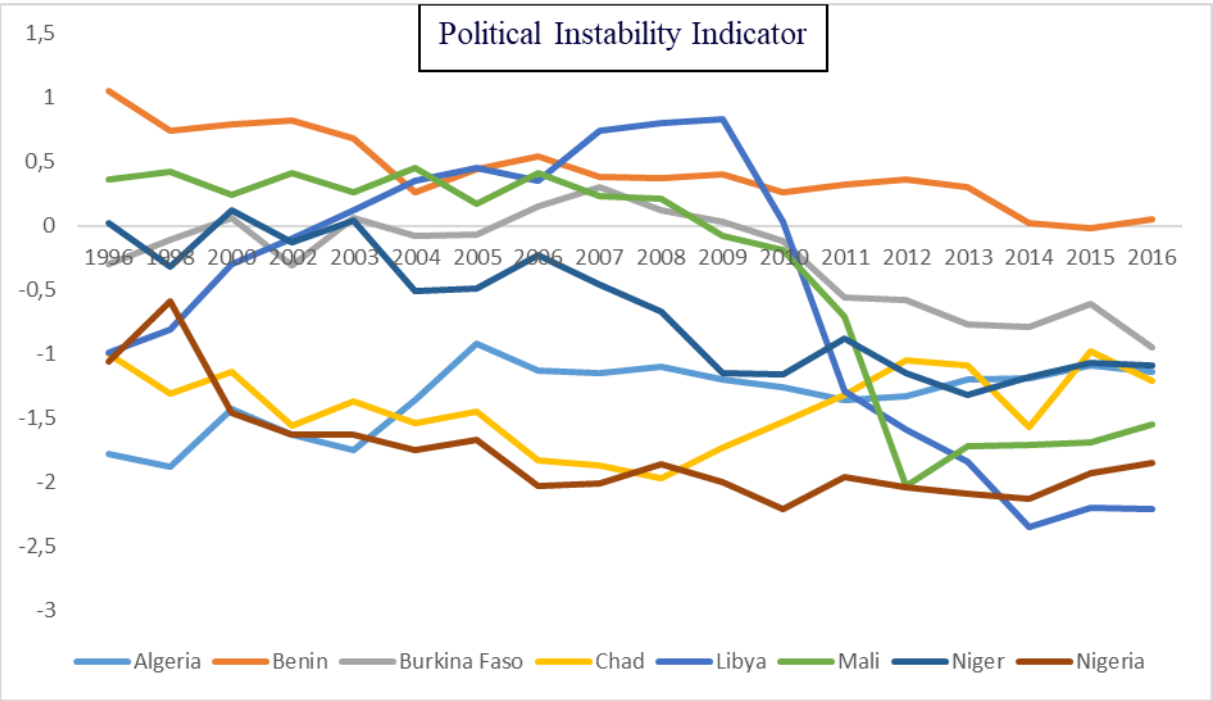

Figure 10: Political Stability in Niger and in its Borders

Source: Based on World Bank dataset (2017).

1.11. Governance and Conflicts Relations in Niger

The two curves in figure 11 are perfectly fitting each other meaning that armed conflict in Niger has to do with bad governance or vice versa.

Figure 11: Armed Conflicts versus Governance

Source: Based on ACLED dataset and the World Bank dataset (2017).

In order to understand the possible direction between armed conflict and governance, we drawn figures 12 and 13, using the governance indicator from World Bank and the number of death due to armed conflict.

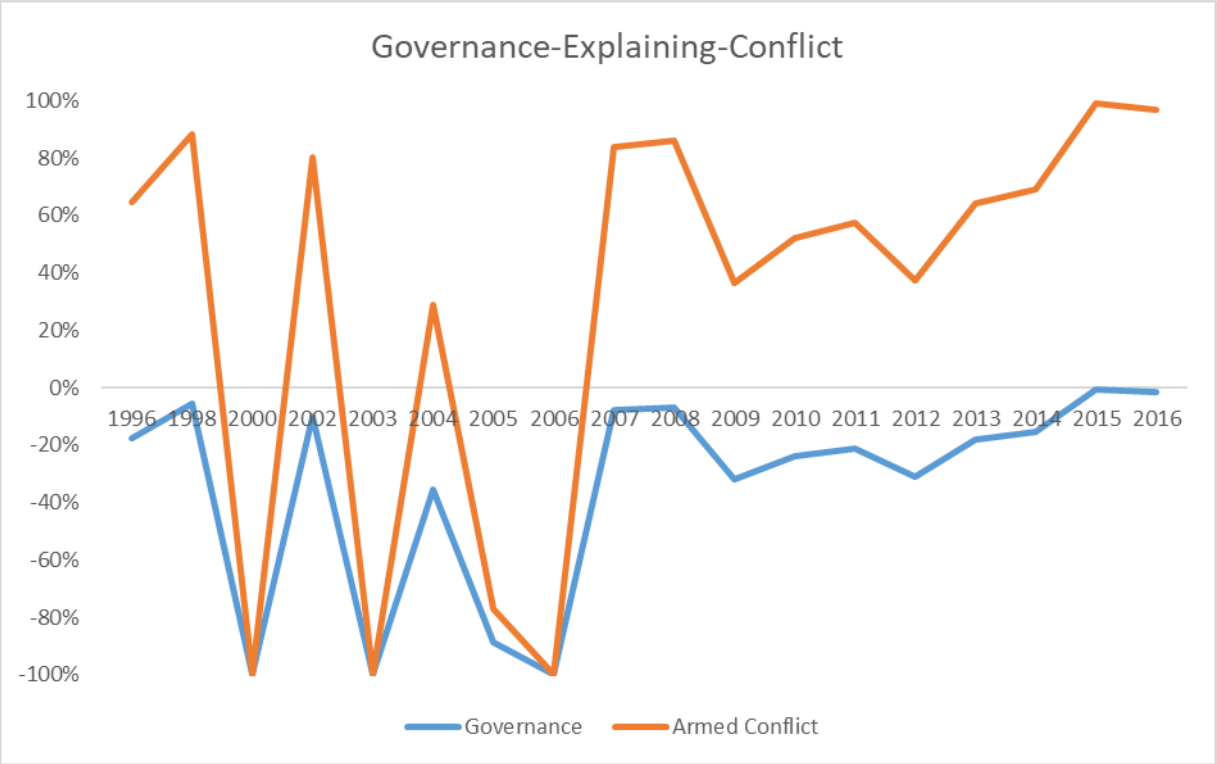

Figure 12: Governance and Armed Conflicts

Source: Based on ACLED dataset and the World Bank dataset (2017).

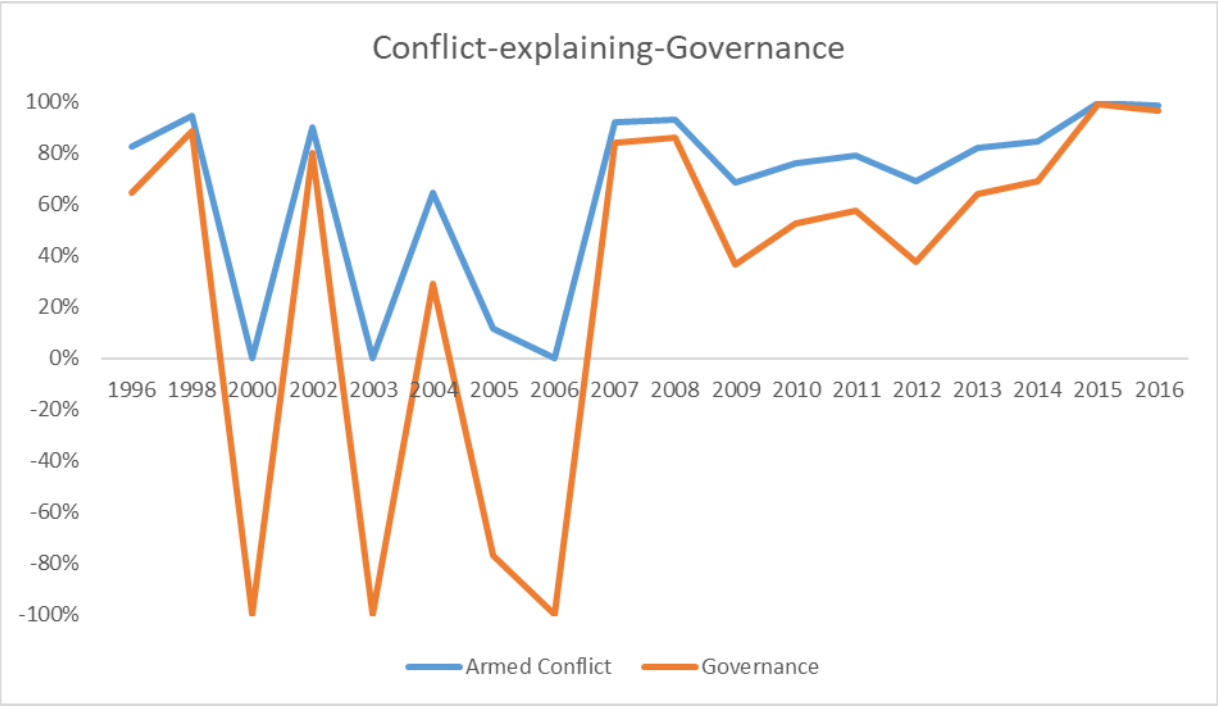

Figure 13: Armed Conflicts and Governance

Source: Based on ACLED dataset and the World Bank dataset (2017).

In general, from these figures, whenever governance is "ameliorated" conflict escalation will decrease in Niger over the period considered. However, even when there is no conflict, Niger is still badly governed. It is also readable from figure 13 that armed conflict also explains some percentage of bad governance in Niger.

2.0 CHAPTER TWO: DOES CLIMATE VARIABILITY FUELS ARMED CONFLICT IN NIGER?

2.0 Introduction

This chapter analyses pathways through which climate change may affects violent conflict in Niger. We expect the likelihood of armed conflict to increase when agricultural income deteriorates due to climatic changes: individuals anticipate that their returns from labour diminish, and the ability of the government to provide goods and services for the people and to maintain order breaks down. This decreases the opportunity costs of engaging in political violence. However, this work is also based on the assumption that armed conflict is more likely to occur in states where existing institutions and mechanisms for conflict resolution cannot provide people with the assurance that climate-induced economic problems will be resolved without recourse to violence. Indeed, formal institutions that help enforce commitments intertemporally can mitigate commitment problems in situations in which each individual or group's effort to increase its own well-being reduces the well-being of others. Consequently, as many scholars, we argued that democratic institutions that restrain the dark side of self-interest, such as a constrained executive and separation of powers, a civil society, elections, an independent judiciary, as well as the rule of law, collectively work to reduce the risk of conflict. Conversely, societies with weak government institutions and few checks and balances are likely to be more prone to armed conflict. Based on this assumption, autocratic countries are more likely to experience intrastate conflict than democratic countries when economic conditions deteriorate due to climatic changes.

The most important reasons supporting the argument that democracies are expected to mitigate conflict are as follow: in democratic political systems citizens are informed by independent mass media about the state of their environment and economy as well as government policies and they can thus subject their government's actions to close scrutiny. They also have the opportunity to express freely their opinions and organize around alternative political views (Payne, 1995). Also, Aldrich (1994) argued that political parties are not only instrumental in aggregating preferences and representing interests, thus solving the collective action problem, but also in managing conflict since they help decrease uncertainty about the intentions and actions of important political actors. Moreover, through electoral mechanisms opposition parties are free to redress their grievances and express their preferences without state repression. Elections also

provide political leaders with incentives to satisfy their citizens' requests if they wish to retain power. In addition, since democratic political leaders are responsive to a larger winning coalition and lack sufficient resources to reward their comparatively large group of supporters with private goods, they have to resort to the provision of public goods including economic prosperity to ensure political support and, thus, their survival in office (Bueno de Mesquita et al., 2003). Furthermore, an independent legislature ensures the representation of a broad range of interests and also guarantees that no group will have to suffer from (governmental) policies and actions that are considered to be detrimental to its own interests. Finally, an independent judiciary, by ensuring that the rule of law is observed and maintained, preserves political stability and maintained, preserves political stability and increases the legitimacy of the state.

The next section presents the current state of the literature on the nexus between violent conflict and environmental stresses. A critical literature review on climate change and conflict must begin by defining these terms and understandings, because they influence how one "reads" the arguments and findings. Section three presents the materials and methods. Finally, the section four exposes result and discussions.

2.1 Empirical Review

This section reviews the empirical literature on short-term climate/environmental change and intrastate conflict, with special attention to intergroup conflict. It focuses on how precipitation and temperature anomalies and weather- related natural disasters may lead to conflict. Based on this assessment, we will identify the gap we have to fill in this dissertation.

2.1.1 Evidence Linking Climate to Conflict

There are three effects of climate change (natural disasters, sea-level rise, and increasing resource scarcity) that are frequently assumed to lead to loss of livelihood, economic decline, and increased insecurity, either directly or through forced migration. Interacting with poor governance, societal inequalities, and a bad neighbourhood, these factors in turn may promote political and economic instability, social fragmentation, migration, and inappropriate responses from governments (Theisen et al., 2013). Likely, this will motivate individuals or groups to fight in order to redress their grievances. It is then clear that climatic conditions never cause conflict alone, but changes in climate can alter

the conditions under which certain social interactions occur and thus have the potential to change the likelihood that conflict happens. In other words, climatic conditions are neither necessary nor sufficient for conflicts to occur, but changes in climatic conditions could have measurable impact on the probability and intensity of conflict, holding other conflict-related factors fixed (Burke et al., 2015). Based on the logic of vulnerability the majority of quantitative climate–conflict studies have focused on Sub-Saharan Africa or a sub-sample within the continent, although some global studies exist (see Bollfrass and Shaver, 2015; Landis, 2014; Salehyan and Hendrix, 2014), as well as some studies of other regions that are argued to have many of the same characteristics as Sub-Saharan Africa (see Bohlken and Sergenti, 2010; Wischnath and Buhaug, 2014).

An important aspect when evaluating vulnerability to climate-related hazards is coping capacity (Busby, Smith, and Krishnan, 2014), which makes actors better equipped to deal with climate anomalies and adapt to or mitigate future climate anomalies (Adger, 2006). A specific example of adaptation among farmers and livestock keepers is having several crops and holding different types of livestock (Mortimore, 1998). Adaptation policies can also add to frictions between groups, as seen in a case study from the Mopti region in Mali. Here the official policy encouraged farmers to expand their rice fields in to the 'vacant' riverbeds and build irrigation systems in areas that previously were used as dry-season pastures for pastoralists, which eventually led to violence between the farmers and the pastoralists (Benjaminsen et al., 2012).

Economic causes of conflict are widely discussed within the civil-war literature, particularly arguments concerning opportunity structures (see Collier & Hoeffler, 2004), and the same arguments can also be found in the climate–conflict research field. This argument states that economic considerations are the foundation for individuals when they make a cost benefit evaluation about joining violent action. Grossman (1991) suggested that the mechanisms driving civil wars are the same as those driving crime. On the basis of this argument, one could expect an inverse relationship between economic growth and violence, where periods of declines in economic conditions lead to more violence because the returns of joining are higher then and create so-called opportunity structures. Economic hardship is also crucial in relation to the relative deprivation argument (Gurr, 1970). In this view, conflicts between already existing groups are much more likely, and particularly the (perceived) differences between individuals and groups. One of the most frequently suggested arguments within the

climate-conflict research field is that the loss of livelihood increases the risk of conflict (Deligiannis, 2012; Meierding, 2013). Economic productivity in areas with predominantly rain-fed agriculture, such as sub-Saharan Africa or the Sahel could be inherently sensitive to climate variability and extreme weather events (Fjelde & von Uexkull, 2012; Koubi, Bernauer, Kalbhenn, &Spilker,2012; Miguel, Satyanath, & Sergenti, 2004; Von Uexkull et al. 2016; Von Uexkull, 2014). Accordingly, the opportunity cost of joining violent action would decrease in periods with unfavourable climatic conditions. This argument is based on dynamics in rural agricultural areas (Raleigh,2010), urban areas may be of little interest and actually disturb the findings in the empirical analysis when testing this argument. In this vein, the loss-of-livelihood argument is split into two individual mechanisms: loss of income from agriculture and loss of income from livestock. The two mechanisms are described as separate mechanisms here, but are often hard to distinguish from each other because households in marginal areas often use a variety of strategies to sustain their livelihood, such as combining agricultural production with livestock keeping (Mortimore, 1998). Even though the impact of climate variability on agricultural production is frequently brought forward as a cornerstone argument in the climate–conflict literature, it is still debated among researchers (see Gornall et al., 2010), and the theoretical and empirical understanding of agricultural production as an intermediate variable connecting climate and conflict remains limited. However, temperature and precipitation during the growing season have been suggested to explain 30 percent or more of the year-to-year variations in global crops yield (Lobell and Field, 2007), implying potential tremendous impact on agricultural livelihood. When agricultural production decreases, unemployed farmers and wage laborers in the rural economy may see increased relative returns from fighting, when compared to farming (Fjelde, 2015), which could increase the recruitment to violent activities. The State could be an appropriate target in situations when agriculturalists experience livelihood contraction due to environmental hardships, particularly when hardship accumulates over longer periods. A study by vonUexkull (2014) finds that sustained droughts increase the risk of civil conflict in Sub-Saharan Africa. Households in these areas have developed strategies to cope with drought events (Mortimore and Adams, 2001), whereas repeated drought events may create an accumulative effect that challenge the existing coping strategies (de Waal, 2005). To date, the central empirical challenge addressed by the literature has been to quantify this effect. Since our study area, Niger, is a landlocked country, we reviewed only works

dealing with natural disasters and resource scarcity and our interest is not in reviewing work on sea level rise.

a) Changes in precipitation and temperature

Climate change may have adverse security implications through its effect on availability of resources necessary for sustained livelihood. In line with common practice, we define scarcity as low per-capita income or access to a resource. When we talk about resource scarcity, we refer to a low per capita availability of a renewable resource, such as freshwater, arable land, livestock or even low per capita income. Growing scarcity will be the consequence of either one (or both) of the two following processes: (i) a dwindling resource base, and/or (ii) increased demand for the resource through increased population pressure and/or increased consumption. While increasing scarcity is generally regarded as more harmful than scarcity per se, increasing resource variability, which is associated with higher levels of unpredictability, will often constitute the greatest challenge to human livelihood.

According to the AR4 of IPCC scenario and similar studies, the environmental impacts of climate change will vary enormously between regions. Some areas, including Northern Europe, are likely to benefit from an increase in average temperature as it is expected to result in increased crop yields, increased forest growth, decreased energy demand for heating, and reduced mortality from cold exposure. Most parts of the world, however, including the most densely populated regions, face a grimmer future. Increasing temperatures, changing precipitation patterns, and an overall reduction in annual rainfall suggest that some of the most crucial subsistence resources will become increasingly scarce.

In all of these cases, institutional, political or economic factors can be as important as physical or material factors in limiting to supply growth. Governments can make scarcity worse (for example through perverse subsidies or price controls); similarly, perceptions of scarcity can be as damaging as absolute limits (as for example when over 30 countries implemented food export restrictions during the food price spike that peaked in 2008, even as many import-dependent countries sought to rebuild stock levels).

As concern over both climate change and resource scarcity has increased in recent years, so speculation has grown that they will lead to increased risk or incidence of violent conflict. However, while climate change and resource scarcity do pose risks – especially for poor people and fragile states, which as discussed below are most vulnerable to their effects – caution is needed in forecasting their effects, particularly in the area of violent conflict.

In part, this is because the impacts of resource scarcity or climate change will in practice almost always blur with those of other risk drivers, with the effect that it becomes extremely difficult to attribute particular impacts solely to climate change or resource scarcity. The rise in the number of undernourished people from 854 million people in 2007 to over 1 billion in late 2009, for example, is only partly attributable to the effects of the food price spike: also critical were the subsequent effects of the global downturn, which further eroded the purchasing power of many poor people.

Similarly, while poor people are undoubtedly vulnerable to the direct impacts of climate change, the most far-reaching effects of global warming may be the indirect "consequences of consequences" – such as political instability, economic weakness, food insecurity or large-scale migration.

It is important to remember that the actual risk of violent conflict posed by climate change or resource scarcity depends as much on the vulnerability of populations, ecosystems, economies and institutions as on the strength of climate or scarcity impacts. The fact that poor people are more exposed to price spikes, resource scarcity and climate impacts is well-established, for example environmental risks are among the most frequent, costly and impactful causes of the kinds of shock that can cause people to become poor in the first place, and that make escape from poverty so difficult.

The institutional and political weaknesses of fragile states have been argued to make them more susceptible to conflict risk arising from climate change and resource scarcity. A 2007 report from International Alert, for example, found that 46 countries, home to 2.7 billion people, would experience a "high risk of violent conflict" as a result of climate change interacting with economic, social and political problems, while in a further 56 countries with 1.2 billion inhabitants " the institutions of government will have great difficulty taking the strain of climate change on top of all their other current challenges".

Climate change and resource scarcity are rarely, if ever, the sole cause of violent conflict, then: instead, they are better understood as 'threat multipliers' that will in

practice interact both with other risk drivers, and with diverse sources of vulnerability. However, this is not to say that climate and scarcity do not increase the risk of violent conflict. On the contrary, as a United Nations Environment Programme report recently argued: "the exploitation of natural resources and related environmental stresses can be implicated in all phases of the conflict cycle, from contributing to the outbreak and perpetuation of violence to undermining prospects for peace". Kahl (2006) cites a range of evidence for the argument that scarcity can increase the risk of violent conflict, including quantitative studies that suggest population size and density are significant conflict risk factors, and statistical work indicating that countries highly dependent on natural resources, as well as those experiencing high rates of deforestation and soil degradation or low per capita availability of arable land and freshwater, have higher than average risks of conflict.

More recently, Burke et al. (2009) found strong historical linkages between civil war and temperature in Africa, with warmer years significantly increasing the likelihood of war (a 1°C rise in temperature leads to a 4.5 per cent increase in civil war in the same year). When combined with projections of future temperature trends as a result of climate change, they found, historical data suggest a roughly 54% increase in armed conflict incidence by 2030, or "an additional 393,000 battle deaths if future wars are as deadly as recent wars".

Overall, however, the data on the links between resource scarcity and conflict risk remain limited.

An alternative, non-quantitative approach rests on identifying examples of specific cases of recent conflicts in which scarcity of basic natural resources played a significant role, and exploring how resource availability interacted in such instances with other factors, such as governance and its role in defining perceptions and fostering grievance or supporting resilience.

Above all, while it is possible to use both quantitative and qualitative approaches to identify particular instances in which scarcity and conflict may be correlated, the deeper question is how they are linked, and what are the specific transmission mechanisms through which scarcity can lead to conflict – or vice versa. In this chapter, we explore the first side of the latter question.

There is highly publicized quantitative literature that links hot temperatures to individual aggression, including violent crime and riots. According to Anderson (2001),

global warming may increase violence. But the causal mechanism proposed in this study is different from the scarcity thesis that is at the core of the relationship proposed in the literature on climate change and armed conflict (Reuveny 2007; Burke, et al. 2009), and the type of violent is also different. Other researchers focused on mechanisms through which abundant rainfall ruined harvests and lead to property crime (Mehlum, et al., 2006) in Bavaria. In studying witch killings in a rural Tanzanian district, Miguel (2005) concludes that both positive and negative extremes in rainfall increased its frequency. Lecoutere, et al. (2010) also used a field experiment from semi-arid Tanzania, and they find water scarcity drives conflict behaviour, particularly for poor and marginalized households. According to Hidalgo, et al. (2010) rainfall deviations (used as an instrument for agricultural economic shocks) lead the rural poor to invade large landholdings in Brazil, and particularly in municipalities with a highly unequal land distribution. From these works, one can expect that when climatic conditions are worse it will coincide with more armed conflict.

Some quantitative studies of conflict in Africa have found social violence and communal conflict to be most likely in or following wet periods (e.g. Raleigh and Kniveton 2012; Hendrix and Salehyan 2012; Theisen 2012). Other scholars found that the risk of violence increased in dry years (Fjelde and von Uexkull 2012). Qualitative researchers, especially anthropologists, found that in Africa death rates in years with abundant rainfall are higher than in dry years (Adano and Witsenburg 2009; Adano, et al. 2012) or in seasons with less vegetation (Meier, *et al.*, 2007). The argument is that dry periods are associated with cooperative behaviour (Eaton, 2008).

b) Natural disasters and Resource

Climate change is predicted to increase the frequency and intensity of natural disasters. Guha-sapir, et al. (2011) reported that there has been a sharp increase in the number of disasters, although it is unclear how much of this can be accounted for by population growth, climate conditions, and shifting patterns of settlement. In this review, we are not dealing with papers on geological disasters like volcanic eruptions, earthquakes, and tsunamis since they are unlikely to be influenced by climate change. Some works show that the severity of disasters, measured by the number of casualties, shows no evident time trend. The argument is that the increase in coping capacity in many countries and future economic development is likely to further increase the ability of many societies

to absorb natural disasters without great loss of human life. Actually, this argument is highly relative, when we consider societies like Niger where almost always the country is classified as the poorest by the HDI measure. Natural disasters are expected to exacerbate conflict risk primarily through economic loss and by weakening government authority. Some quantitative studies (Drury and Olson 1998; Brancati 2007; Nel and Righarts 2008) do indeed find the risk of conflict to be higher following natural disasters. However, Slettebak (2012), finds the opposite effect and attributes it to a tendency to unite in adversity. According to Besley and Persson (2011), climatic disasters do not affect growth, but increase the risk of civil war, although only in fragile states. Another study, by Bergholt and Lujala (2012), reaches the opposite conclusion. They found that climatic natural disasters have a negative impact on economic growth but they have no effect on the onset of conflict, neither directly nor as an instrument for economic shocks. The contradiction between these two studies is probably due to the fact that the former studied the incidence of civil war and disasters which could introduce endogeneity problems (Theisen, et al. 2013).

Wenche and Tanja (1998), in the most comprehensive global test of the environmental-scarcity leads to violence hypothesis with a range of data (1980-1992), found that although deforestation, land degradation, and low freshwater availability were positively correlated with the incidence of civil war and armed conflict, the magnitude of their effects was tiny.

Increased environmental scarcity caused by one or more of these factors is assumed to have several consequences, which in turn may lead to domestic armed conflict. Important intervening variables between environmental scarcity and conflict are decreased agricultural production, decreased economic activity, migration, and weakened States. To summarise, here are some hypotheses researchers formulate when studying climate-conflict nexus: hypotheses falling within supply-induced scarcity are (i) Countries experiencing land degradation are more likely to experience domestic armed conflict than countries where land degradation does not take place; (i) Deforesting countries are more likely to experience domestic armed conflict than are countries not deforesting and (iii) Countries with a low freshwater availability per capita are more likely to experience domestic armed conflict than countries with a high freshwater availability per capita. For the demand-induced scarcity we have: (iv) Countries with high population density are more likely to experience domestic armed conflict than countries with low population density. Finally, for the third dimension of

the environmental scarcity concept structural scarcity hypotheses are summarised as: (v) Countries with high income inequality are more likely to experience domestic armed conflict than countries with greater income equality; (vi) Countries experiencing resource scarcities (land degradation, Deforestation, low freshwater availability per capita, high population density etc.) are more likely to experience domestic armed conflict than countries where resource are relatively abundant.

From this review, it is clear that there is no consensus on empirical findings linking climatic conditions to conflict. This is partly because of the diversity of indicators applied, differences in samples, time periods, type of conflict studied, and estimation techniques. Broadly speaking, the econometric literature summarised above suggests that different classes of conflict, in different contexts and at different scales of analysis, have a general argument that their likelihood of occurring is influenced by climatic conditions.

c) Neo-Malthusian, Cornucopian and Other theories

The link between resource and conflict has been debated by many schools. Their arguments are sometimes diametrically opposed. Indeed, in showing evidence of conflict occurrence, some argue that the cause of conflict is the scarcity of resources and others defend that the cause of conflict is much more about the resource abundance. The 'neo-Malthusians' group, claims that environmental changes pose a severe and direct threat to security because they increase resource scarcity6. According to Homer-Dixon decreasing access to renewable resources increases frustration, which in turn creates grievances from individuals against the state, weakens the state capacity to satisfy basic needs, and increases the opportunity for instigating an insurrection. This author identifies three types of environmental scarcity: (1) supply induced scarcity, it is the reduction of the availability of renewable resources due to consumption and degradation that develop faster than regeneration; (2) demand induced scarcity, which is a consequence of population growth and/or increased the consumption per capita; and (3) structural scarcity caused by an unequal distribution of access to natural resources

[6] Some scholars have argued that local abundance of natural resources can contribute to violent conflict as well (Collier, & Hoeffler 2004, 1998, Fearon & Laitin, 2003; Le Billon, 2001; Ross, 2004). These works, remain very interesting but deal with extraction of high value resources, for instance oil, gold or diamonds, rather than environmental changes.

(Homer-Dixon 1994, 1999). These components may give room to groups facing resource scarcity to migrate into areas that are already ecologically stressed. Thus, increases the risk of violence between natives and migrants7. Figure 14 summarizes these mechanisms.

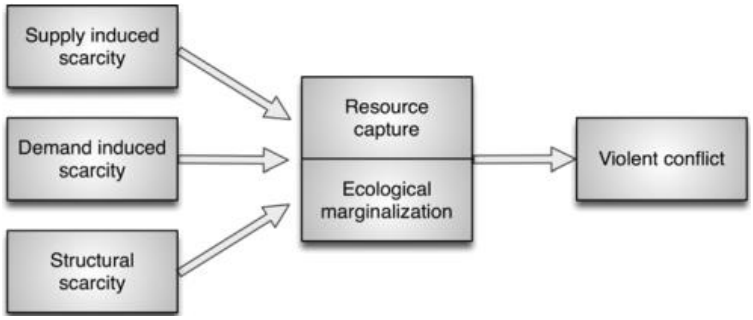

Figure 14: Environmental Scarcity and Violent Conflict

Cornucopian, in contrast to the pessimistic view of neo-Malthusian, they are 'resource optimists. However, they acknowledge that environmental changes may periodically put human well-being at risk. Their point is that humans are and will be able to adapt to resource scarcities either through market mechanisms, social institutions for resource allocation, technological innovations, or any combination thereof (Lomborg, 2001). Researchers argued that mankind will be able to respond to new circumstances imposed by environmental changes through improvements in technology and efficiency (Simon, 1996). Although this author admits that in the short run, population growth may lead to resource shortages or increased economic burdens.

Cornucopian also disagree with neo-Malthusian arguments because they are overly deterministic and ignorant of economic and socio-political factors (e.g. Gleditsch 1998, (de Soysa, 2002a, 2002b; Matthew, et al. 2003; Barnett and Adger 2007; Salehyan, 2008, Koubi et al. 2012)[8]. The optimists summarize the arguments as follow: even though environmental changes exacerbate resource scarcity, violent conflict is not a

[7] The neo-Malthusian arguments, in majority, are in fact motivated by observations of low-intensity communal disputes over scarce natural resources.

[8]The majority of Cornucopian do not believe that resource scarcity leads to major violent conflict, but they do acknowledge that smaller-scale violent conflict over scarce resources is possible, though not unavoidable. Therefore, the main disagreement between neo-Malthusians and cornucopian appears to concern primarily the deterministic character of the neo-Malthusian argument and the expected frequency of larger-scale violent conflict.

foregone conclusion. Moreover, even if violent conflict occurs, resource scarcity is unlikely to be the main cause.

At theoretical level, we can then ask the following question: which theories could help us to explain the outbreak of armed conflict? This paragraph provides a brief overview (for full description, see Blattman and Miguel 2010) of the main theoretical approaches and comments on the testable hypotheses.

- ✓ **The Organization of Rebellion**

In this type of conflict, rebels challenge the government and rebellion can be thought of as a public good. If the rebellion succeeds everybody will live under the new regime, whether they actively supported the rebellion or not. This violent strive for change requires the formation and persistence of a rebel army. According to the theory of collective action (Olson, 1965), common interests within a group are insufficient to produce a public good. Individuals in any group have incentives to 'free ride' on the efforts of others since they cannot be excluded from the consumption of the public good. The incentive to 'free ride' is reduced if only active participants receive private benefits. Thus, without theses selective incentives to motivate participation, collective action is unlikely to occur even when groups have common interests. Olson also argued that group size is critical in achieving collective action. Not only do large groups face relatively high costs of organization, but their members will also gain relatively less per capita on successful collective action. The incentive for group action diminishes as group size increases; as a consequence, large groups are less able to act in their common interest than small ones. Thus, according to the theory of collective action, smaller groups are more likely to rebel and in order to recruit followers they will have to provide selective incentives.

Typically, rebellions do start with a small group of rebels and then swell to large, self-sustaining organizations that require finance and some 'glue' to hold them together. The initial motivation to rebel is the centre of much controversy and a lot of the discourse has been based on the 'greed versus grievance' debate. Invariably, rebel leaders provide an account of motivation in terms of common interests. The need to address grievances due to religion, ethnicity or class is commonly cited as joint interests that motivates rebellion. At the same time, rebels may also be motivated by the opportunities of private gain that organized violence can offer. Thus, theories if rebellion should consider common interests as well as private gain as possible motivation. Since motivation

cannot be directly observed it is difficult to decide whether the cited underlying causes of the conflict are indeed the motivation to take up arms, or whether private gain plays a significant role. Revealed preferences can sometimes provide clues as to which motivation is dominant. Rebellions may also start off as addressing grievances but justice-seeking can turn into loot- seeking during the course of the war. Weinstein's model of rebel recruitment suggests that where there are opportunities for large profits, the composition of the rebel group will gradually shift towards those with a motivation for private gain: the rebellion experiences adverse selection in motivation (Weinstein, 2005)

The benefits of selective incentives are key features in microeconomic models of rebel organization. Grossman (1999; 1991) presents a model in which peasant households decide how to allocate their labour time to production, soldiering, or participation in an insurrection. The interaction between the ruler and the peasant households results in an equilibrium allocation of labour time and a probabilistic distribution of income from the three activities. One possible equilibrium outcome is a higher expected income if time is allocated to rebellion despite its opportunity cost. Gates (2002) argues that the leader faces a principal-agent problem and he tries to overcome this by the offer of selective incentives. The greater the geographic or social distance between leader and recruits, the greater the supervision problem and thus the need for private gain.

These economic models assume that potential recruits make a rational decision to join, based on a cost-benefit analysis. However, many rebel armies use coercion in their recruitment process. Beber and Blattman (2008) argue that threats and punishments can be used as selective incentives. They provide a framework in which it is rational for the rebel leader to use force rather than rewards to solve the collective action problem. Other models do not rely on the provision of selective incentives because the free rider problem will not arise due to varying preferences for the public good within the group. Kuran (1989) assumes that there are a number of individuals who are sufficiently motivated by their common interests to get a rebellion started. In other words, individuals with a strong preference for revolution are likely to be the first joiners. Individuals with a less strong preference are more likely to join once the there is an increased chance of success. Thus, they are more likely to join once the rebellion has reached a certain size. This 'bandwagon' effect is most likely to result in strong rebel support if preferences are uniformly distributed. Clustered preferences make rebellion less likely. The discussion on the causes of war focuses on rational explanations of civil

war which tend to emphasize economic motivations for conflict. Psychological or sociological factors are less well integrated into formal approaches. For example, charismatic leadership may be crucial to the formation of a rebel army. There is already some empirical evidence that leadership matters for economic outcomes (Jones and Olken, 2005) and it would be interesting to consider leadership in the study of civil war. Other, 'irrational', behaviour by leaders (Gartzke, 2003) and followers (Muller, 2004) may be more difficult to integrate into formal modelling and a critique of rational choice approaches in the study of war is presented by Cramer.

- ✓ **Theories of violence**

The above discussion centred on rebellion as a collective action problem because the key feature of civil war is the formation and persistence of a rebel army. Theories of rebellion should therefore focus on the explanation of this phenomenon. However, there are a number of other economic theory approaches to conflict which may help us to explain the causes of conflict.

Following Blattman and Miguel (2010) the theories can be loosely grouped into two categories: **contest and bargaining models.**

- ✓ **Contest Models**

In contest models two competing groups decide on the allocation of resources to production and appropriation (Garfinkel, 1990; Hirshleifer, 1988, 1989; Skaperdas, 1992). Production is modelled in the standard way and appropriation depends on the 'contest success function'. This function describes the relative military capability of the two groups to capture the likelihood of successful appropriation. Contest models use a general equilibrium framework in which some arming is regarded as the normal outcome. Another assumption of these models is that they typically treat the contestants as unitary actors, not as leaders who have to overcome collective action problems. Predictions regarding the role of resources are ambiguous in this framework. In contest models the winner consumes the resources of the winning as well as the losing side. The larger national income and assets are the more effort will be devoted to fighting. However, in low productivity situations appropriation might be attractive but the rewards are also smaller, making fighting less likely.

- ✓ **Bargaining Models**

Predatory behaviour is risky and costly and a violent contest for resources can be

avoided by pre-emptive redistribution (Azam, 1995; Roemeri, 1985). Rational actors should prefer a bargained solution over violent conflict. The literature lists a number of mechanisms why bargaining over resources fails. Fearon, (1995) suggests three mechanisms which are compatible with rationalist explanations for war. First, asymmetric information results in opponents not knowing their relative military capability. If agents are over-optimistic, there may be no peaceful outcome that both recognize as mutually beneficial. This is analogous to the 'winner's curse'; when the fighting starts the players discover that they are too weak to win the contest. Thus, models of asymmetric information are more suited to explain short, rather than prolonged civil war. A second reason for bargaining failure is commitment problems. Powell argues that commitment problems are due to large shifts in the future distribution of power. Parties are more likely to renege on the agreement once their relative power has changed. When the government regains strength during the post-conflict period, they are more likely to renege on the settlement negotiated in the aftermath of the war when the government was relatively weak. This limits the credibility of the promise of transfers made in the initial bargaining process. Weak institutions and an absence of external contract enforcement exacerbate the commitment problem. A third rationalist explanation relies on issue indivisibilities. Some contests are fought over issues which do not allow compromise. Examples are places of special religious or cultural significance. As there are few indivisible issues, this explanation is unlikely to be a general cause of civil war. Indivisibilities can also be interpreted a special case of the commitment problem. Without commitment problems the parties would accept a lottery that awards the indivisible prize to one party.

The various theories of conflict provide us with a wide array of testable predictions. The collective action-based approaches suggest that common interests as well as selective incentives can be causes for large scale violent conflict. Contest models are ambiguous in their predictions of the effect of resources on violence and bargaining models suggest that state capability should reduce commitment problems and thus facilitate peaceful settlements. We now turn to review the empirical problem.

2.2 The Empirical Problem

As with most of economic problems, studying the climate change and conflict nexus is not straightforward. The ideal situation would be to observe two identical populations or

societies, change the climate of one, and observe whether this treatment will lead to more or less conflict relative to the control group. Given that climate cannot be experimentally manipulated, researchers have relied on natural experiments in which plausibly exogenous variation in climatic variables generates changes in conflict risk that can be measured by an econometrician (Burke, et al. 2015).

2.2.1 Identification in Time Series/Panel data

Recent works study the climate and conflict nexus by using time-series variation for identification, usually in a panel data context rather than a cross-sectional approach. With these techniques, a single population serves as both the control population (e.g., just before a change in climatic conditions) and the treatment population (e.g., just after a change in climatic conditions) (Burke, et al. 2015). Inferences are thus based on how a fixed population responds to the variation over time of different climatic conditions. In this case, the assumptions necessary for causal inference are more likely to be fulfilled, because the structure, history, and geography of the two populations are nearly identical.

However, the central shortcoming of this approach is the trade-off for the frequency-identification that emerges because populations and societies change at a much faster rate than do many low-frequency climatic changes. For instance, to study the effect of climate conditions over 100 years, the control and treatment populations in the sample must necessarily be roughly 100 years apart on average. However, human populations change dramatically over a century, violating the assumption that the control and treatment populations are largely identical. This generates a direct tension between our ability to credibly identify causal effects of climate and our ability to examine slow-moving climatic changes.

3.3. Methodology

To achieve the first specific objective of this work (which is to determine how climate change interacting with socioeconomic parameters may cause violent conflict in Niger) we applied the Padro-i-Miquel (2009) modified model.

3.3.1. Theoretical Model

In the original model, Chassang and Padro-i-Miquel (2009) considered two actors who

have to decide whether to engage in costly conflict and redistribution when bargaining fails. We will also consider the Baysan, et al. (2014) enrichment on the basic model with additional mechanisms that have been proposed but, were not in the original analysis.

Consider two groups $i \in \{1, 2\}$ sharing territory of size N. Land is used to produce crops for farmers and to feed animals for herders. Each group uses land for production purposes. Groups cannot commit to not attacking one another in an infinite number of periods, indexed by t. Each group begins each period with the landholdings they controlled at the end of the previous period. If a transfer exists between groups that avoids conflict, it is implemented. If such a transfer does not exist, a conflict takes place. The winning group appropriates the land and the output of the losing group. The losing group receives a payoff of zero, and the game concludes. Each group has assets with productivity $\theta_t$that produces $\theta_t l$ output when combined with l units of labour (Chassang & Padro-i-Miquel (2009) set $l = 1$). We follow the Burke, et al. (2015) specification to enrich the model to account for a population n_t (not all of whom must be labourers) that consume this output for a per capita, per period consumption of $\theta_t l/n_t$ under non-conflict conditions. This consideration of population in the model is more realistic than assuming $\left(\frac{l}{n_t}\right) = 1$ in the context of Niger, which leads the world in terms of total fertility rate. If one of the agents attacks the other first, then it gains a first-strike advantage and captures all of the opponent's output and assets with probability P_t> 0.5. Such an attack costs both the aggressor and defender a fraction c > 0 of output because both groups divert c units of labour from production to fighting. If both groups choose to attack simultaneously, they are each considered to win with probability of 0.5. Following Baysan et al. (2014), an attacker is assumed to have a non-rival psychological consumption value of violence γ_t; if the attacker dislikes being violent, then γ_t< 0, and γ_t> 0 if the attacker derives positive utility from violence.

In the original formulation, if a group loses the conflict, then it is removed from the game. If there is no attack in the current period, then each group expects a peaceful continuation value V^P, which is the discounted per capita utility of expected future consumption from the group's initial assets and which captures expectations about the future values of all parameters. Similarly, if an attacker wins, then it has a continuation

value of victory V^V, which is the per capita expected utility from consumption of both the attacker's initial assets and the assets the attacker captures from its opponent. Let δ be the per period discount rate.

Considering the modification (n_t and γ_t) of the original model of Chassang & Padro-i-Miquel (2009) the condition for no conflict is as follows:

$$\underbrace{\frac{\theta_t l}{n_t} + \delta V^P}_{value-of-peace} > \underbrace{P_t\left(2\frac{\theta_t l}{n_t}(1-c) + \delta V^V\right) + \gamma_t}_{value-of-attacking} \quad \textbf{(1)}$$

Simply put, it means a group finds it privately beneficial not to attack, if the per capita value of consuming all output with initial assets plus discounted expected utility under peace δV^P exceeds the expected utility of consumption from both the groups' original assets and captured assets, minus expenditures on the conflict, plus the expected continuation value $P_t \delta V^V$ and the consumption value of violence γ_t, which is experienced with certainty.

Because we are dealing with intergroup conflict, we are not assuming that $l = n_t = 1$. Then when rearranging the inequality (1) we have:

$$\frac{\theta_t l}{n_t}(1 - 2P_t(1-c)) - \gamma_t > \delta\left(P_t V^V - V^P\right), \textbf{(2)}$$

where the left-hand side of the inequality represents the marginal value of peace in the current period weighed against the discounted marginal expected utility from attacking on the right-hand side. For expositional purposes, we will assume that initially this inequality is satisfied, and thus there is no conflict. From that baseline, we will then consider how marginal changes in parameter values driven by climate might cause this inequality to be violated.

3.3.2. Empirical Model

3.3.2.1. Model Specification

To test our hypothesis on the climate change increasing resource scarcity and armed

conflict relationship using panel data from all regions of the country in the period 1990–2016. In practice, we used a combination of the two common techniques (Two stage method and Instrumental variable method) in the literature to deal with our hypothesis.

- We first follow Koubi *et al.* (2012) and Bergholt and Lujala (2012) in not using an instrumental variable approach merely as a technical solution, as previous studies have done (e.g. Miguel et al., 2004). Indeed, we hypothesize that climate variability may indirectly affect the probability of armed conflict via its effect on agricultural income. Given that conflict escalation and the state of the economy are not independent of each other (see Blomberg and Hess 2002; Blomberg, Hess, and Thacker, 2006), as shown by our descriptive statistics, we employ a two-stage procedure. We use measures of precipitation and temperature deviations to estimate per capita agricultural income in the first stage of the model.

$$Agricom_{it} = \beta_{1i} + \beta_{1,0}\,\mathrm{prep}_{it} + \beta_{1,1} temp_{it} + \gamma_1 X_{it} + \alpha_1 yeartrend_{it} + \varepsilon_{1it} \quad \textbf{(Eq. 3.1)}$$

where locations are represented by i, observational periods are represented by t, β is our parameter of interest, and ε is the error term. Precipitation and temperature are our measure of climate variability. Time fixed effects *yeartrend* flexibly account for other time-trending variables such as gradual demographic changes or economic growth that could be correlated with both climate and conflict.

To investigate the underlying mechanisms, we include interaction terms between agricultural income and the national governance in the baseline equation. These interaction terms captures the effect of latent tensions and shed light on factors that create a spark which fuels tensions and can lead to armed conflicts (Couttenier and Raphaël, 2011). We then estimate the following equation:

$$Agricom_{it} * Governance_{i,t} = \beta_{1i} + \beta_{1,0}\,\mathrm{prep}_{it} + \beta_{1,1} temp_{it} + \gamma_1 X_{it} + \alpha_1 yeartrend_{it} + \varepsilon_{1it} \quad \textbf{(Eq. 3.2)}$$

We then estimate the effect of predicted agricultural income and the predicted interaction term on armed conflict in the second-stage equation:

$$Conflict_{it} = \beta_{2i} + \beta_{2,0} percagricom_{i,t} + \beta_{2,1} governance_{i,t} + \beta_{2,2}(agrincom_{i,t} * governance_{i,t}) + \gamma_2 X_{it} + \alpha_{2,1} fatalities_{it} + \varepsilon_{2it} \quad \textbf{(Eq. 3.3)}$$

Equation (3.1) is estimated using the fixed effects vector decomposition (fevd) estimator by PÏmper and Troeger (2007). This estimator allows us to include time invariant variables, we also correct for autocorrelation.
Equation (3.3) is estimated using logit regression with bootstrapped standard errors. To model temporal dependence. This approach acknowledges that the likelihood of armed conflict onset at present depends strongly on conflict that occurred in the years before and thus controls for time effects.

- We secondly used the Instrumental Variable approach in estimating the impact of agricultural income losses due to climate variability on armed conflict in Niger. We followed the model as in Miguel et al. (2004) panel data approach:

$$conflict_{it} = \beta * prep_{it} + \theta_i + \psi_t + \varepsilon_{it} \quad \textbf{(Eq. 3.4)}$$

where locations are represented by i, observational periods are represented by t, β is our parameter of interest, and ε is the error term. We used precipitation deviation because we believe that agriculture in Niger is more driven by precipitation than another climate parameter. If different locations in a sample exhibit different average levels of violence, because of any number of cultural, historical, political, economic, or geographic, differences between the locations, then it will be accounted for by the location-specific fixed effects θ_i. Time fixed effects ψ_t flexibly account for other time-trending variables such as gradual demographic changes or economic growth that could be correlated with both climate and conflict.

To investigate the underlying mechanisms, we include interaction terms between precipitation and region-specific characteristics (Ci = poverty rate per region, agricultural production, fractionalization indices, food prices, etc.,) in the baseline

equation. These interaction terms captures the effect of latent tensions and shed light on factors that create a spark which fuels tensions and can lead to civil conflicts (Couttenier and Raphaël, 2011).

$$conflict_{it} = \beta_0 C\lim ate_{it} + \beta_1 C\lim ate_{i,t-1} * C_{it} + \gamma C_{it} + \theta_i + \psi_t + \varepsilon_{it} \quad \textbf{(Eq.3.5)}$$

where β_1, is the effect of the prior period's climate at $(t-1)$ on conflict in the present period (t), and β_0, is the contemporaneous effect. Burke, et al. (2015) mentioned three reasons where β_1 might be nonzero. First, climatic events might induce conflicts to be displaced in time, for example, delaying a conflict that will eventually occur anyway or accelerate the emergence of a conflict that would have otherwise occurred in the future. In either case, β_0 and $\beta_1$would have opposite signs but with equal magnitude for conflict incidence, and therefore the net effect of the climatic event ($\beta_1 + \beta_1$) would be zero. Whenever there is an increase in the number of contemporaneous conflicts in addition to a displacement of conflicts forward in time (i.e., partial displacement), the lagged effect may be negative, but the cumulative effect may remain positive (Hsiang, et al. 2014). In the presence of either full or partial displacement, estimating the *Equation 3.4* instead of the *Equation 3.5* will overstate the effect of climate on conflict.

Second, it is also possible that climate events could have persistent or delayed effects on conflict. Suppose that conflicts in rural areas are more likely when agricultural productivity is low. So, because agricultural growing seasons are long and often span calendar years, a climatic event early in the growing season might affect the harvest in the next calendar year, which could result in a zero coefficient on β_0 and a nonzero β_1.

Third, bad shocks can persist: A bad agricultural harvest in one year may lower the resources available to invest in the next year's crop, lowering productivity in that year as well. In this setting, β_1 and $\beta_1$would have the same sign.

If any of these three dynamics are at play, then estimating *Equation 3.5* and summing contemporaneous and lagged effects will likely provide a more complete picture of the climate and conflict nexus than estimating *Equation 3.4* alone.

a) Reduced-form estimates

The focus will be on the reduced-form relationship between climatic variables and conflict variables. Many studies followed the paper by Miguel et al. (2004) in studying

the climate change and conflict nexus using panel data. These authors used rainfall as an instrumental variable for economic growth when studying the effect of growth on civil conflict. The key assumption in the instrumental variables approach is that climate only affects conflict through a particular intermediary variable. However, many studies argued that climatic events can affect a variety of socioeconomic outcomes (e.g. Dell, et al. 2014 for a review), and the latter assumption becomes increasingly implausible. Climatic events affect many factors that may in turn affect conflict, such as, human health (Burke, et al. 2015b), residential mobility (Bohra-Mishra, et al. 2014), and agricultural income (Schlenker and Lobell, 2010). Given these difficulties, and following Burke et al. (2015), we instead focus in this work on the total effect of climatic events on conflict as described by the reduced form. We interpret the reduced form as the net effect of climate on conflict operating through numerous potential channels. Formally, this total effect is as follow:

$$\frac{dconflict}{dPDSI} = \sum_i \frac{\partial conflict}{\partial pathway_i} * \frac{\partial pathway_i}{\partial PDSI}, \quad \text{(Eq. 3.3)}$$

Where $pathway_i$ represent variables that characterize an intermediary mechanism, such as income or human aggression.

3.3.3. Data and Data Analysis

3.3.3.1. Data

a) Conflict data

The conflict data is from the Armed Conflict Location and Event Dataset (ACLED). ACLED is a detailed and widely used conflict dataset developed by the International Peace Research Institute of Oslo (PRIO). It has the advantage in specifying the exact location, date and other characteristics of conflict based on news and reports within unstable states. Given that the data is not based on survey, it might be affected by selection in reporting, a drawback common to conflict datasets. However, such reporting bias is not likely to be systematically correlated with our weather indicators (Maystadt 2014) and should not constitute a major problem for our identification strategy. Focus is on violent conflict events, comprising battle, defined as ‘a violent interaction between two politically organized armed groups at a particular time and location’; and violence against civilians (one-sided violence), defined as ‘deliberate

violent acts perpetrated by an organized political group, typically either a rebel or a government force, on an unarmed non-combatant' (Raleigh and Kniveton., 2012). About 535 violent events with two thousand and eighty-three (2083) fatalities were reported in the ACLED dataset from 1997-2016 for Niger. We completed the dataset using the UCDP/PRIO where ACLED's dataset is not available (1990-1995).

b) Climate and Governance data

Weather data are from the National Institute of Statistics (INS). This dataset provides monthly mean temperature and precipitation from 1990 to 2016 for each regions of Niger. Governance and political instability data are from World Bank dataset[9].

3.3.3.2. Data Analysis

The estimation of the effects of climate change on armed conflict through agricultural income will follow a clear identification strategy. We begin by estimating the cross-sectional and intertemporal variation in the incidence of armed conflict events as a function of climate parameters to detect a potential income–climate relationship and to quantify its strength in the data. We then explore the possible channels through which climate change pass on to conflict outbreaks, assuming that actors' motivation to fight is essentially driven by economic causes. This is the opportunity cost approach, according to which income losses caused by an external shock, lower the opportunity costs of the affected people of engaging in conflict activities defended by Miguel et al. (2004). Because of the large contribution of agriculture (livestock husbandry and cropping) to national GDP, agricultural income per region is used as a proxy for changes in groups' incomes.

The challenge of our identification strategy is to isolate the agricultural income channel from all other possible channels of transmission. And because we may not be able to fully exclude all other potential channels due, we perform a comprehensive set of robustness checks to the preferred model specification and validity tests of the identifying assumptions.

The empirical model requires dealing with endogeneity and potential problems of omitted variables and measurement errors. Indeed, the causality between conflict and

[9] https://goo.gl/VRxadm

economic variables may run in both directions, such that agricultural income loss increases the likelihood of conflict, and conflict in turn can be a shock to income earnings from agriculture by reducing manpower (labour). Another problem that may arise is omitted variables from unobserved factors that affect both the proxy for actors' interest (income) and the conflict variable. This potential problem of omitted or unobserved variables is addressed in a general manner by controlling for region and time fixed effects in both the reduced-form estimation and the two-stage estimation. The region-fixed effects will pick up time-constant, unobserved heterogeneity across regions, including region-specific factors of conflict and ethnic composition of the population, and infrastructure accessibility.

3.3.4. Study Area

The following figure 15 is a map of Niger's administrative eight (8) regions. Each region is considered as an individual in this work.

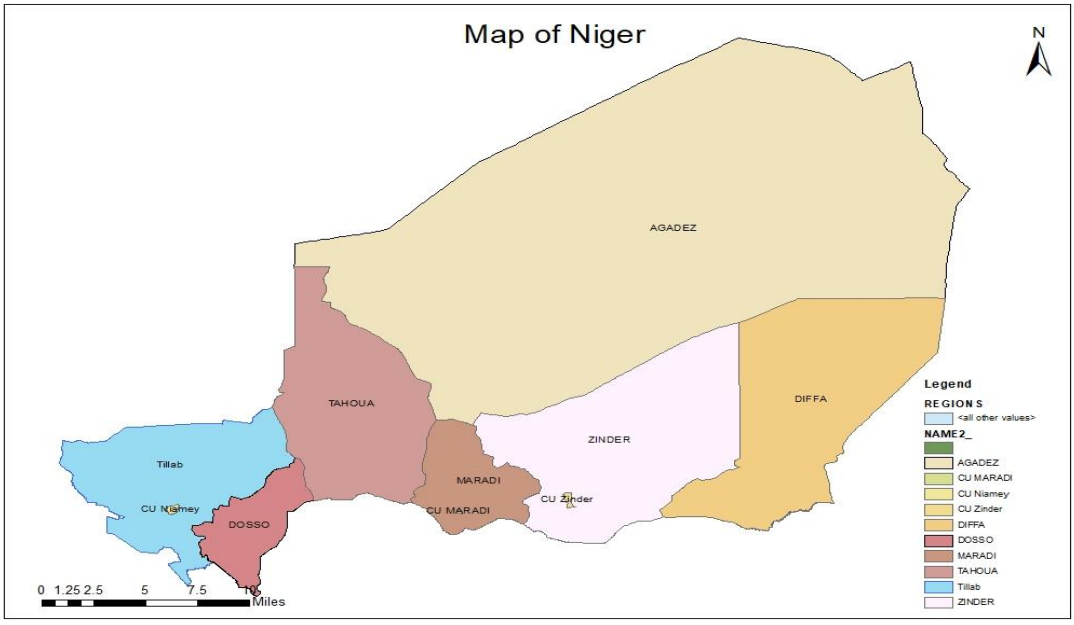

Figure 15: Map of Niger showing its 8 regions

3.4. Results and Discussions

A. Results I: Two Steps Analysis

Table 3.1 reports the results from the regression of the per capita agricultural income on climate variability and some control variables described above. It does so for two different methods: simple panel model and the fixed effect vector decomposition. We conduct such separate analysis because in the literature some authors argued that the inconclusive result regarding the climate and conflict nexus is due to methodological differences. The reason for focusing on the per capita agricultural income is that we do not assume population to be constant when dealing with the most important sector in the national economy and the highest level of population growth in the world.

Table 4: Panel fixed effects regression with vector decomposition (Fevd)

Percincomagri	(1) Model PanelSimple	(2) Model Fevd
Prep	0.0355***	0.0446*
	(0.00981)	(0.0185)
Population	0.0000274***	0.0000515***
	(0.00000215)	(0.00000649)
Trend	1.318***	-0.236
	(0.327)	(0.517)
Tempdevi	2.729	8.009
	(4.290)	(4.351)
Eta		1.000
		(.)
Constant	-35.24386***	-55.3918***
Observations	216	216
R-squared	0.63	0.70

Marginal effects; Standard errors in parentheses
(d) for discrete change of dummy variable from 0 to 1
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In contrast to Koubi et al.'s (2012) findings, our results show that there is a statistically significant impact of climate variability on agricultural income. The analysis supports the argument that income from agriculture is affected by climate variability. Both temperature and precipitation used as climate parameters are positively impacting the agricultural income. However, the positive impact of temperature is not significant. In

contrast to Malthusianism thought, we found that population growth contributes positively and significantly to the per capita agricultural income. This is probably due to the fact that in Niger, agriculture is still function of labour and land. Thus, the more a household is big the more the man power is.

In **table 5** we present results on the likelihood of armed conflict escalation when agricultural income affected by climate variability has changed.

Table 5: Resource and Armed Conflict in Niger

Conflict	Model ArmedConflict
Percapagricom	-0.348*
	(0.167)
Badgovernance	5.851***
	(1.517)
Population	9.09e-09
	(0.000000300)
Fatalities	4.091***
	(1.139)
N	216
R-squared	0.53

Marginal effects; Standard errors in parentheses
(d) for discrete change of dummy variable from 0 to 1
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Our results suggest that climate variability, measured as deviations in temperature and precipitation from their past (1990-2016), affects armed conflict through agricultural income. This result is important because the causal pathway leading from climate variability via (decreasing resources) to conflict is a key part of most theoretical models of the climate conflict nexus.

Though our empirical results provide support for the climate change-resource scarcity-conflict pathway, further research is required before we can move towards closure of the debate. In particular, it would be very useful if we had regional adaptation measure to climate variability. For instance, in the absence of appropriate indicators for adaptation it remains difficult to estimate the effect of climatic variability on agricultural performance and hence on the probability of armed conflict.

The findings also suggest that bad governance affect positively and significantly the probability of conflict escalation. This is in accordance to the argument of Collier (2004) and many other authors. Importantly, we found that fatalities (number of death) is significantly contributing to conflict escalation. This is very crucial for policy recommendation for the country. Indeed, it means whenever people died due to a conflict then the probability of retaliation is very high and it will become a vicious circle. This is very common in Niger especially when dealing with farmer-herder conflict. One could also read this result to be an incapacity to resolve conflict after one party is being attacked or even to prevent conflict. Though from our result population contribution to conflict escalation in Niger is not statistically significant, we think that it is contributing to shrink the per capita income from agriculture.

B. Results II: Instrumental Variable Method

The aim of this chapter is to analyse how resource changes triggered by climatic variability determine the likelihood of armed conflict escalation. Our previous estimations have shown that agricultural income lost increases the risk of armed conflict escalation in Niger. From this, it follows that climate variability may increase the probability of armed conflict through their negative impact on agricultural income.

Table 3.3 summarizes key results from our instrumental variable analysis. First, we check how robust the disaster growth relation is to commonly used conflict determinants.

In section A regression we found climate variability to be relevant for agricultural income in the first-stage equation and to be exogenous in the second stage. A potential problem is that climate variability might affect the potential of conflict through channels other than agricultural income. In case of the existence of other channels, the second

stage regression could give us biased coefficients. Hence it is not feasible to rule out the possibility that climate variability triggers armed conflict only through agricultural income, it is then required to use instrumental variable method.

Results show that climate variability has a significant direct effect on the likelihood of armed conflict onset. Indeed, the coefficient of the per capita income is negative (point estimate equal to –0.0107), that is, the rejection of our hypothesis. When the agricultural per capita income increases by one percentage point, the likelihood of armed conflict onset is reduced by 1.07 percentage points. This result is significant at the 10% level. Control variables such as fatalities and bad governance have their expected signs and are significant at the 5% level. However, the population variable has the expected sign, when it increases conflict escalation probability increases, but not significant at 10% level. In summary, we find support in our data for the argument that climatic variability affects conflict onset not only through agricultural income changes.

Table 6: Instrumental Variable Method

	Instrumental Variable Method
Percincomagri	-0.0107
	(0.00561)
Population	0.000000205
	(0.000000177)
Badgovernance	1.220***
	(0.318)
Fatalities	0.000952*
	(0.000451)
N	216

Marginal effects; Standard errors in parentheses
(d) for discrete change of dummy variable from 0 to 1
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Conclusion

The hypothesis we formulated in this chapter, climate variability and associated agricultural income losses do not have significant effect on the likelihood of occurrence

of conflict, is infirmed. The fundamental argument of whether increasing local or regional climate variability due to large-scale, human-induced changes is associated with an increased risk of conflict remains contested, both among policymakers and in academic circles. In this chapter we contribute in two ways to the existing literature on the climate change–conflict nexus. First, in studying the nexus between climatic variability and the probability of intrastate conflict we used the per capita income from agriculture, and where these effects may be contingent on the quality of governance system. Second, the cross-country nature of previous studies, leaves regional (subnational) heterogeneity unobserved and thus limits the ability to derive context-specific recommendations for effective strategies and national policies of conflict prevention. Government should promote tolerance through forums and promote irrigation system to improve agricultural actors' income.

3.0 CHAPTER THREE: SOCIO-ECONOMIC AND ENVIRONMENTALTRIGGERS OF FARMER-HERDER CONFLICT

3.1 Introduction

The rapid population growth (Niger is the World record) combined to the needs of new arable lands to develop irrigation and the adverse effects of climate change reduce considerably grazing land for animals. So, the mobility of the animals in the search of pastures, salted cures and water points is not done without difficulties. In this chapter, we aim at understanding triggers of conflict between farmers and herders in Niger. Understanding of legitimate and functioning conflict resolution tools and mechanisms may contribute to farmers and herders' security, by increasing the ability of communities to deal with their own vulnerabilities and the threat of conflict itself.

3.2 Empirical Literature Review

Recent studies have shown that, in West Africa, farmer-herder conflicts are not only a common phenomenon over the years but also a common characteristic of their economic livelihood (Moritz 2012; Tonah 2006; Turner, et al. 2011). In several countries of the Sub-Saharan Africa, farmer-herder conflicts have escalated into widespread violence leading to economic damages (crop destruction and loss of animals), loss of human lives and displacement of people (Dary, et al. 2017; Hussein, et

al. 1999). For instance, in November 2016 in Tahoua region of Niger twenty (20) people were killed and forty-three (43) got injured after conflict escalate between farmers and herders. In the same line, 10 people were killed and thirteen (13) injured in November 2014 in Konni (Tahoua region). In Tillabery region during 2010 more than fifty (50) herders were killed when conflict escalated between herders from Mali and Niger herders. In 1991, more than one hundred (100) people passed because of violence escalation between farmers and herders in Maradi region of Niger (Boureima 2000). On the 20th November 2017, about thirty-four (34) people were killed including the head of *Maijirigui* village in Maradi region.

Another conflict between farmers and herders occur in June 2012 at *Zouzou Sané Peulh* in the department of Boboye (Dosso)[10]. This latter conflict did more than six people killed and an economic damage estimated to more than five million (CFA).

Farmer-herder conflicts is reported to have many causes. However, the central argument is about the issue of access to and use of land and freshwater resources. According to Moritz (2012), the likelihood of conflict between these actors increases, whenever a given factor increases the competition to access the land or the freshwater. Climate change is a key factor that may accentuate the scarcity (Abbass, 2014 Mwiturubani and Wyk, 2010; Okoli and Atelhe 2014) of those resources used by the groups simultaneously or mutually exclusive depending to the season. According to Dary, et al. (2017), climate change also causes conflicts due to pastoralists migration from drought prone areas into favourable grazing areas.

Other important factors leading to conflict through resource scarcity are the population growth and the expansion of agricultural land. Indeed, rapid population growth increases competition over available resources by increasing migration of many pastoralists (Moritz, 2012; Adebayo, 1997; Mwiturubani and van Wyk, 2010). Population growth is also reported to raise the demand of food, thus the demand of cropland which in turn shrinks the reserved area for pasturing (Williams, Hiernaux, and Fernández-rivera 1999). Importantly, in trying to adapt to climate change adverse effect, communities encroach pasture land to practice commercial crop production. Therefore, pastoralists are left with insufficient passage for livestock to reach water points, causing conflicts (WANEP, 2010). Turner et al. (2011) have shown that this closeness of livestock to the farm land creates more crop damages. The livestock-

10 https://goo.gl/dkRvSM

induced crop damage, either on the field or in storage on farms, has been argued to be the most important trigger of farmer-herder conflicts in most parts of West Africa (Abubakari, Yakubu, and Longi, 2014; Ofuoku and Isife 2009; Turner, et al. 2007).

However, resource scarcity is not the only path through which conflicts occur. Indeed, evidences show that farmer-herder conflicts can occur in the abundance of resources and low human population densities. For instance, in studying Ghana's case, Tonah (2002; 2006) found that conflict arose between farmers and herders over access to the best agricultural lands and water sources.

According to (Ahmadu, 2011) and Moritz (2012), cultural, religious and ethnic differences between herders and farmers are also triggers of conflicts by creating misunderstandings, suspicion, hostility and prejudices. In some communities, herders are considered or felt to be strangers or alienated (Yembilah and Grant, 2014). Such consideration leads to conflicts as soon as the herders started demanding for equal or acceptable right in the usage of land. Mwamfupe (2015) argues that it is the non-functioning of government institutions and the breakdown of traditional rules are recent key elements explaining the increase of farmer-herder conflicts. Other authors found that cattle rustling, theft, highway robbery, female harassment and rape, corruption of local authorities, and deliberate bush burning are some other factors causing farmer-herder conflicts (e.g. Abubakari, Yakubu and Longi, 2014; Ahmadu, 2011; Ofuoku and Isife, 2009). Distinguishing between long term and short-term causes of farmer-herder conflict is very important for policy implementations. Indeed, resource related conflicts do not simply escalate because of an increase of the competition over the scarce resource but that triggering factors are often involved (Turner, 2011).

Dary, et al. (2017) specified climate change, rapid population growth, expansion of agricultural land, cultural and religious differences, and changes in policies as factors considered as remote causes of farmer-herder conflicts. While destruction of crops, pollution of water bodies, engagement in social vices and the inability of institutions (local and national) to deal with grievances are considered to be triggers of such conflicts. This work is interested in analysing both remote causes and triggers of the farmer-herder conflict in Niger.

3.2.1 Intergroup Conflict

The existing literature defines intergroup conflicts to be conflicts between collections of individuals, such as organized political violence, civil conflicts, riots, wars, and land invasions. In trying to study farmer-herder conflict, we believe that from a climate-and-security perspective it is most likely that small-scale violence is more affected by resource scarcity. However, some studies argued that pastoralist violence seems to be more driven by tactical concerns than by resource-based grievances. For instance, Adano, et al. (2012), argue from two case studies in Kenya that weather tensions are high in resource scarce area and in abundant resource area. A theoretically work by Butler and Gates (2012), using a contest success function model, deduced the presence of biased property rights institutions in periods of relative rainfall abundance to be crucial in determining whether pastoralists engage in inter-ethnic violence or focus on production. The majority of the research on pastoralist societies were conducted in drylands and it is reasonable to assume that the mechanisms at play are different from those driving civil wars (Theisen, et al. 2013). Indeed, Raleigh and Kniveton (2012), found that communal violence takes place in less-populated areas, in contrast to what is found for civil war literature (Theisen, et al. 2012). Barron, et al. (2009), used survey material on Indonesia and conclude that violent conflict is more likely in villages that had suffered a natural disaster during the last 3 years. According to Benjaminsen, et al. (2012), there is no relationship between climatic conditions and land-use disputes in the Mopti region of Mali. Rather than natural resource scarcity, they find, political negligence, restricted mobility for pastoralists, and rent seeking and corruption to be at the heart of conflict in the region. Many scholars have found that high temperatures elevate the risk of many forms of intergroup conflict, both political violence and other forms of collective violence (e.g. Burke, et al. 2009; Hsiang,et al. 2011; Hsiang, et al. 2013; Dell, et al. 2012; O'Loughlin et al. 2012; Baysan, et al. 2014; Caruso, et al. 2016; Maystadt and Ecker 2014; Maystadt, et al. 2015). Importantly, for all these cases, the finding is primarily in low and middle-income settings in which populations are exposed to, on average, warm or hot temperatures.

3.3 The Empirical Problem

As with most of economic problems, studying the climate change and conflict nexus is not straightforward. The ideal situation would be to observe two identical populations or societies, change the climate of one, and observe whether this treatment will lead to

more or less conflict relative to the control group. Given that climate cannot be experimentally manipulated, researchers have relied on natural experiments in which plausibly exogenous variation in climatic variables generates changes in conflict risk that can be measured by an econometrician (Burke, et al. 2015).

3.3.1 Cross-Sectional Approaches

In order to deal with the above problem, researchers have proposed and conducted work with several methods. One approach is to assume that populations or societies inhabiting different locations are identical to one another in all respects except their climate, usually after regression adjustment for observable economic, social, and political correlates of conflict. This assumption of identity of societies seems implausible so that the conditions needed for causal inference to be fulfilled are rarely found, because populations and societies differ from one another in many ways (e.g., religion, culture, history). Many of these dissimilarities are unobserved or hard to measure, so it is not possible to infer whether a climatic treatment has a causal effect (Wooldridge, 2002; Angrist & Pischke, 2008). Buhaug, (2010) compares the rate of civil war across different countries in Africa. For instance, the author used a cross-sectional analysis to compare average rates of civil conflict in South Africa and Nigeria. He attributed the observed differences to the different climates of these countries, despite the many other potentially important ways in which these countries differ. Hsiang and Meng, (2014) revisit this example and they test the assumption that no important omitted variables are missing from the analysis. According to their findings, the baseline conflict rates in these countries are not comparable, arguing that they are unlikely to be valid counterfactuals for one another. This critique was shared by Burke, et al. (2015) who argued that in general, the handful of covariates such as national per capita income or political indices that are commonly used in cross-sectional regression analyses are not enough to credibly account for the numerous ways in which populations and societies differ from one another. Following these authors, we believe that cross-sectional analysis may not explicitly account for all important differences in what causes conflict in one region rather than another. To avoid all the inconvenient of such model, we adopt the Heckman two stages models to handle the objective. We conceive the resource conflict nexus to have two steps as many scholars did in studying climate change adaptation at farmers' level. Indeed, they assume that farmers perceive climate change, and then decide whether or not to adopt a particular measure. In

accordance to that logic, our conflict problem becomes: a farmer or herder first has to judge (subjective measurement) that the resource (his interest) is tied and not sufficient to share and at the second step he/she decides to attack (conflict escalation) or not. This gives rise to a sample selectivity problem since only those who perceive resource to be scarce will fight. Since the objective is to determine triggers of farmer-herder conflict escalation in general, we applied the Heckman's sample selectivity Probit model.

3.4 Methodology

In studying climate-conflict nexus, the innovation of this chapter is to apply Heckman two stages model. In climate change studies this method is applied to generally explore farmers' climate change perceptions and adaptation decisions (e.g. Maddison 2007; Deressa, et al. 2009; Mandleni and Anim 2011). Authors argued in applying the Heckman sample selectivity Probit model to have: two-steps of adaptation to climate change. The first requires that farmers perceive climate change then secondly decide to respond to changes through adaptation or not. We assumed the farmer herder conflict to be resource (access to land, access to water points, crop damage, animal theft etc.) based conflict. The problem becomes: a farmer or herder first has to perceive (subjective measurement) that the resource (his interest) is tied and not sufficient to share and at the second step he/she decides to attack (conflict escalation) or not. We also made the assumption that retaliation is also due to prior perception of the resource scarcity. However, the retaliation decision may not be motivated by the same perception of the resource scarcity. Indeed, he/she may retaliate to protect his life or "dignity" and not necessarily to overtake his opponent's goods.

3.4.1 Theoretical model

Heckman (1974) considered a model of labour supply in which wages and hours worked are the two endogenous variables. Based on his assumption of equating wage equation to market's one, the problem became a decision problem in which the person is whether in the labour force or he is not. Individuals choose to belonging to one group or another and this is based on the individual's assessment of the choices. Individual will opt to belonging to a group whenever the expected gains are greater than not belonging to a group and will not adhere otherwise. Therefore, the problem becomes a utility maximization problem. Lewis (1974) and Heckman (1974) noted

that, modelling these kinds of relationship on the outcome from the decision would lead to over prediction of the gains in econometrics. This possibility to over predict the gains creates a selectivity bias problem. This means that there may be some inert characteristics of say the contributors that are related to their contribution level other than the explicitly measured factors. In this study, the objective was to estimate triggers influencing agricultural practitioners' decision to fight upon scarce resources. This suggested that, we are interested in i) the determinants of resource scarcity and ii) the determinants of conflicts escalation between farmers and herders. To handle this objective, conventionally, the approach would have been to estimate a Probit/Logit function for the first part of the objective and an ordinary least square (OLS) function for the second part. But according to Heckman (1974) this is fraud and would lead to inconsistent estimates. To overcome this inconsistency, and following Greene (2003) we adopted the Heckman (1976) two-stage approach. Thus, a new variable is generated through an iteration procedure after estimating the Probit model (the perception of resource scarcity). In the second stage, this new variable is used as an additional variable (the determinants of actors' decision to fight or not).
Mathematically, the model is presented as:

$$\Pi_{ij}^{*} = \beta_3^{'} X_{ij} + \varepsilon_{ij} \quad \text{.....} \quad \textbf{(3.1)}$$

With $\beta_3^{'}$ is a vector of coefficients and ε_{ij} is the disturbance term in the size of the issue equation. The sample selection problem arises in the size of issue equation because the sample contains farmers and herders who perceive resource to be scarce and those who do not. Those who perceived the scarcity choose between fighting or bargaining (peace).

The farmers/herders who chose to fight $(\Pi_{ij}^{*}, j = A)$ are observed only if they perceived both scarcity and chose to fight. The peaceful farmers/herders $(\Pi_{ij}^{*}, j = N)$ are observed only if they perceived scarcity and chose not to fight but to bargain. These two selection processes can be considered as non-random, and the model should explicitly consider this selection problem in order to produce unbiased estimates (Mandleni and

Anim, 2011). Therefore, addressing the multiple sample selection problems inherent in the size of the conflict equation, consider the following model specification:

Let Y_{i1}^{*} represent the propensity of a farmer/herder being convince on scarcity rather than not. Then the relationship between the observed outcome y_{i1} and the response propensity can be written as:

$$y_{i1} = \begin{Bmatrix} 0 & if & Y_{i1}^{*} & \leq 0 \\ 1 & if & Y_{i1}^{*} & \geq 0 \end{Bmatrix} \qquad \text{Resource Scarcity selection} \ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.1)}$$

Let y_{i2} be the corresponding propensity to choose fighting versus peace as a result of scarcity perception. This variable is only observed when $y_{i1} = 1$, i.e. y_{i2} is a choice between fighting and peace if the farmer/herder judged resource to be scarce and takes the value of 1 for fighting and 0 for peace.

$$y_{i2} = \begin{Bmatrix} 0 & if & Y_{i2}^{*} & \leq 0 \\ 1 & if & Y_{i2}^{*} & \geq 0 \end{Bmatrix} \qquad \text{Conflict selection} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.2)}$$

The variable Π_{iA} is only observed when $y_{i1} = 1$ and $y_{i2} = 1$ (scarcity and fighting), while Π_{iN} is only observed when $y_{i1} = 1$ and $y_{i2} = 0$ (scarcity but peace).

If we consider a random sample of N observations, the selectivity model with bivariate Probit selection equations for the farmer/herder i is as follow:

$$y_{i1} = \beta_1^{'} X_{i1} + \mu_{i1}, \quad y_{i1} = \begin{cases} 1 \ldots\ldots\ldots if & Y_{i1}^{*} > 0 \\ 0 \ldots\ldots\ldots otherwise \end{cases} \text{ Perceived scarcity equation} \ldots\ldots\ldots\ldots \textbf{(3.4)}$$

$$y_{i1} = \beta_1^{'} X_{i1} + \mu_{i2}, \quad y_{i1} = \begin{cases} 1 \ldots\ldots\ldots if & Y_{i1}^{*} > 0 \\ 0 \ldots\ldots\ldots otherwise \end{cases} \text{ Conflict equation} \ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.5)}$$

$$\Pi_{ij} = \beta_3^{'} X_{ij} + \varepsilon_{ij} = \begin{cases} E(\Pi_{iA} \mid \mathrm{X}_{iD}, \mathrm{y}_2 = 1, \mathrm{y}_1 = 1) \\ E(\Pi_{iN} \mid \mathrm{X}_{iA}, \mathrm{y}_2 = 0, \mathrm{y}_1 = 1) \end{cases} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.6)}$$

Equation (3.4) summarizes the first situation stage function between scarcity and non-scarcity (abundance) of resources and equation (3.5) represents situation between fighting and peace (no fight). Both equations represent a partially observed bivariate Probit model. The partially observed situation in the model is due to the unobserved cases of the decision (judgement) of some farmers/herders between fight and peace in cases where farmers/herders were not observing the scarcity of resource due to climate change during the study period.

The conditional distribution of the error terms $\mu_{1,}$ μ_2 and ε_{ij} are distributed according to the multi-normal distribution with zero means and, for identification purposes, the variances equal to 1, i.e. $(\sigma_{\varepsilon}^2 = \sigma_{\mu_1}^2 = \sigma_{\mu_2}^2 = 1)$ and with the following correlation coefficients $(\rho_{1,2}, \rho_{2,\varepsilon}, \rho_{1,\varepsilon})$.

The multinomial structure of the model leads to the following variance-covariance matrix:

$$\sum = \begin{pmatrix} \sigma_1^2 & \rho_{12} & \rho_{1\varepsilon} \\ \rho_{12} & \sigma_2^2 & \rho_{2\varepsilon} \\ \rho_{1\varepsilon} & \rho_{2\varepsilon} & \sigma_{\varepsilon}^2 \end{pmatrix} \text{ ..... (3.7)}$$

The three categories of observations are made with unconditional probabilities as follows:

$$y = \begin{cases} 1, y_{12} = 1 : \Pr ob(y_{i1} = 1, y_{i2} = 1) = \Phi_2 \left[\beta_1^{'} X_{i1}, \beta_2^{'} X_{12}, \rho_{12} \right] \\ 1, y_{i2} = 0 : \Pr ob(y = 0, y_{i2} = 0) = \Phi_2 \left[\beta_1^{'} X_{i1} - \beta_2^{'} X_{i2} - \rho_{12} \right] \\ 0, \qquad\qquad : \Pr ob(y_{i1} = 0) \qquad\qquad = \Phi \left[-\beta_1^{'} X_{i1} \right] \end{cases} \text{ ..... (3.8)}$$

The conditional probabilities for a generic X that might appear in either index function can be written as:

$$\frac{\partial \Pr ob(y_{i1} = 1, y_{i2} = 1)}{\partial X_i} = \psi_{i1}\beta_1 + \psi_{i2}\beta_2 \text{ ..... (3.9)}$$

$$\psi_{i1} = \phi(\beta_1^{'} X_{i1}) \Phi_2 \left(\frac{\beta_2^{'} X_{i2} - \rho_{12}\beta_1^{'} X_{i1}}{\sqrt{1 - \rho_{12}^2}} \right) \text{ ..... (3.9a)}$$

$$\psi_{i2} = \phi(\beta_2' X_{i2})\Phi_2\left(\frac{\beta_1' X_{i1} - \rho_{12}\beta_2' X_{i2}}{\sqrt{1-\rho_{12}^2}}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.9b)}$$

Where the bivariate Φ_2 is normal cumulative distribution function, Φ is the univariate normal cumulative distribution function and ϕ is the normal distribution function. The term β_1 is zero if X_i does not appear in X_{i1}; likewise, β_2 is zero if X_i does not appear in X_{i2}. Thus:

$$E(\mathrm{y}_{i2} \mid \mathrm{X}_{i1}, \mathrm{X}_{i2}, y_{i1} = 1) = \Pr ob(\mathrm{y}_{12} = 1 \mid \mathrm{X}_{i1}, \mathrm{X}_{i2}, y_{i1} = 1)$$
$$= \frac{\Phi_2(\beta_1' X_{i2}, \rho_{12})}{\Phi(-\beta_1' X_{i1})} \qquad \ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.10)}$$

and

$$\frac{\delta E(\mathrm{y}_{i2} \mid \mathrm{X}_{i1}, \mathrm{X}_{i2}, y_{i1} = 1)}{\delta X_i} = \frac{\psi_{i1}\beta_1 + \psi_{i2}\beta_2}{\Phi(-\beta_1' X_{i1})} - \frac{\Phi_2(\beta_1', \beta_2' \mathrm{X}_{i2}, \rho_{12})\phi(\beta_1' X_{i1})\beta_1}{[\Phi(-\beta_1' X_{i1})]^2} \quad \ldots\ldots\ldots \textbf{(3.10a)}$$

According to Heckman (1979) the corresponding log-likelihood function to be maximized with respect to the parameters β_1', β_2' and ρ_{12} can be derived as:

$$\Omega = \sum_{y_{i1}=1, y_{i2}=1} \ln \Phi_2(\beta_1', \beta_2' \mathrm{X}_{i2}, \rho_{12}) + \sum_{y_{i1}=1, y_{i2}=0} \Phi_2(\beta_1' \mathrm{X}_{i1}, -\beta_2' \mathrm{X}_{i2}, \rho_{12}) + \sum_{y_{i1}=0} \Phi(-\beta_1' \mathrm{X}_{i1}) \ldots \textbf{(3.11).}$$

A natural starting point for estimation would be an extension of Heckman's two-step estimator. In the first step, equation (3.4) and (3.5) are estimated using a Bivariate Probit Model (BPM) to obtain the two selectivity bias terms λ_{i1} and λ_{i2} (the Inverse Mill's Ratio)[11]; which are defined as (Greene, 2003):

[11] The IMR, named after John P. Mills, is the ratio of the probability density function over the cumulative distribution function of a distribution. Use of the inverse Mills ratio is often motivated by the following property of the truncated normal distribution. If x is a random variable normally distributed with mean μ and variance σ^2 then it is possible to show that: $E(x|x>\alpha) = \mu + \sigma$**[{φ((α-μ)/σ)}/{1-Φ((α-μ)/σ)}]** where α is a constant, φ denotes the standard normal density function, and Φ denotes the standard normal cumulative distribution function. The term in blue denotes the Inverse Mill's ratio.

$$\lambda_{i1} = \phi(\beta_1^{'} \mathrm{X}_{i1}) \left(\frac{\Phi[\beta_2^{'} \mathrm{X}_{i2} - \beta_1^{'} \mathrm{X}_{i1} \rho_{12} / \sqrt{1-\rho_{12}^2}}{\Phi_2[\beta_1^{'} \mathrm{X}_{i1}, \beta_2^{'} \mathrm{X}_{i2}, \rho_{12}]} \right) \quad if \quad y_1 = 1 \ldots\ldots\ldots\ldots\ldots \textbf{(3.11a)}$$

$$\lambda_{i2,A} = \phi(\beta_1^{'} \mathrm{X}_{i1}) \left(\frac{\Phi[\beta_1^{'} \mathrm{X}_{i1} - \beta_2^{'} \mathrm{X}_{i2} \rho_{12} / \sqrt{1-\rho_{12}^2}}{\Phi_2[\beta_1^{'} \mathrm{X}_{i1}, \beta_2^{'} \mathrm{X}_{i2}, \rho_{12}]} \right) \quad if \quad y_2 = 1 \ldots\ldots\ldots\ldots\ldots \textbf{(3.11b)}$$

$$\lambda_{i2,N} = \phi(-\beta_2^{'} \mathrm{X}_{i2}) \left(\frac{\Phi[\beta_1^{'} \mathrm{X}_{i1} - \beta_2^{'} \mathrm{X}_{i2} \rho_{12} / \sqrt{1-\rho_{12}^2}}{\Phi_2[-\beta_1^{'} \mathrm{X}_{i1}, \beta_2^{'} \mathrm{X}_{i2}, \rho_{12}]} \right) \quad if \quad y_2 = 0 \ldots\ldots\ldots \textbf{(3.11c)}$$

The BPM utilizes maximum likelihood estimation (MLE) method to allow the stochastic error terms to be correlated across equations. The parameter ρ_{12} estimates the correlation between the error terms of the BPM equations (3.4) and (3.5). If the MLE estimate of the correlation coefficient ρ_{12} is significant, then the BPM estimation is more efficient than that of independent Probit equations.

Finally, the sample selectivity adjusted size of issue equation can be written as:

$$E(\Pi_{iA} \mid \mathrm{X}_{iA}, \mathrm{y}_2 = 1, y_1 = 1) = \beta_3^{'} \mathrm{X}_{iA} + \gamma_1 \lambda_{i1} = \gamma_2 \lambda_{i2,A} + \varepsilon_A^{*} \ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.12)}$$

Where, $\varepsilon_A^{*} = \varepsilon_{iA} - \gamma_1 \lambda_{i1} - \gamma_2 \lambda_{i2,A}$ & $E(\varepsilon^{*} \mid \mathrm{y}_2 = 1, y_1 = 1) = 0$

$$E(\Pi_{iN} \mid \mathrm{X}_{iN}, \mathrm{y}_2 = 0, y_1 = 1) = \beta_4^{'} \mathrm{X}_{iN} + \gamma_1 \lambda_{i1} = \gamma_2 \lambda_{i2,\mathrm{N}} + \varepsilon_N^{*} \ldots\ldots\ldots\ldots\ldots\ldots \textbf{(3.13)}$$

Where, $\varepsilon_N^{*} = \varepsilon_{iN} - \gamma_1 \lambda_{i1} - \gamma_2 \lambda_{i2,\mathrm{N}}$ & $E(\varepsilon^{*} \mid \mathrm{y}_2 = 0, y_1 = 1) = 0$

In the second estimation stage (conflict), the Tobit issue size equations incorporate the probability of the limit and non-limit observations from the first stage (scarcity observation) estimation and take into account the correlation across equations. The correlation could arise because the unobservable capture might be correlated with the unobservable that influence the choice of the form of scarcity caused by climate change (Yes or No) i.e. the correlation coefficients from equations (3.4) and (3.6) and equations (3.5) and (3.6) might not equal zero. The Heckman estimators described above are considered consistent, even though not fully efficient.

3.4.2 Empirical Models

To handle this objective, two stages are needed: in the first stage, we examined the

probability that a farmer or herder with particular characteristic perceives environmental resource to be scarce or not.

Heckman's sample selectivity Probit model is based on the following two latent variables:

$$y_{1i}^{*} = X_{1i}^{'}\beta_1 + u_{1i}$$
$$y_{2i}^{*} = X_{2i}^{'}\beta_1 + u_{2i} \qquad \textbf{(3.13)}$$

$$y_{1i} = \begin{cases} y_{1i}^{*} & if \quad y_{2i}^{*} > 0 \\ 0 & if \quad y_{2i}^{*} \le 0 \end{cases}$$

With X_1 a k-vector of regressors, X_2 is an m vector of repressors, u_{1i} and u_{2i} are error terms.

The sample rule is that y_{1i} is observed only when y_{2i}^{*} is greater than zero. Suppose as well that u_{1i} and u_{2i} have a bivariate normal distribution with zero means and correlation ρ.

$$\begin{aligned} E[y_{1i} \mid y_{1i} \textit{ is observed}] &= E[y_{1i} \mid y_{2i}^{*} > 0] \\ &= E[y_{1i} \mid u_{2i} > -X_{2i}^{'}\beta_2] \\ &= x_i^{'}\beta + E[u_{1i} \mid u_{2i} > -X_{2i}^{'}\beta_2] \\ &= X_{1i}^{'}\beta_1 + \rho\sigma_{u_{1i}}\phi(X_{2i}^{'}\beta_2 / \sigma_{u_{1i}}) / \Phi\lambda_i(X_{2i}^{'}\beta_2 / \sigma_{u_{1i}}) \end{aligned} \qquad \textbf{(3.14)}$$

Where Φ is the cumulative distribution function of the standard normal distribution; ϕ is the corresponding density; $\sigma_{u_{1i}}^2$, $\sigma_{u_{2i}}^2$ are the variances of u_{1i} and u_{2i} respectively; and ρ is the correlation between u_{1i} and u_{2i}.

The latter term in the last line in (3.15) causes sample selection bias if $\rho \neq 0$. In order to avoid the sample selection problem, and to get asymptotically efficient estimators, we followed Maddison, (2007) and Deressa et al. (2008) in applying the Heckman Probit selection model but for different purposes.

This is specified as:

$$\begin{aligned} Scarcity_i = \alpha_0 + \alpha_1 Hhsize + \alpha_2 Resource + \alpha_5 Hheduc + \\ \alpha_6 Hhage + \alpha_8 Extension + \mu_1 \end{aligned} \quad \ldots \textbf{(3.16)}$$

In the second stage, we sought the probability to fight instead of bargaining (negotiating) a situation. The model specification here is:

$$Conflict_i = \beta_0 + \beta_1 Gender + \beta_2 Hheduc + \beta_3 Hhage + \beta_4 Perc\exp + \beta_5 hhsize + \beta_6 Accesscredit + \beta_7 Disauth + \beta_8 Corptauth + \mu_2 \quad \textbf{(3.17)}$$

Where; ***Gender*** is a dummy variable taking 1 if the actor (farmer or herder) is male and 0 if females; ***Heduc*** is the number of years a household head has been to formal school; ***Hhage*** is the number of years of the household head; ***Percexp*** is an estimation of the total riches from herding or farming; ***hhsize*** is the number of persons that depend on the household head; ***Extension*** (Access to Credit**,** Heath services, Good roads….) represents the facilities a farmer or a herder have access to, given his location; the degree of corruption of traditional and modern authorities (***Corptauth)*** is a binary variable taking one (1) if a farmer/herder thinks that authorities in his area are corrupted in managing conflict issues and takes zero (0) otherwise.

3.5 Model Variables

a) Dependents Variables for both Models

The dependent variable for the selection equation is binary and indicates whether or not a farmer/herder perceives resource scarcity due to climate change. The dependent variable for the outcome equation is also binary and indicates whether or not a farmer/herder responded to the perceived scarcity by fighting. Farmers/Herder are asked to indicate whether they had been in conflict and if this is motivated by scarcity or other reasons (envy, ethnic tension, seek for revenge etc.). A dummy variable was then created taking the value of one (1) if the farmer had been in conflict because of the observed scarcity, and zero (0) if he/she had not.

b) Explanatory Variables for the Selection Equation

Variables are chosen base on the hypothesis that they influence a farmer/herder to judge whether he/she observes a scarcity and its origin. The household head's socio-economic conditions[12] have an impact on their judgement of resource scarcity.

The household size (***Housesize***) is expected to be positively correlated to farmer/herder's capacity to observe the resource scarcity. The per capita needs in the household is supposing to decrease given the decrease of resources associated to climate change. The ***resources*** (Land size, water access, agricultural gain…) is supposed to be negatively correlated to the scarcity judgement. Everything being equal, big land for farming or herding gives more opportunities to produce or to get more pasture. Education[13] (***Hheduc***) is more likely to expand farmers' sources of information through various media, such as newspapers, TV and radio. The more education a farmer/herder has, the greater his ability to perceive resource scarcity is. Therefore, higher education is likely to expose farmers to more information on climate change and to the associated scarcity. Previous studies (Maddison 2007; Nhemachena and Hassan 2007; Ndambiri, et al. 2013) have indeed found that education influenced the ability of a farmer to perceive climate change and its effect. The farmer/herder's age (***Age***) is used as a proxy of his/her experience and is assumed to be positively correlated to his/her perception of scarcity causes by climate change and other source of scarcity. Access to credit (***Accesscredit***) and off-farm (***Offfarm***) activity participation are binaries and are assumed to be positively correlated to the scarcity observation. Indeed, a farmer/herder who leaves his own activity to look for minimal survival means or who has to borrow informally (high interest rate) is more positioned to observe resource scarcity link to climate change. Importantly, the income (***percexp***) is critical in drawing the attention of a farmer/herder that resources available are scarce. Their (farmers and herders) income is estimated base on what they produce during the 2017 harvest season. Environmental stresses such as drought and flood increase the farmer/herder judgement on scarcity of resources. Drought hits both farmers and herders because they all lose their production, while flood is more likely to be more dangerous for farmers.

[12] Age of the head of household, Educational level, Information on climate change, access to credit, and off-farm participation, household size, land size, farmer/herder's Income.

[13] This variable is supposing to contribute positively in observing scarcity and in deciding not to fight but seek for negotiations (peace).

c) Explanatory Variables for the Outcome Equation

The variables hypothesized to influence conflict escalation between farmers and herders include the level of education of the head of household, the size of the household, the gender of the head of household, conflict precedent, access to credit, the household's income, land size, the distance to the administrative authority, degree of corruption of traditional and modern authorities, crop damage, animal theft, and ethnicity.

The education (***Hheduc***) level is believed to be negatively corelated to conflict escalation. The more the farmer/herder is educated, the more he chooses to resolve issues through negotiation rather than violence. The gender (***Gender***) of the household head is hypothesized to influence the decision to fight over negotiation. Probably[14] men are more violent than women when facing a scarcity in resource. The income (***percexp***) and age (**Hha*ge***) are continuous variables and are expected to be negatively correlated to conflict escalation. The more endowed a farmer/herder is, the les he/she is interested in fighting over scarce resource. Also, we assumed that elders are characterised with wisdom and less motivated to get involved their families in a deadly battle. The household size (***Hhsize***) is expected to offer more fighting power and increases the likely preference of conflict over peace. ***Extension*** services such as access to Credit is expected to decrease the probability to fight. Indeed, credit may increase the coping strategies of farmer/herder when scarcity due to climate change is crucial. It also allows to diversify activities, which impose to the actor to consider others as customs not as opponents. Another explanation of our assumption is that, researchers (Katungi and Akankwasa, 2010) found that credits availability of credit relaxes the financial constraints and allows farmers to afford the cost of adaptation (use of improved crop varieties and irrigation facilities) to cope with climate change adverse effects, thus to help not to fight.

Also, researchers have shown that variables such as conflict precedent, distance to the administrative authority, degree of corruption of traditional and modern authorities, crop damage, animal theft, are all to contributing positively to conflict escalation. However, in this work we dealt with time constraints therefore such variables were not used in the regression but analyse in the interview results.

[14] According to Bello and Maman (2015) the majority of households are headed by men (99%) in Niger.

3.6 Study Area

Conflict related to natural resources (except mining) in Niger is across the whole country. However, they are more frequent in areas where population density is higher (UNDP

[United Nations Development Programme], 2014) such as Maradi region and the southern part of Dosso, Tahoua and Zinder regions. Some factors such as bad governance and injustice, rapid population growth, climate change, political instability, and segregationist practices are reported by the UNDP to accentuate such conflicts in the country.

Seven over the eight administrative regions (Agadez, Diffa, Dosso, Maradi, Tahoua, Tillabery and Zinder)[15] were considered in this study. The capital city (Niamey) is not considered in this study because with the bad and unorganized urbanization, there is almost no land for farming or herding for the region. Farmer-Herder conflict is then difficult to analyse in such place. Even among these seven regions, the UNDP conducted a field work at national level and classified the risk of conflict related to resources (farmer-herder) escalation to be very high in some regions (Dosso, Maradi and Diffa) and moderate in the remaining regions of the country. Indeed, some ethnic groups (practicing the almost the same activity like farming) developed an unpleasant behaviour to see another group (like group almost practicing herding) as an eternal enemy. Resource scarcity combined with some cyclical tension between communities make these three regions predominant in conflict escalation between farmers and herders. Therefore, for the general analysis we consider the seven regions and for the focus group discussions and resource persons interview we purposively (financial resource availability and predominance of conflict) chose the three regions (Diffa, Dosso and Maradi).

Dosso region (with the department of Gaya) is relatively wetter than the other regions. The harsh climate conditions make the grass growth very hard and even agricultural practice. Niger regions' populations are made up of both sedentary farmers and migratory herdsmen. Importantly, the three regions are key in the national economy as represented in the table 4 bellow. Indeed, Maradi and Dosso are respectively first and second producer of cereals (millet, sorghum, beans etc.) in the country. Given their

[15] See Figure 15

weight in crop production (farmers) and the relatively good animal production (herders) and the high population pressure on such resources, they are potential for conflict escalation. The region of Diffa is the main (about 50%) producer of fish at national level because of Lake Chad and the Komadougou. Diffa is also a zone of transhumance of herders (nomadism) and an important area for irrigation of leguminous such as sweet pepper (called the *Red Gold*).

Table 7: Agriculture statistics of the study area from (2000-2009)[16]

Source: Summations from INS, 2010

Region	**Animal Production (in 1000 of heads)**			**Cereals Production (in 1000 of tons)**			**Fishing (in tons)**	**Conflict prone (UNDP)**
	Cattle	Caprine + Ovine	Dromedary	Millet	Sorghum	Bean		
Diffa	8,246.5	17,248	3,644.5	431.1	30.9	709.9	**141,885**	Very High
Dosso	7,260	15,000.3	276	5,162.7	519.3	1,369.5	19,492	Very High
Maradi	11,680.9	35,104.8	2,479.6	5,602.3	2469.7	1,474.9	1,145	Very High
Niger	**75,639**	**204,255.3**	**15,532.9**	**26,012.4**	**6620.5**	**3,551.5**	**243,016**	

[16] The period is just to give statistics when all regions have and for all agricultural aspect being considered.

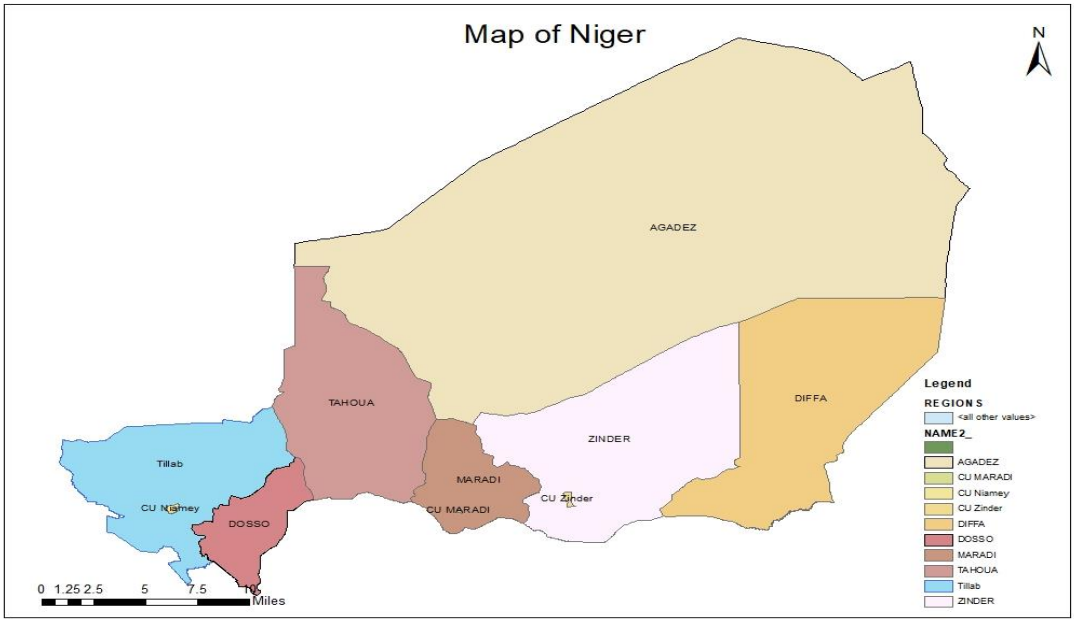

Figure 16: Map of Niger showing its 8 regions

3.7 Data and Sampling

3.7.1 Data

To conduct this study and achieve the stated objective, we used primary data from field work conducted in October 2017 and household survey secondary data from the INS. The following data collection methods are used: Focus Group Discussions (FGDs) with farmers and herders to capture what causes their conflicts and how they are being resolved. There were interviews of key resource persons, NGOs, and local authorities on conflict management. A questionnaire was implemented on four hundred farmers and herders in the three (Diffa, Dosso and Maradi) regions. The secondary data are from INS for the year 2015 on about 2,500 farmer/herder households throughout the seven regions.

3.7.2 Data Collection

The primary data is collected from farmers, herders, local government officials, community leaders, representatives of farmers and herders' associations, and non-governmental organizations (NGOs) directly related to farmer-herder cohabitation. Two research instruments for data collection are used: The first one is a questionnaire survey which was used to elicit information on socio-economic characteristics of actors (farmers and herders), incidences of conflict, causes, consequences and strategies

adopted to resolve conflicts. A total of four hundred (400) copies of questionnaire were administered to farmers and herders. Each of the tree regions received proportionally to its population size (2016 national estimation) the number of respondents. Thus, in Diffa we administered 50 questionnaires, 130 for Dosso and 220 for Maradi region. The second instrument is an interview guide containing open-ended questions for local government officials and community leaders and resource persons, to understand how resource scarcity affects farmers and herders, and policies that regulate the use of land and water sources by these actors. In total we worked with 87 respondents in October 2017.

3.7.3 Sampling Design

Respondents for the study are selected through multi-stage sampling procedure. We select purposively at the first stage three regions (Diffa, Dosso, and Maradi) of the country where conflict between farmers and herders is more frequent. At the second stage we selected purposively one (1) department from each region. For Diffa region, the reason for a purposive randomisation to choose the department of *Mainé Soroa* is due to security issue. But for the department of *Boboye* (Dosso) and department of *Madarounfa* (Maradi) the selection purpose is simply due to the frequency of conflict escalation in these departments. From each of the selected department we randomly select one (1) district. At the third stage, we randomly selected and respectively one (1), two (2) and four (4) villages in Mainé Soroa, Boboye and Madarounfa, giving a total of 7 villages for the sample. At the fourth stage, a combination of respectively 50 (Mainé Soroa); 130 (Birni N'Gaoure) and 220 (Madarunfa) actors are randomly selected from the selected villages. The sample repartition is based on the proportion of the region population in the national total. The selection is on adults as respondent, yielding to four hundred (400) total respondents for the study.

Key informants provide information and opinions on the causes and factors that lead to conflicts between the farmers and herders in their various communities and the possible solutions to such problems. For instance, issues between these actors can be where and what size the corridor for herders should be? What is the right time to release animals for free grazing? How much should be paid per hectare to compensate a farmer in case a given herder damages his crop, and vice versa? As one can see these are just some issues on which the parties are surely going to have differences of preferences.

Table 8: Selected communities for qualitative data

Region	Department	District	Village	Sample	COORDINATES	
					LAT.	LOG.
Diffa	Mainé Soroa	Mainé	Alaouri	50	L:011°59',409	l:13°11',376
Dosso	Birni N'gaoure	Birni	Batama Beri	65	L:002°53',952	l:13°07',459
			Kofo	65	L:002°44',113	l:13°09',311
Maradi	Madarounfa	Madarounfa	Gangaré	55	L:007°11',958	l:13°17',053
			Jambali	55	L:007°11',936	l:13°15',983
			Angoual Mata	55	L:007°11',752	l:13°19',996
			Kountoumi	55	L:007°11',892	l:13°10',606

Source: Garba, 2018

3.8 Results and Discussion

3.8.1 Interview and FGDs Results

- ✓ **Farmer-Herder's perceptions of change and how they cope with**

This section analyses actors' perceptions of climate change and how it affects their resources availability. We present the outcome of the survey of farmers-herders 'constraints in their activities practices in response to climate changes.

The survey instruments were designed to capture farmer-herder's perceptions and understanding of climate change as well as channels through which their activities are affected and how they cope with. The respondents were asked whether they have noticed changes in mean temperature and rainfall. Results show that 92% of the selected households have perceived changes in the mean temperature while the corresponding response to rainfall accounts for 94.5% in the last two decades.

Regarding the direction of the change in temperature, 86.5% of the sample households perceive an increase in mean temperature and 5.5% a decrease. The rest (8%) do not know the direction of the mean change in temperature. With regard to the rainfall, 3.5% of the sample households observed an increase and 78% a decrease while 19% of them do not observe any change. Table 9 depicts respondents' perceptions of climate

changes. In general, increased temperature and declined precipitation are the predominant perceptions in the study sites.

Table 9: Farmers' perception of changes in the climate

Number	Directions	Precipitation	Temperature
1	increase%	86.5	3.5
2	decrease%	5.5	78
3	same%	8	19
Total		100	100

Source: Garba, July 2018

- ✓ **Coping strategies with limited resource**

In general, Niger Republic farmer-herder's ability to adapt is limited by their lack of economic and technical resources, and their vulnerability is accentuated by heavy dependence on the climate, because of the rain fed system, diseases/pests and their poverty. Given the diversity of the constraints they have to face, the general capacity to cope with changes is currently very low.

The effects of the climate variations and climatic constraints in Niger Republic are numerous. The climate change is associated with the source of difficulties in the rural world. The prolonged and increasing temperature, combined with the declining of the rainfall and the frequency of the drought, as well as the marked degradation of the soils, have resulted in a succession of bad years. Many studies such as Deressa et al. (2008) indicated that crop yield declined by 32.8% as result of shocks such as drought, hailstorm, and flood etc. Farmers and herders therefore try to develop their own strategies to mitigate or adapt to climate adverse impacts.

The adaptation methods most commonly cited in the literature include the use of new crop varieties and livestock species that are more suited to drier conditions, irrigation, crop diversification, mixed crop livestock farming systems, changes of planting dates, diversification from farm to nonfarm activities, increased use of water and soil conservation techniques, and trees planted for shade and shelter (Nhemachena and Hassan, 2007).

In the case of this study, farmers and herders were asked about their perceptions of climate change and their actions to counteract the negative impact of climate change. The adaptation measures that farmers report may be profit driven, rather than climate change driven. As shown in Table 4.2, about 85% of the respondents did at least

something in response to climate changes. This shows that they are aware of the changing climatic conditions. About (15%) of the sample did not use any adaptation option for a number of reasons. The adaptation strategy most commonly used (about 17%) is irrigation especially in Dosso region. Other adaptation strategies farmers used are soil conservation (8%), using different crop varieties (12%), trade (10%), planting trees (12%), fighting (11) and livestock (14%).

Table 10: Coping strategies to climate change

Number	Adaptation methods	Percentage
1	No Adaptations	16
2	Soil conservations	8
3	Planting trees	12
4	Different crop varieties	12
5	Irrigations	17
6	Trade	10
7	Fight	11
8	Livestock	14
Total		100

Source: Garba, July 2018

The use of planting trees is mainly ascribed to provide natural shades for their livestock or as a wind or hail storm break when the temperature is hot. Soil conservation techniques may be attributed to avoid the risk of flooding. The use of different crop varieties as an adaptation method could be associated with the lower expense and ease of access by farmers. The greater use of irrigation could be attributed to the closeness of some villages in our sample to Lake Madarunfa and the Boboye (zone of the country, Dosso, where even at one-meter depth well is operational). But take as the whole Niger Republic this cannot be the case because of lack of more capital and low potential for irrigation over the country. However, 16% of the farmers do not have any of these adaptation strategies mainly because of lack of necessary funds, information and government support. To our point of view, this group could easily join the group of those who chose to fight over resources as an adaptation strategy.

- ✓ **Constraints on coping strategies**

Summary statistics indicate that there are four major constraints to adaptation in our sample. These are, shortage of land (30%), poor potential for irrigations (38%), lack of

access to credit (30%) and lack of information (2%), and culture. Table 11 shows the major constraints to adaptation perceived by farmers in these regions.

Table 11: Barriers to coping strategies

Constraints	Percentage
Poor potential for irrigation	19
Shortage of land	29
Lack of money	22
Lack of information	19
Culture	11
Total	100

Most of these constraints are associated with poverty. Lack of information on appropriate adaptation options could be attributed to scarcity of research on climate change and adaptation options. Lack of money hinders farmers and herders from getting the necessary resources and technologies that facilitates adapting to climate change. Shortage of land has been associated with high population pressure, which forces farmers and herders to intensively use a small plot of land. Poor irrigation potential is most likely associated with the inability of farmers to use adequately the water e due to technological incapability. Importantly, culture is defined in this study as ways of life of the people in the country. By defining culture to be a barrier to adaptation, one has to remember that some of our respondents used fighting as an adaptation strategy. So, we then asked what is stopping others to use the same method to adapt? Result shows that 11 per cent respond that it is because of their culture, which is against using violence to solve issues.

3.8.2 Regression Results

Table 121: Results of the Heckman's Model of Farmer-Herder Scarcity Perception and Conflict decision

	Scarcity Perception model				**Conflict model**			
	Regression model		**Marginal effects**		**Regression model**		**Marginal effects**	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Household Head Age	0.013691***	0.000	0.013691***	0.000	-0.0420264***	0.003	0.013691***	0.000
Gender					0.3851825	0.439		
Household Head Education level					-0.969638*	0.062		
Household size	0.0270679***	0.000	0.0270679***	0.000	0.325733***	0.002	0.0270679***	0.000
Extension services	0.1467351***	0.003	0.1467351***	0.003			0.1467351***	0.003
Resources	-2.05e-06***	0.000	-2.05e-06***	0.000			-2.05e-06***	0.000
Per capita income					-0.0000281***	0.000		
Scarcity					7.56046***	0.000		
Constant								
Wald test for zero slopes	*10,313.58, Prob > chi2 (4) =0.000*							
Wald test for independent equations	*61.99 Prob > chi2(1) = 0.0000*							
Total observations	*2,333*							
Censored	*1,703*							
Uncensored	*630*							

Notes: ***, **, * = 1%, 5%, and 10% significance level, respectively

Source: Regression from INS dataset

To be able to check the appropriateness of the proposed model, we tested the dependence of the error terms in the outcome and selection equations. We found that the error terms from the outcome and selection models were dependent, therefore there is a sample selection problem. The coefficient "rho" was significantly different from zero (Wald test for independent equations = 61.99, with P = 0.0000), giving room for the use of the Heckman model. The Wald $\chi 2$ statistics, which hypothesize that the estimated coefficients are equal to zero and that significantly, thus the null hypotheses (Wald for zero slopes = 10313.58, with P = 0.0000). The model is globally suitable and the independents variables have a strong explanatory power.

The results showed that the ***extensions*** (electricity, TV, Radio, Health centre, access to credits etc.), ***household size***, ***household head's age***, and ***resources*** (land mass, income from farming and herding) significantly affect the perception of resource scarcity. The conflict escalation between farmers and herders is significantly affected by the ***household size***, ***household education level***, the ***per capita agricultural income***, the ***household's age*** and the ***scarcity*** perception. The household head's gender is not significant in explaining conflict escalation.

As expected, the ***age of the household*** head, which represents experience in herding or farming, is positively and significantly related to the scarcity perception but negatively and significantly related to the conflict escalation. This means that older households are more likely to perceive the dwindling of agricultural resources and less willing to fight. This finding is intuitive, when we assumed that elders are more tolerant than young men in retaliation for any damage.

The ***household size*** is positively and significantly related to both the scarcity perception and to the conflict escalation variables. Farmers and herders feel more the scarcity based on the number of people they are feeding. This is expected because the per capita land to farm or the per capita livestock are decreasing given the negative effect of climate variability. So, from our sample, we can assume that the size of a household is not synonymous of having labour for production but people to feed. Importantly, the size of a household increases the potential for conflict escalation. Big households tend to fight more probably because they have more to feed and expect a victory from any conflict outbreak. The arms used in farmer-herder conflict are mainly traditional and

does not require any skill so sized household can easily retaliate. Beyond the household, groups (farmers or herders) decides to retaliate base on the opponent soldiers.

Extensions availability and their access allow a farmer or a herder to perceive how resources are scarce. Indeed, whenever extension increases, a given actor perception of scarcity decreases.

The ***level of education*** is negatively and significantly correlated to the likelihood of farmer-herder conflict. Educated people are more willing to resolve differences through negotiation instead of fighting. This result is important in terms of policy recommendation. Indeed, to build a peaceful society, the work has to be done from the bottom through educating young people from rural to urban area.

As many scholars have shown, the ***per capita income*** is significantly and negatively correlated to conflict potential. This finding confirms the theory of environmental resource constraints leading to violence in areas where people lack education and households' size bigger.

The more an actor has ***resourced*** the less he considers the scarcity not to be crucial. Everything being equal, it shows that big farming or herding households will automatically have less per capita resources compare to small households.

One of our variables of interest, ***scarcity***, is positively and significantly correlated to conflict escalation. This is fundamental because scarcity perception is linked in our sample to frustration. It means people when they lack basic needs, the become frustrated and are willing to fight in order to redress their grievances. Climate change hampered the agricultural resources and lead people to fight over the remaining resources instead of cooperating.

Though the variable ***gender*** is not significant, the coefficient is showing that males are more likely to fight each other compare to female, probably because males are more involved in farming and herding activities.

Conclusion

In general, the current situation of developing countries and our country in particular is characterized by high population growth and dwindling natural resources, increased competition for the exploitation of natural resources generating conflicts between rural actors.

In this chapter, conflict is defined as the manifestation of a difference, an antagonism, an opposition between people or groups of people on a specific object or interest. Any conflict involves three key elements that are: the actors, the object, and its manifestation.

Farmer-herder conflict is the more frequent as conflict type in Niger and results in many deaths and economic damages. Through our interview results, we understand that it has many causes such as: Resource access (well, pasture, water points…), Sinking of private wells, Introducing of animal diseases in a common grazing area, Grazing area cultivation by sedentary herders, Refuse to obey to usages and customs, Animal theft and robbery, Bad interpretation of land tenure system, Refusal to obey to court decision, and Empoisoning of water points and so on. The regression result from the Heckman two stage model shows that the extensions (electricity, TV, Radio, Health centre, access to credits etc.), household size, household head's age, and resources (land mass, income from farming and herding) significantly affect the perception of resource scarcity. The conflict escalation between farmers and herders is significantly affected by the household size, household education level, the per capita agricultural income, the household's age and the scarcity perception.

Given this situation and with the aim of boosting local development, in the peace and social tranquillity, favourable behavioural changes for a better use of available natural resources is needed.

4.0 CHAPTER FOUR: ARMED CONFLICT RESOLUTION IN NIGER

4.0 Introduction

Conflict resolution has grown as a very important research area in the study of armed conflict. We examined in this chapter techniques of conflict resolution and the extent to which Niger's stability is at risk and what its future trajectory is likely to look like. It is important to understand and gain knowledge about the resolution of conflicts within states because of their frequency, and because of their negative consequences, including human starvation and death, refugee and displacement flows, and economic and ecological devastation. In this chapter we used qualitative methods in using Svensson (2014) analytical tools (When, Who, What, and How) to understand how conflicts (terrorism, rebellion and farmer-herder conflict) can be peacefully handled. Basically, this method seeks answer to the question of: under what conditions are armed conflicts resolved? Given its neighbouring countries instability, one can say that Niger is relatively stable. Indeed, Niger is surrounded by countries facing severe security crises: Libya, Mali and Nigeria and they are at risk of partial or total disintegration. Recently even the relatively stable borders such as Burkina Faso, Chad and Algeria are increasingly facing attacks from terrorists. Many reasons explain how critical the security situation of the country is at risk. First, due to porous borders and transnational linkages, events in the first three countries have inevitable implications for Niger. Second, the country suffers from the same or very similar long-standing structural disadvantages that are at the heart of security crises elsewhere. Third, Niger is no stranger to political instability (since its independence in 1960, the country has lived under seven different constitutions, experienced four military juntas in power), seen two rebellions and ongoing terrorism attacks.

4.1 Conceptual Framework

In this section, we summarised the conceptual meaning of "conflict resolution." Also, concepts utilized in the field related to conflict resolution are explained, such as conflict management, conflict settlement and conflict transformation.

Svensson (2014) highlighted three important aspects of the concept: Firstly, *voluntariness*, end of violence and agreement on the issues. According to (Kriesberg,

2007) conflict resolution was used to describe "*mutually acceptable ways of ending conflicts*". The key point here is the acceptance by parties, which implies a high degree of voluntariness. Similarly, (Mitchell, 1981), described conflict resolution as "*a solution which is generally acceptable to parties to the conflic*t". The voluntary nature of conflict resolution should be dissociated from enthusiasm in the agreement. Indeed, parties in conflict often feel obliged to settle their conflict against their expected gain, and conflict resolution represents second-best solution (whereas the best option is victory). Simply put, parties resolve their conflict (using voluntariness approach), not necessarily without pressure, but ultimately by their free will.

The second form of conflict resolution is its conception as a form of conflict termination. It represents a way of ending the violence between parties. This implies that the parties lay down their arms. Termination through conflict resolution implies that armed conflicts will be brought to an end (at least temporarily) (Svensson, 2014).

The third aspect relates to conflict resolution concept is the issue of the dimension of conflict. For a conflict to be resolve, it is necessary that the parties come to an agreement that settles or dissolves their basic dispute. Scholars in conflict theory argued that, the stated aspirations concerning a contested resource are called *incompatibility*. Wallensteen (2011) stated that conflict resolution is the dissolution of the incompatibility. According to this author conflict resolution is a "*social situation where the armed conflicting parties in a (voluntary) agreement resolve to live peacefully with and/or dissolve their basic incompatibilities and henceforth cease to use arms against one another"*. Mitchell (1988) describes conflict resolution to be an arrangement "*towards a solution whereby neither opponent abandons any of its basic values.*"

It is also important, to sperate analytically how conflict resolution is related to the concepts of *conflict management, conflict transformation* and to *conflict settlement*.

Ramsbotham et al. (1999) define *conflict management* as "the limitation, mitigation and containment of violent conflict." In similar vein, Wallensteen (2011) states that conflict management "typically focuses on the armed aspect of the conflict: bringing the fighting to an end, limiting the spread of the conflict and, thus, containing it". Rubin, Pruitt, and Kim, (2004) defined conflict management as an agreement where the parties work out ways of deescalating and avoiding future escalation. Therefore, conflict management is about the behavioural aspects of the conflict in minimizing the intensity, the violence, its spread, the escalation but not about resolving the issues at

stake.

Conflict *settlement* is sometimes used interchangeably with conflict resolution, and at other times used to describe a less ambitious agreement on the issues. While a conflict *settlement* has to do with enough of the issues that the parties are willing to give up their escalated struggle, conflict *resolution* represents an agreement in which most or all of the issues are cleared up (Rubin, Pruitt, and Kim, 2004). Some authors argued that the difference between these concepts is not about the number of issues, but it is about the depths of the issues. Indeed, conflict settlement is merely an agreed ending of the conflict, but conflict resolution, "implies that the deep-rooted sources of conflict are addressed, and resolved (Ramsbotham, et al. 1999). Another understanding is that conflict settlement is to reach a compromise solution, whereas conflict resolution is a more integrative solution (a "win-win" solution) (Mitchell 1981).

The difficulties linked to the concept of conflict *transformation* definition makes it less utilised by researcher compare to policy-makers and to NGO. However, some scholars (Ramsbotham et al. 1999) made attempts to define it as: "*the transformation of unjust social relationships […] and implies a deep transformation in the parties and their relationships and in the situation, that created the conflict*." Here the emphasis is not on resolving conflicts but rather to change the means of pursuing them (from violent to non-violent) (Svensson 2014)

4.2 Empirical Review

Conflict is the opposition between individuals and groups on the basis of competing interests, different identities, and/or differing attitudes.

Most of us associate conflict with what is undesirable. This is to say conflict is considered to be bad and its resolution to be good. However, hence conflict is part of live for each society, we should appreciate its importance for stimulating new social thoughts, for promoting social change, for redefining social groups relationships, for helping us from our own personal identity and for many other things we used to take for granted in everyday lives. Likewise, it should not be considered that not all attempts to

resolve conflict are good or desirable. Indeed, some attempts do not lead to justice or to mutual satisfaction.

(Schellenberg, 1996) in his book "*conflict resolution: theory, research and practice*" summarises approaches of conflict resolution practice to be five (5) in numbers: i) coercion, or forcing parties in conflict to a particular conclusion; ii) negotiation and bargaining, or involving the parties in a process of discussion that seeks to bring them into voluntary agreement; iii) adjudication, or using the power of the state and its legal system to provide an authoritative conclusion; iv) mediation, or using a third party to help those in conflict come to a mutually satisfactory agreement; and v) arbitration, or using a third party to decide, through prior mutual consent, the issues in dispute.

According to Hortala-Vallve and Llorente-Saguer (2015) the non-zero sum Colonel Blotto games is for the first time studied experimentally with complete information by Hortala-Vallve and Llorente-Saguer. However, many scholars studied experimentally the alternative versions of the Colonel Blotto game. Indeed, Avrahami and Kareev, (2009); Chowdhury, Kovenock, and Sheremeta, (2013) and Avrahami, et al. (2014) study versions of the game in which each subject valued each battlefield identically. While in Chowdhury, Kovenock, and Sheremeta (2013) the payoff is the sum of the battlefields won, in Avrahami and Kareev (2009) and Avrahami et al. (2014) participants are paid according to the outcome in a randomly selected battlefield. In our work, we focus on qualitative techniques through focus group discussions and interviews of key actors.

4.3 Methodology

The analytical tools (when, who, what and how) of conflict resolution is used to understand at national level the process to conclude peace. To apply the method we interview resource person, NGO, and national institutions dealing with conflict resolution. The method is described as follow:

a) When: ripe for conflict resolution

Timing is one of the main debates in conflict resolution. Under what conditions should conflict resolution interventions be undertaken? Researchers in the domain argued that

it is not all times that are suitable for trying to negotiate a resolution to a conflict. Hence parties' openness to consider resolution is rare, it is crucial for any mediator to target that moment and seize it. Such moments of opportunities have been described in the literature in terms of "ripeness" (Zartman, 2000). The concept of ripeness consists of two main components: a Mutually Hurting Stalemate (MHS) and the existence of Mutually Enticing Opportunities (MEO) (Ohlson, 2008).

A stalemate that is, when parties' unilateral efforts to reach their goals on the battlefield are not working any longer. It becomes is mutually hurting for the parties when both sides perceive the current situation as costly and unsustainable. If both sides, at the same time, have found themselves in this particular kind of situation, then they are more likely to be open to reconsider their strategies and to be willing to consider resolution attempts. However, the second aspect of a ripe situation impose that parties need to believe that there are opportunities to engage in negotiations with the other side. In other words, there have to be some possibilities and opportunities for the parties, some positive gains that can be reached at the negotiation table (Svensson, 2014).

Ripeness describes a necessary condition but not a sufficient one for conflict resolution. Indeed, there are situations where parties may engage in negotiations, not because they have sincere and reveal interests in getting to a negotiated settlement, but because of secondary motives. Parties may wish in accepting to be in negotiation just to have lull in the fighting in order to regroup and rearm, or simply because they want to improve their relationship to an outside party (K. Beardsley, 2009; Richmond, 1998). Therefore, the ripe moment needs to be capitalized on in a correct way otherwise, the moment may float by without actions that lead to a negotiated settlement.

b) Who: spoilers and inclusion in conflict resolution

In his work, Stedman, (1997) coined the concept of "spoiler" to designate some actors, individual leaders, factions or groups that feel threatened by any movement seeking for resolving a given conflict. He identified different types of spoilers (limited, greedy and total) and three basic approaches in managing these spoilers (inducement, socialization and coercion. These actors are outside/inside the peace process and can utilize violence to provoke a breakdown of trust and negotiation attempts. In order to decide the

appropriate management approach, it is key to understand what types of spoilers the situation is facing. Because, depending on the spoilers' motivations (whether it is an ideological resistance towards peace, or a more instrumental reason) they will be open for different types of influence. It is also important to differentiate third party role in conflict resolution process. which has also been influential for the field. For instance, external actors, the custodians, are external actors that intervene, through mediation, peacekeeping, aid or other types of engagement, with an agenda of reaching a resolution of a conflict through a negotiated settlement. With such measures, they are potential source of conflict escalation or making the resolution very hard and long.

c) What: peace settlements and conflict resolution

When one talks about conflict resolution, the question of "what are the types of settlements that could resolve conflicts?" quickly comes in the debate. Most of conflict, basically are conflicts around the issue of governmental power, political power, or territorial or land control of the regions. It is clear that the sharing of power is essential for conflict resolution. Therefore, political and territorial power-sharing arrangements can be seen as essential components of conflict resolution of civil wars. (Licklider, 2001) considered that the distribution of political power to be "the most important issue in any civil war settlement). Scholars (Hartzell and Hoddie, 2003; Walter, 2002) argued that the power-sharing arrangements have dual purposes: to signal peaceful intent, but also to create effective institutions that can function well after an agreement is settled. In the same vein Walter (2002) and (Jarstad and Nilsson, 2008) found evidence indicating that if the parties agree to territorial power-sharing arrangements, then the chance for durable peace increases.

d) How: mediating conflict resolution

Mediation is obviously one of the instruments for a conflict resolution process. Mediators need to craft specific stipulations that can pave the way for sustainable resolution to the conflict. There is need to understand which kind of mediation strategies are most effective as peace making strategies in a given situation. Is it a communication or facilitation strategies that are most effective? Or that the use of power, pressure and threats which may lead to decreased levels of trust among the conflict parties (Nathan, 1999)? Manipulation may work as best strategy getting the

parties to a formal agreement and reduces the risk for further crisis (Beardsley, et al. 2006). Depending to the situation mediators can help to overcome bargaining problems in armed conflicts. For instance, when conflict occurs because of information failure between parties, then mediators could help by credibly transferring information and thereby minimizing the informational gap between.

4.4 Result and Discussion

Recently, there are encouraging annual growth rates (2011: 2.3%, 2012:11.8%, 2013: 5.3%, 2014: 7.1%, 2015:3.6%, 2016: 5.0%, according to the World Bank), but the majority of Nigeriens live in extreme poverty. Despite these successes, leaders were unable to translate its macroeconomic gains and donor support into pro-poor growth that benefits ordinary Nigeriens (Elischer, 2018). Importantly, there has been little progress in the fight against corruption. This situation is probably favouring armed conflict escalation and its repetition in Niger. Results are presented in three different points: We first present how Niger Government is dealing with terrorism, secondly, we present techniques of resolving farmer-herder conflict and lastly, we summarised ways of building peace in Niger in general.

4.4.1 Dealing with Terrorism:

The type of terrorism in Niger is in contrast with Goodwin's (2006) hypothesis. The latter author hypothesizes that civilians (accused to complicit with government) are likely to be targets of terrorism when they are of a different ethnic or religious group from the rebels. Indeed, in Niger, given the bad colonial demarcation of borders, almost you have the same ethnic composition between Nigeria side (MAIDUGURI) and Niger side (DIFFA). Also, the same religion belief (Islam) because those areas belong to the former *Kanem-Borno* Empire. So, it makes it difficult to understand why civilians are targeted by Boko Haram. The same ethnic composition and religion belief is also true on the border between Mali and Niger (they all belong to Mali Empire). The security crises in Mali and Nigeria led to an influx of 57,405 Malian and 108,470 Nigerian refugees. The fighting inside Niger has produced 129,015 internally displaced people (UNHCR, 2017).

In the specific case of Niger's southern regions, what appears as a conflict between Boko Haram and the Nigerien state can also be linked to local land disputes between

competing pastoralist communities. Members of Niger's Buduma community, ethnically affiliated with Nigeria's Kanembu and Kanuri groups (who provide the majority of Boko Haram's recruits), have rallied to the Islamist group. They have attacked Fulani groups deemed to have encroached on traditional Buduma pasturelands. In turn the local Fulani have received government assistance to fight back, increasing regional violence without providing a lasting solution.

In October 2017, we conducted a field work on over twelve groups (Focus Group Discussions) in Diffa region and many interviews from resource persons and *Imams* (Islamic scholars) to understand the terror in the region. At national and even sub-regional level, it should be recalled that the sect holds an unfortunately commonplace speech of injustice of political leaders, bad governance, plot of the Western through the multinationals against our people and younger generations not educated and very poor are easily attracted.

For the terror group to come in Niger, it had many advantages:

- The laxity of the government vis-a-vis the young and radicalised people of Diffa who preached exactly the same philosophy as the sect did at its beginning in Nigeria. Since 2004, some Imams and resource persons announced the toughening of some youth of their environment and their enrichment without any legal base. But at each warning, the government authorities took this information like "jealousy" between marabouts or simply that "the old" generation of Imams does not want the competition of the "young scholars".

- The assassination of the Libyan Guide, Muhammar Khadhafi, is also a significant cause of the advent of the sect in Niger. Between the end 2011 and the beginning of 2012, there were more than 80 000 Niger citizens returning back who fled Libya to take refuge on the territory. At the same time, several thousands of ex-combatants from Niger who had joined Libya to fight for Khadhafi in 2011. With very limited skills and without a real system of reintegration these young people were exposed to any proposition.

- The creation in Niger of the refugees' camps in 2014 to receive the victims fleeing (from *Baga, Malam-Fatouri* and *Damassak* in Nigeria) the massacres of Nigerian

army and Boko Haram. As one does not know who flees what, then many combatants of Boko Haram threw their weapons to return in the camps of the refugees with the victims. Those puppets constituted after a great source of information for the sect to attack Niger.

- Diffa is the oil extraction region of the country. Since 2012 crude oil is being extracted and despite that, the young people of the region though they are less skill but they do not benefit even with simple occupation. They feel frustrated to see their grounds being used to some individuals benefits at their expense. Thus, the unemployment of the young people constitutes a major cause of the acceptance of Boko Haram.

The first attack of Boko Haram in Niger, goes back to February 2015. By attacking Bosso department, the sect aimed at destroying the economic lung of all the zone, namely the Lake Chad and Komadougou (a river in Niger on more than 195 km). Along these waters people developed vital activities (culture of sweet pepper called "RED GOLD", fishing, culture of rice…) for the population and their cattle. But actually, the worst consequences of the attack were the answers of the government such as:

- Total prohibition of the use of motor bicycles, which are transport means,
- Closing of the schools and health centres in areas known as sensitive,
- Villages clear off (more than 108 villages and hamlets were erased in 48 hours by the government) along the Lake and the Komadougou,
- Total prohibition to sale or to purchase fuel for any reason,
- Curfew including for the pregnant women and patients from 7 pm to 6 am,
- Prohibition of purchase and sale of artificial fertiliser (Iré) while the zone is irrigated based,
- Arrest, torture and sequestration on the basis of libellous denunciation,
- Extra-legal execution, of the citizens and many were killed just because they do not know areas and ways prohibited,

These measurements were largely counter-productive. They even worsen the corruption of the local authorities and create a non-denunciation behaviour of the population which in turn benefits the terrorists. Refugee communities and displaces often become prime recruitment grounds for terrorists' organizations targeting the country of origin or own nation. These people (migrants and/or displaces) often have a grievance against the government from which they fled or which forced them to move.

Moreover, because they have lost their possessions (lands, ancestral inheritances, goods etc) and their homes, young and unskilled people among them have few opportunity costs for joining a militant faction. Indeed, taking up arms can promise a better quality of life than living in a squalid refugee camp and can also provide people with a sense of purpose and belonging (Cunningham, et al. 2013).

To summarize, terrorism in Niger has many causes and it is difficult today to say that Niger is using any method to resolve it.

4.4.2 Dealing with Farmer-Herder Conflict:

Farmer-herder conflict is the more frequent as conflict type in Niger and results in many deaths and economic damages. However, for scarcity to lead into conflict, it has to: be sufficient enough to threaten livelihoods of both communities, be perceived and deeply felt as a phenomenon, and to impact the psychology of both conflicting parties. Regardless to what causes conflict, actors involved used different methods to resolve it. In the following points we present actors involved and techniques they use to overcome conflict.

- **Village or tribal leaders**

They are competent to reconcile parties in conflict in the population of a village or a tribe. Village or tribal leaders are most often assisted by religious authority during the conciliation. If conciliation is accepted by the parties, the conflict is considered settled. Otherwise, it is referred to the head of canton or group.

The village or tribal chief consults members a conflict commission where it exists. This commission is headed by the village or tribal chief; and is compose by a secretary who can read and write in French or in the local language, one farmer, two (2) herders, one representative of fisher/hunter, two (2) women's representatives and one rural youth.

The village or tribal chief tries to reconcile the parties before the witnesses. In case of failure of the first conciliation attempt, the chief may refer the parties to appear at the next hearing.

In case of successful conciliation, the chief draws up a conciliation report signed by the parties and witnesses. This decision amounts to judgment (Article 15 of Ordinance No. 93-028 of 30 March 1993 on the status of traditional chiefdoms in Niger modified and supplemented by law 2008-22 of 23 June 2008.

The purpose of this law is to establish on the territory of the Republic of Niger, the existence of communities whose structures have been inherited from our traditions and customs under the denomination of customary and traditional communities.

- **Head of canton or group**

These authorities are competent to deal with cases falling within their jurisdiction conflicts related to the exploitation of natural resources when the head of village or trial fails in their attempt at conciliation.

Thus, in case of failure of the conciliation attempt, the village or tribal chief draw up a record of non-conciliation and refer the parties to the head of Canton or grouping.

Even at this level, the head tries a conciliation in the presence of his court and witnesses.

In case of success he draws up a conciliation report which is equivalent to judgment (Article 15 of Ordinance No. 93-028 of 30 March 1993 on the status of the chiefdom in Niger amended and supplemented by Law 2008-22 of 23 June 2008.

If the various attempts at conciliation have failed, the head of the canton or group or parties go to the common law judge.

- **Joint Conciliation Committees**

Parties in conflicts may also have proceedings to joint committees provided for in Ordinance No. 2010-29 of 20 May 2010 on pastoralism. Article 66 of this order stipulates that "*on penalty of nullity the conciliation proceedings of disputes between farmers and herders provided for in Order 93-015 guiding principles of the Rural Code and the texts in force concerning the status of traditional chieftaincies should be brought before joint committees of the conciliation at each level: villages, tribes, neighbourhoods, groups, townships, Province or Sultanate*".

The joint committees are chaired by the traditional rulers of the area and equal number of representatives of farmers and herders. Equitable representation in this Committee is a pledge to avoid abuse in the management of the dispute. The Joint Conciliation Commission sets the amount of compensation, taking into account the extent of the damage and the market value of losses incurred.

In the event of failure before a joint conciliation board, conciliation will continue up to the highest level of the traditional chieftaincy of the place.

- **Administrative authorities**

Some conflict actors make use this category of authorities because on the grounds there is no physical presence or remoteness of jurisdictions in their localities.

In fact, the administrative authorities under the legislation in force do not have conciliation power. However, during the first exceptional regime (1974 - 1989), the rulers had removed the competent judicial authorities to attribute this function of conciliation to the administrative authorities simply by circular.

However, it should be noted that the legislation in force gives this competence only to customary and judicial authorities.

- **Judicial Authority**
  - ✓ **District Court and District High Court**

The district and high courts have jurisdiction over conciliation and adjudication of disputes in accordance with the applicable provisions. They interpret the laws and customs and are responsible for their application.

In customary matters, the District Court is the first instance court. From here, the party which felt aggrieved by a decision rendered by this jurisdiction can appeal to the High Court.

These two levels of jurisdiction judged in customary matters (rural disputes, succession ...) in a collegiate formation composed of a professional judge and two customary assessors of the custom of the parties to the dispute.

In practice, the customary assessors are none other than local Islamic scholars, chosen by ministerial decree and remunerated by the State. Customary assessors have only one advisory role because the judge is not bound by their opinion when making decisions.

  - ✓ **Supreme Court**

This is the judicial chamber of the Supreme judge. The litigant who is not satisfied with the decision of the appeal judge may challenge it before this chamber by an appeal in cassation. The court does not examine the facts but the way in which the judge of appeal applied the law. If it considers that there has been a bad application of the law, it breaks the decision and remits it for judgment before the same court but otherwise composed.

- **Techniques / methods of conflict management intervention**

In the case of the management of confit, there are methods / techniques of conflict management which are structured processes by which we try to settle disputes by mutual agreement with the participation of all parties concerned and, if necessary, request the intervention of a neutral third party. The ideal supposes that the parties themselves make the effort to prospect the alternatives and the paths of an amicable settlement without a third party.

- ✓ **Negotiation or constructive communication**

This is a free trial by parties to the conflict to reach consensus on points of disagreement through direct discussions. If parties agree to discuss the points of difference, they will eventually find a consensual solution.

Conflict managers encourage actors towards the seeking a compromise solution on the basis of divergent interests because the agreements that are found are based on the "win-win" principle and they preserve social relations between parties in conflict.

- ✓ **Intervention techniques by a third person**

If for various reasons the parties cannot agree to find a solution, they can always avoid the option of going to court (losing winner), looking for a third person to either do: facilitation, mediation, conciliation (arbitration), intermediation, the counsellor or good offices (see table … below).

No matter the option chosen by the parties, the aim would be to achieve the same result that they could not find through direct dialogue.

The correct choice of intervention technique depends on several factors, including among others:

- the purpose of the intervention: what exactly is it aimed for?
- the mandate of the third party: what exactly is his/her role?
- the context of the conflict: what is the dynamic in which the conflict has happened?

Table 13: Intervention techniques by a third party

Type of Intervention	Purpose	Indicators	Mandate
Facilitation	Support actors solve a problem by way of negotiation	Problems complex to solve, relationships are only not completely deteriorated	master of process -provide a assistance to parties in conflict To arrive at a solution consensual
Mediation	Restoration of a dialogue Process led by a third person to bring parties to renew the dialogue.	relationship deteriorated Dialogue broken	master of process- here, actors in Conflicts ask the intervention of the mediator.
Arbitrage	Proposes a solution after listening to actors and research facts (testifying.) Application of rules or a law (Customary)	The actors do not are not in measure of solve their problem	Players ask the intervention of the referee (conciliator) The parties to the end submit themselves to his decision.
Intermediary	Support to an actor who is weaker than the other (increase power of a party)	Shyness, conflicts asymmetric	Entered by a actor of the conflict
Adviser	Support to an actor conflict to clarify his role and interest in the conflict	expression of a need of clarification, support	Is seized by the actor
Good Offices	Creating a frame favorable	In the case where relations between	Neutral and without official power,

	e.g. Messenger, offer a neutral place Establish a link communication indirect between parts.	the parties conflicts are broken.	his asset: moral authority.

Source: Code Rural 2018

- **Customary conciliation procedures**

Of all the aforementioned intervention techniques, we chose to come back to customary conciliation because almost all the conflicting actors use them systematically.

Whether it is land conflicts following the damage to the fields, claims of property rights or boundaries of fields or inheritance, four (4) main phases are considered in the normal course of a process of conciliation: initiation, preparation, negotiation and application.

Let's illustrate this process, through the type of conflict we are dealing with in this work. The farmer-herder is opposing an owner or usufructuary of a field (the farmer) to a pastor or shepherd (herder) following damage to the crops of one by the animals of the other.

- ✓ **Initiation phase**

It is during this phase that the victim in our case the owner or the usufruct field initiates the process of conflict resolution by posing the problem of compensation for the damage suffered as a result of damage to his crops.

Very often, the author of the reprehensible act favours an amicable solution in imploring forgiveness from the farmer at first. Usually the farmer agrees to forgive if the damage done to crops is minor, if the herder has not fled the scene of the damage or if he declared himself the damage to the farmer.

In the absence of an amicable solution, the victim may demand compensation, thus dedicating the beginning of the procedure whose first step is the information of the customary authority of the locality where the damaged field is located. Once complaint received, then the verification of facts starts.

- ✓ **Preparation phase**

Immediately after the registration of the complaint, the customary authority invites the author of the damage in this case the herder. The traditional chief may either send a

member of his personal guard to "Escort" the party in question, either by verbal convocation ordering him to appear at court to hear the case. The day of the hearing, in addition to the parties to the dispute and the Chief, witnesses are also present. Once the parties have been heard, an Audit and evaluation committee damage led by the chief is rushed to the place. This commission could be assisted by some resource person of the village in particular the Islamic scholar (Marabout) and other influential people of the court. The audit commission and damage assessment collect evidence, and considers the magnitude of the damage.

The Commission challenges the defendant (i.e. the party accused of having committed the damage) on the spot as to the recognition of the facts in order to establishing proof of his guilt. When the chef himself is not present at the site of the damage, the commission reports back to him the herder's answer.

- ✓ **Negotiation phase**

In the presence of concordant testimony or in case of flagrante delicto, the defendant, generally acknowledges the facts against him and the proceedings are concluded by accepting the compensation of the victim by the latter.

The damage estimate can be made by the farmer himself at the request of the commission by asking him to show a certain realism. Phrenology of crops and the extent of damage are taken into account when estimating, with the consideration that the damage is more costly if the cultivation is at an advanced stage.

Damage estimation can also be done by counting animals or traces left by their fingerprints taking into account the different species concerned.

For the same species, each quadruple of well-placed fingerprints corresponds to an animal of that species and the counting of animals may be done by the farmer himself. In the latter case, if the herder agrees with the estimate, it is opposable to both parties. But in reality, the amounts of compensation are clearly below fixed rates considered too severe and destructive values of civilization made of solidarity, harmony and social peace between members often sharing the same land. Finally, under the authority of the village chief, a compromise is always found, based on the "win - win" strategy.

- ✓ **Application phase**

Once the negotiation is conclusive, the herder remains indebted for the negotiated amount that he will have to pay as soon as possible.

However, some parameters (distance from the market, the need to inform animals' owners in order to collect the necessary amount) are considered when the herder requests for a relatively long delay of up to two (2)
weeks.
In some parts of Niger, the herder is obliged to give a debt recognition guarantees before obtaining the time limit unless bonded by the representative of the chief of his tribe or his group. The guarantee is mobilized in monetary form but remains deductible from total amount required.
It often happens that the farmer demands instead of cash repayment a manure service of his field through a verbal grazing contract that allows the animals to benefit from agricultural by-products during the time parties agreed.

Some herders are often asked to offer a refund in kind (small ruminants in particular) but it must be said that this practice is very rare.
The conciliation process is practically the same both in the agricultural zone than pastoral.
In principle, crops grown in pastoral areas (pastoral enclaves, corridors of passage) known to all are illegal and therefore the possible damage would not be considered, the farmer being declared officially guilty.
But in practice, things are not so simple and sometimes stubborn farmers or benefiting from a certain complicity, encroach on these pastoral areas that are anyway classified in the public domain in accordance with the legislation in force.

It should be noted that the procedures described above are only applicable when the herder acknowledges the facts alleged against him. It happens sometimes that the herder rejects the accusations of damage. In this case, the search for evidence is done either through the Qur'anic oath or by the possible identification of animal traces. The starting hypothesis for this last alternative is that traces leading to at the home of a breeder make him the culprit. But this last method has a low reliability coefficient.

- **Administrative conciliation procedure**

It happens sometimes that the administrative authorities, particularly the prefects or their secretaries-general are involved in the process of conciliation and conflict resolution.

The administrative authority is especially requested in conflicts involving several canton chiefs. Nonetheless, third parties who are not satisfied with a conciliation tempted by a canton chief refers directly to the administrative authority of the department. Conciliation and Dispute Resolution Committees exist at the level of departments and municipalities in accordance with the regulations in force but very few are functional.

Once seized of a dispute, the members of the conciliation and regulations go to the scene to check for any damage and try to conciliate the parties directly on the spot of the dispute. The Prefect often uses his prerogatives of authority with the rural police to end or at least calm some conflicts. Unfortunately, sometimes the intervention of the administrative authority is too late, once the deadly fight has been committed.

- **Jurisdictional procedure of conciliation and settlement**

The judicial authority seized of a case through a verbal trial from a cantonal or group leader tries in turn to reconcile the two parties after having summoned them to appear at his cabinet. Either the judge disposes of evidence, he investigates the case until its settlement; either he does not have evidence, he will ask for example parties to proceed to the Koranic oath for the treatment of the case. The complainant may appeal a decision made by a conciliation judge to the court of first instance for example for customary affairs, this Court of Appeal for the case.

- **Local tools for conflict management**

In the area of conflict management (prevention, conciliation or settlement), it is recourse to tools which are the gentleman's agreement of conciliation or non-conciliation, Koranic oaths and traditionally specific tools to certain areas.

- ✓ **Denominational oaths**

In Niger, it is especially the Koranic oath, of course the other forms of oath (biblical and civil) are legally enshrined in the Civil Code and other texts in force. With regard to the Koranic oath which is most frequently used in the conflict resolution, it should be noted that it is only used when all other conciliation attempts will have been unproductive, when one of the parties made the request expressly or when the judge deems it ex officio. This is the last resort. The Koranic oath is a prescription of the Islamic religion and it is for this reason that the people (the Imam or Alkali according to the regions)

with some knowledge of the subject are competent to officiate the ceremonies attached to it.

The gravity of the act and the consequences that might result from it are recounted by the cadis and the great marabouts to sensitize and possibly dissuade the wrong party to resort to it. If not the party to whom the oath is deferred raises the right hand on the Koran after he has purified himself and swears to end the conflict.

- ✓ **GON (in Zarma) or Kara (in Hausa)**

This is a customary practice quite common in some parts of Niger. The master of ceremonies secures two (2) twigs of ground grasses with an interval of a few inches between them. The parties to the dispute, having made their ablutions are invited to take turns in their right forearm between the two twigs. The part around the forearm from which the twigs are narrowed to the image of the handcuffs is found guilty.

It should be emphasized that the implantation of twigs and the act of introduction of the right arm between them are always followed by the recitation of Koranic verses and / or other incantatory formulas in a language unknown to the laypersons. Sources of knowledge of the master of ceremonies are unknown but in the in most cases, he has Koranic knowledge.

It should be pointed out that this practice sometimes fails, the "miracle" identification of the culprit through the tightening of twigs that may not happen in some cases and the master of ceremonies then declares himself incompetent.

- ✓ **Toungouma**

It is a magic stone that would have the singularity to move towards the guilty when the latter stands before it at a public sitting of conflict resolution. The crowning of the punishment inflicted by this stone magic can be death, as a result of a hit on the culprit by the stone under the impulse of an invisible force. It's a practice that's going on in the center-west of Niger in the Arewa in particular.

- ✓ **Head of Dog (Tête de chien)**

It is a practice used in the regions of Maradi and Zinder. The procedure used consists of install a dog's head on a tabernacle and have it carried by two (2) men.

Under the effect of the incantations of the master of ceremonies, the dog's head goes into move and indicates the home of the culprit who committed the wrongdoing decried by the victim or even the community.

- ✓ **International tools for conflict management and resolution**

They are part of conflict management at the Sub-regional institutional level and community-based organizations such as WAEMU, ECOWAS, the African Union, the CEN-SAD, etc. As such, we can mention among others:

• The International Court of Justice of ECOWAS and the African Union;

• The WAEMU court of justice;

• treaties and agreements ratified between states;

Conflict management and its prevention are having different technics but almost the same actors are involved. In terms of conflict prevention, several institutional and non-institutional actors intervene and contribute to the strengthening and rooting of good relations between rural actors.

- ❖ **Structures of actors involved in the prevention conflicts**
- ✓ **Traditional chiefdom**

In order to prevent conflicts between users of natural resources, traditional chiefs carry out periodic missions in their respective localities to sensitize rural operators to respect the limits of pasture areas and corridors of passage and to leave a band around the points of water.

In order to strictly respect the dates of animal release and closure of the farming fields, the traditional chiefs also sensitize the populations but also ask them to warn authorities on time in case of damage or outbreaks of bush fires.

- ✓ **Administrative authorities**

The administrative authorities intervene in the prevention of the conflicts on one hand through the consensual fixing of the dates of closing and of the liberation of the fields and on the other hand with the wide diffusion of these dates to the whole of the rural operators according to various channels.

Like the customary authorities, the administrative authorities organize information and awareness-raising missions at the level of their respective entities on subjects of general interest such as the culture of peace, peaceful coexistence between rural populations, protection and conservation of natural resources ....

It should be noted that the administrative authorities (governor, prefect, mayor) are holders of rural police power and exercise it in accordance with the regulations in force.

The purpose of exercising rural policing power is to ensure the management and control of the development of agricultural, silvicultural and pastoral wealth.

The rural police comprise all the legal and material means of enabling and guaranteeing equitable access to natural resources for all actors and preserving a peaceful climate in the use of these resources.

Starting from the requirements of Article 114 of Ordinance 93 -015 on the guiding principles of the Rural Code, the rural police include all the necessary global and individual measures:

- the maintenance of public order,
- the protection of rural areas,
- the safety of rural activities as well as compliance with legal and regulatory standards relating in particular to cultural choices and methods and the fight against desertification.
- Measures guaranteeing the free movement of persons and goods (determination of general rules applicable to transhumance, rangelands, grazing and transit of animals - corridors of passage).

In addition, customary authorities are empowered to "take individual measures that can maintain the peaceful coexistence of different rural operators".

Indeed, it is important to point out that despite the efforts made to prevent conflicts by the State and its dismemberments, populations and organizations of civil society, conflicts arise. To cope with this situation, various conflict management mechanisms are planned and described as follows:

- ✓ **Rural Code Institutions**

In the context of land tenure security for rural operators and the prevention of land conflicts, the State has set up a specialized land administration at different levels of the country's administrative organization. These structures of the Rural Code, according to their sphere of competence, carry out activities that are part of the logic of conflict prevention.
Depending on the level, the conflict prevention missions carried out by the Rural Code institutions are described as follows:

The Regional Permanent Secretariat assumes the following responsibilities:

- coordinating and monitoring the application and extension of the Rural Code in the region;
- the collection, processing and preservation of the data necessary for the development of the Land Development Plan at the regional scale;
- the development of the Land Development Plan;
- regional archiving of rural land files and records in each region;
- methodological support, coordination and synthesis of the activities of the Departmental and Communal Secretariats and the transmission of reports to the Permanent Secretariat of the Rural Code.
- the supervision and coordination of the activities of the Departmental Land Commissions;
- the mapping of the different spaces according to the defined classification as well as all the acts of security issued by the Basic Land Commission; which will enable better monitoring at regional level;
- the control of natural resource development modalities, which is a prerequisite for retaining title deeds…

The Departmental Land Commission has advisory powers and decision-making power. As part of its advisory powers, the opinion of the land commission is obligatorily required, on pain of nullity for all questions relating to:

- the determination of the content of the development of the lands of the communes and the department;
- the procedure for developing rural concessions that can lead to the acquisition of a property right on the concession lands;

- The opinion of the land commission may be requested by any party to a contract in which ownership and exploitation of a property are severed.

As part of its decision-making power, the Land Commission has the power to recognize and establish the content of the land rights as well as the transformation into property rights of the rural concession rights.

When conflicts between rights over rural resources cannot be resolved by the application of the accession rule, the land commission determines the basis of each right and determines the amount of any compensation.

The Land Commission has a general power to control the development of rural natural resources. It can transfer undeveloped land use to a third party.

The decisions of the land commission are administrative acts. They can be the subject of a hierarchical appeal addressed to the prefect of the department and an appeal for excess of power, according to the legal procedure.

The communal land commission assumes the following responsibilities:

- information and sensitization of the population of the municipality through the popularization of the texts of the Rural Code;
- keeping the rural file of the commune in relation with the departmental land commission;
- to conduct the land titling process in relation to the departmental land commission;
- the establishment and supervision of village and tribal land commissions;
- the control of development of the rural natural resources of the municipality;
- the management of the security process (identification, delimitation, materialization and registration in the rural file) of the shared resources (corridors of passage, pasture areas, forests, water points, rest areas for animals, etc.) and the control of their development;
- contribution to the development process of the Land Development Plan of the Region;
- issuance of rural concession contracts on public and private land;

- the issuance of a certificate of priority right of use on the home lands of pastors, in connection with the departmental land commission.

The basic land commission is responsible for:

- information and sensitization of the populations of the village or the tribe by the popularization of the texts of the Rural Code;
- issuing of land transaction documents;
- • assistance to village or tribal leaders in filling out conflict resolution conciliation proceedings;
- control over the development of rural natural resources of the village or tribe;
- conducting the security process involving the identification, delineation and materialization of shared resources including corridors, grazing areas, forests, water points, animal rest areas, etc.;
- land advertisement as part of the land titling process;
- the village or tribal land commission will effectively respond to all the requests of the communal and departmental land commissions in the exercise of their respective missions

✓ **City councilors**

As representatives of local populations and in direct contact with the population, municipal councilors play an important role in the prevention of conflicts between operators.

Their contribution will be greater when their capacities are strengthened in the area of conflict prevention and management.

✓ **Deconcentrated technical services**

The deconcentrated technical services of the State, particularly those in the rural sector, contribute to the prevention of land conflicts through their sovereign missions of supervision, support to producers and information and awareness activities.

✓ **Civil society structures**

In the field of conflict prevention, civil society organizations carry out information and awareness-raising activities for rural populations on the respect of the laws and

regulations in force governing their daily activities. This important work done by civil society associations contributes significantly to reducing the risk of conflicts between rural operators.

- ✓ **Conflict Management Mechanism**

In conflict management, there are no ready-made recipes.

Each situation requires a detailed analysis of its actors, its context and any other factor that may influence the situation.

The strategy is to give keys to try to decipher certain situations and to adapt the answers or the attitude to what has already happened.

Indeed, from a legislative point of view, Article 93 of Ordinance 93-015 of March 2nd, 1993 on the principles of guidelines of the Rural Code stipulates that "Disputes between rural operators between them shall be settled in accordance with the provisions of the Law 2004 - 050 of July 22, 2004 establishing the organization and jurisdiction of the courts of the Republic of Niger and that of Law 63-18 of February 2, 1963 laying down the rules of procedure to be followed before the justices of the peace ruling in civil matters and commercial ".

However, the judicial procedure must be preceded by an attempt to reconcile conflicts by the customary authorities. The result of the customary conciliation is recorded in minutes.

Article 150 of the same law provides that disputes between rural operators and public entities arising out of their administrative activities shall be settled in accordance with the provisions in force.

Similarly, article 15 (new) of Ordinance 93 - 028 of 30 March 1993 on the status of the traditional chiefdom in the Republic of Niger modified and supplemented by the law 2008 - 22 of 23 June 2008 stipulates that "The chief Convention has the power of conciliation of the parties in customary, civil and commercial matters.

It regulates according to the custom, the use by families or individuals, lands of cultures and pastoral spaces, on which the customary community for which it is in charge, has recognized customary rights.

In all cases, it draws the minutes of these conciliations or non-conciliations which must be recorded in an ad hoc register whose extract is sent to the administrative authority and to the competent jurisdiction.

The minutes of conciliation signed by the parties may be lodged with an enforceable form by the competent court at the instance of one of the parties ".
In all cases, in the field of conflict management between rural operators, the legislation in force clearly specifies the structures / actors involved in the management of conflicts within the limits of their prerogatives.

4.4.3 Summary of ways of building peace in Niger in general

Conflict resolution has grown as a very important research area in the study of conflict. We examined in this section techniques of conflict resolution and the extent to which Niger's stability is at risk and what its future trajectory is likely to look like. It is important to understand and gain knowledge about the resolution of conflicts within states because of their frequency, and because of their negative consequences, including human starvation and death, refugee and displacement flows, and economic and ecological devastation.

(Schellenberg, 1996) in his book titled "conflict resolution: theory, research and practice" summarises approaches of conflict resolution practice to be five (5) in numbers: i) coercion, or forcing parties in conflict to a particular conclusion; ii) negotiation and bargaining, or involving the parties in a process of discussion that seeks to bring them into voluntary agreement; iii) adjudication, or using the power of the state and its legal system to provide an authoritative conclusion; iv) mediation, or using a third party to help those in conflict come to a mutually satisfactory agreement; and v) arbitration, or using a third party to decide, through prior mutual consent, the issues in dispute. The current peace building process in Niger looks like a combination of these steps but unfortunately when collecting the data on the field the method used by actors is not working. The peace state we are looking for in this section does not concern only farmer-herder conflict. We assumed that solving one type of conflict does not necessarily bring peace in an area. The following points summarises our results:

Peace Building: Role of Local Actors

In Niger, all actors (Imams, Customary Chiefs and the Population) who must participate in the search for lasting peace feel trapped.

Imams feel trapped. On the one hand, there is the government that they must help at all costs by denouncing, de-radicalizing the young and the other members of the sect who in turn are concealed everywhere listening to any Imam who insults them in order to proceed to his physical elimination.

Traditional Chefs also feel trapped. At one hand, the government demands a lot from them without giving them the means to do so, and at the other hand the population who no longer respects these leaders because they believe that the unpopular measures of the government are taken in consultation with the community leaders.

Even the population is caught between the hammer and the anvil. Cooperate with the government without confidentiality (appear as a traitor in your community) or being silent with the risk that the terrorist will take over and crush you.

The population has become a cold monster because of the draconian measures of the government and continues to think that it has lost everything through the fault of the government. The following statements from the participants summarized the feelings: "Do not be surprised that a non-poor suddenly who becomes poor accepts any proposal from anyone." An old man indexed four (4) cows that are left to him among thirty-eight (38) cows before the government measures and he said "By Allah, if ever these 4 cows are gone, I would urge my children to join the terror because there is nothing is more shameful than a father watching his family collapsing without any alternative ".

Peace Building: Return to the Normal?

When it comes to proposing solutions to normalize the situation in the area, the participants agree on several principles:

- Involvement of the population in making decisions before their implementation. Here it has been pointed out to us that several ethnic groups in the area are in a logic of tribal allegiance. That is to say, one never delivers a member of the tribe. Yet it is enough to conduct a real awareness campaign even on the Islamic basis. Indeed, Islam allows allegiance but in greatness and not in killings. It is also easy to better explain that Terrorism is not a tribe.
- Social justice, punish all citizens with the same laws and regulations of the country. A participant to say: "I will only feel concerned in this conflict, if I see the soldier who stole my motorcycle being punished as a thief and not as an authority. Otherwise for me

the military and the terrorist are all thieves of our properties and they can kill each other ". Another justice would be to extend the network of national television (ORTN) on the Lake area. For example, per week there is information once in Boudouma language even though there is no ORTN in the only Boudouma zone of the country.

- Stop defending that nomadic areas cannot have a good and long education system.
- Stop the economic hemorrhage: The State must hunt Boko Haram at least in its part on the Lake Chad and on the Komadougou so that agriculture and animal husbandry resume in the area.
- Reconstitute the herd of the population victims of cattle thefts by terrorist. Indeed, even if the conflict is stabilized, these breeders have nothing to do as an activity. And in the local language it is said that "it is not the absence of arms that makes the absence of war, there can be war without arms".
- Modernize the area. Because if the law is embodied only by a Gendarme who comes once on the market day to "judge", strike and take 24,000 CFA on each disputed part without giving a receipt then the problem will never end.
- Avoid the theory of chaos: that is to say, to divide the communities as during the rebellion of 1995 (at the time the government armed the Arabs and Fulani to fight the Toubous).
- Stop repeating that all Boudoumas, Kanouris and Toubous ethnic groups are Boko Haram.
- Fight the corruption of the administrative authorities that benefit from the population following each dispute (farmer and herder conflict, community conflict ...).
- Use the advantage that the whole area is Muslim, through the Imams. Indeed, even when the person does not have Islamic knowledge, he listens to the Imams and especially the decisions of the Imams.
- Study the culture of this area in depth. This allows for example to insert teaching subjects of Islam from primary schools up to high school.

Conclusion

Given this situation and with the aim of boosting local development, in the peace and social tranquillity, favourable behavioural changes for a better use of available natural resources is needed.

In this chapter, we assessed methods that are used by conflict's actors to overcome their differences in Niger. Any conflict involves three key elements that are: the actors, the object, and its manifestation.

Policy makers need to strengthen the legal and institutional framework prevention and conflict management in Niger. As for the rural actors, they must respect the different standards established in order to avoid the occurrence of unnecessary conflicts.

For this purpose, customary, administrative and local authorities, civil society must ensure a better coexistence between the actors and make the necessary arrangements to overcome the frequency of land disputes, institutional and political.

Similarly, the structures of society, including the family, the village, the community, decentralized communities must contribute to the creation of conditions of stability and social peace in their localities, an imperative condition for better life.

GENERAL CONCLUSION

This dissertation explores the climate induced scarcity effect on armed conflict escalation in Niger Republic. The first chapter explained in details, the stylized facts of climate change, resource scarcity and armed conflict in Niger. It presented the new and traditional schools of thought on the environmental constraint and conflict. In the second chapter, the work used, a secondary conflict data from ACLED and PRIO, governance data from the World Development Indicator (WDI) and climate data from the national Institute of Statistics to evaluate how agricultural income are affected by climate variability and in turn being a fuel for conflict escalation. Thus, we used on a panel data analysis to evaluate the climate variability effect on agriculture resources and on conflict at the first step and we used instrumental variable to check the direct link between climate variability and conflict escalation. The chapter three used primary households level data enriched with secondary climate to assess triggers of farmer-herder conflict in Niger. In this chapter we used a Heckman two stage model to analyze farmer-herder perception of the resource scarcity and their decision to fight or to bargain. We presented focus group discussion results and interviews outcomes.

Our results of scarcity perception and the decision to fight of farmer-herder that households are observing the scarcity linked to environmental constraint and some decide to fight in order to maintain or get access to the scarce resource. Apart from resource, our respondents report some reasons why they fight each other such as: community protection (warning to opponent or retaliate for dignity), deliberate crop damage, animal poisoning, conflict precedent, corruption of local and administrative authorities, envy, planting on animal corridor etc. Respondents also reported that climate variability affects their agricultural productivity of both short term and long-term climate change and some have implemented various adaptation mechanisms to climate variations including fighting.

Despite the importance of coping strategies at both farmer and herder's level, fighting is the worst measure parties can decide to implement if households are to counter the expected impacts of long-term climate change. The government should therefore play a more critical role in encouraging traditional adaptations measures to climate change. Monitoring projects to disseminating information on peace and conflict resolution to farmers and herders would be a critical intervention. There is also need to gather knowledge through a multidisciplinary approach involving soils scientists, hydrologists, climate experts and agronomists, livestock experts are required. Indeed, this could help producing at a sufficient level and to resolve the acuity of scarcity. Using this knowledge could help farmers and herders to be sensitized, through extension network, on implications of climate change, including the vulnerability of crop and livestock production and the necessary adaptation strategies. Management of the scarce water resources in the country could generate more accessible water for irrigation purposes and livestock raising. In addition, water harvesting techniques should be introduced to farmers and herders to supplement any available water. In addition, protection, conservation and rehabilitation of water catchment areas and river basins are critical to ensure sustainable water supply. Policies that improve household welfare as well as access to credit with simple and very low rate are also a priority for both short term and long-term adaptation measures.

The results of the interviews in chapter three are based on primary data collected in only three regions out of eight administrative regions. Given that different groups have different climate exposure, different conflict background and different ethnic composition future studies need to be focused on the overall regions and take in

consideration traditional measures of adaptations, so to check if farmer-herder are already adapting to climate constraints what is still triggering conflict. Another shortcoming of this study springs from the nature of household data used for the Heckman model in chapter three. Though there is data on long term climate change, the full impact would be better assessed with time series data on farmers and herders' historical conflicts dataset. Long term changes in agricultural production may better reflect the impact of long-term conflict than one time estimates of fight.

The President of Niger recently (February 2019)[17] comments following his speech in Niamey during the first Sahel Climate Summit that fighting climate change adverse effects are in line with the view that military force will not resolve Niger's poor security alone. Security conditions in the country, where the government has struggled for years against mobile criminal (drugs and armed robbers) and militant groups (including groups from neighboring states such as Nigeria's Boko Haram; Mali's MUJAO), will remain extremely poor, owing to a combination of poor governance, lagging socioeconomic development and environmental challenges.

The World Bank estimates that 76% of Niger's labor force still works in the country's agricultural sector, where the downside risks relating to poor security and volatile weather conditions, further aggravated by climate change, remain high. The UN has classified the overall Sahel region as one of the most environmentally degraded areas in the world, with temperature increases projected to be 1.5 times higher than the global average. The results across the region have been desertification, droughts, floods and food insecurity. From our assessment the fragile environmental context of Niger has helped to drive national violence. Fighting between settled farming communities and traditional pastoralists (and among herders themselves) has increased, as natural disasters and temperature changes have wreaked havoc with old patterns of economic activity.

Climate change in environmentally fragile Sahel communities is one key factor driving transnational terrorism and inter-ethnic fighting, both of which remain serious downside risks to security in Niger.

[17] https://bit.ly/2NwgkH5

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5.0 APPENDICES

5.1. Appendix A: Survey Questionnaire

QUESTIONNAIRE OF THE SURVEY

ECONOMIC ANALYSIS OF CLIMATE CHANGE INDUCED RESOURCE SCARCITY AND ARMED CONFLICT IN NIGER

WASCAL program, G.H.M.Bello mbello.hima@gmail.com

I. GEOGRAPHIE

Date : ___/___/___ Région

Numéro : ○ Dosso ○ Tillabery

District : _____ ○ Maradi ○ Zinder

Village : _____

Coordonnées GPS du village. Latitude _____ S and Longitude E ____

II. Description du Répondant (e)

A. Sexe ○ Masculin ○ Féminin

B. Age :

25- 35	35-45	45-55	55-65	66 & Plus

C. Taille du Ménage

Personne de moins de 12 ans	Personne de plus de 12 ans

E. Quelle est votre activité principale ? ○ Agriculture ○ Elevage

E. Avez-vous toujours pratiqué cette activité dans cette région ?

○ Oui ○ Non

Si non, quelle est la raison ?

○ Changement du climat ○ Politique gouvernementale

○ Accès facile à la terre ○ Autres____

F. Quel est votre niveau d'éducation ?

Ecole Coranique	Primaire	Secondaire	Tertiaire	Aucun

G. Depuis combien de temps pratiqué vous cette activité (en années) ?

1-5	6-10	11-20	21-30	31-plus	Je ne sais pas

H. Pour combien de temps comptez-vous exercer cette activité?

○ <= 1 an ○2-5 ans ○ 6-10 ans○ Je ne sais pas

III. Production agricole, commerce et climat

1) **A**. Quelle est la taille de votre champ? **B.** Sur les 10 dernières années est ce que votre champ:

- ○ <2 ha
- ○ 2-5 ha
- ○ 6-10 ha
- ○ >10 ha

- ○ a augmenté
- ○ a diminué
- ○ était resté invariante

C: S'il avait augmenté ou diminué, quelle est la raison ?

- ○ Le climat est favorable à la production
- ○ Le climat n'est pas favorable à la production
- ○ Mesure d'adaptation
- ○ Je reçois des transferts

---

2) A. Que est ce que vous cultivez?

- ○ *Pennisetum glaucum* (Millet)
- ○ *Phaseolus vulgaris* (Haricot*)*
- ○ Ayya
- ○ *Arachis hypgea* (Arachide)

B. Avez-vous changé de culture?

○ Oui ○ Non

Si Oui, quelle est-il dû aux:

- ○ Prix
- ○ Variabilité de la pluie
- ○ La demande
- ○ Certaines cultures résistent mieux
- ○ Autres_____

3) Votre culture est-elle :

- ○ Pluvieuse
- ○ Pluvieuse et irriguée traditionnellement
- ○ Irrigation moderne

4) A. Avez-vous changé la manière dont votre culture est arrosée ?

○ Oui ○ Non

Si Oui depuis quand ?

- ○ Moins d'un an
- ○ 2-5 ans
- ○ Plus de 5 ans

5) Utilisez-vous des engrais et pesticides ? ○ Oui Non Si oui sur recommand@ de Qui ?

- ○ Recommendation par ONG, INRAN, AGRIMETH, ACMAD…
- ○ Connaissance personnelle et expérience

Si connaissance personnelle est-il parce que :

- ○ Recommandations ne sont pas tenables ?

- ○ Dégradation des sols
- ○ Conditions climatiques très difficile.

6) Quels sont les facteurs affectant la production ? (Donnes 1 au plus frappant et continues…)

- ➢ Chaleur ___
- ➢ Inondation ___
- ➢ Sècheresse ___
- ➢ Peste ___
- ➢ Insectes ___
- ➢ Perte après récolte ___

7) A. Pratiquez-vous la Jachère? B. Est-ce que la production change suite à la jachère?

- ○ Oui
- ○ Non

Si Oui, donnez la durée et la séquence :

____ ____ ____ ____

- ○ Oui
- ○ Non

Si Oui a-t-elle :

○ Augmentée ○ Diminuée

8) Sur les 20 dernières années avez-vous observé un changement de la production ?

- ○ Diminution
- ○ Augmentation

A. Si Diminution quelle est la raison ?

- ○ Variabilité du climat
- ○ Sècheresse
- ○ Dégradation du sol
- ○ Pollution
- ○ Inondation répétitive
- ○ Forte chaleur
- ○ Autres_____

B. Si Augmentation quelle est la raison ?

- ○ Stabilité des conditions climatiques
- ○ Engrais moins cher
- ○ Pesticide et insecticide moins chers
- ○ Réduction de la perte après récolte
- ○ Utilisation des OGM
- ○ Politiques gouvernementales
- ○ Autres_____

9) Quelle sont les contraintes de l'agriculture Ici ? Donne 1 au plus frappant et continuez…

- ○ Température ____
- ○ Pluie ____
- ○ Type du sol ____
- ○ Surface cultivée ____
- ○ Cout des intrants ____
- ○ Manque de variété ____
- ○ Main d'œuvre ____

IV. Production Animale, commerce et climat

10) Pratiquez-vous un peu d'agriculture ? ○ Oui ○ Non

Si oui,

A. Quelle est la taille de votre champ? **B.** Sur les 10 dernières années est ce que votre champ:

- ○ <2 ha
- ○ 2-5 ha
- ○ 6-10 ha
- ○ >10 ha

- ○ a augmenté
- ○ a diminué
- ○ était resté invariante

C: S'il avait augmenté ou diminué, quelle est la raison ?

- ○ Le climat est favorable à la production
- ○ Le climat n'est pas favorable à la production
- ○ Mesure d'adaptation
- ○ Je reçois des transferts
- ○ L'élevage n'est pas rentable

11) **A.** Sur les 10 dernières années est ce que votre couloir de passage :

- ○ a augmenté
- ○ a diminué
- ○ était resté invariante

B: S'il avait augmenté ou diminué, quelle est la raison ?

- ○ Le climat est favorable à la production
- ○ Le climat n'est pas favorable à la production
- ○ Mesure d'adaptation
- ○ Les Agriculteurs cultivent nos passages
- ○ Je reçois des transferts

---

12) A. Qu'est-ce que vous Elevez ?

- ○ Chèvres et moutons
- ○ Bœufs
- ○ Mélange des 2 premiers
- ○ Chameaux

B. Avez-vous changé de type de troupeau ?

- ○ Oui ○ Non

Si Oui, quelle est-il dû aux :

- ○ Opportunités de Prix
- ○ Variabilité de la pluie
- ○ La demande
- ○ Animaux résistant mieux au climat
- ○ Autres_____

13) Votre Elevage est-il:

- ○ Extensif
- ○ Intensif
- ○ Nomadique

14) A. Avez-vous changé la manière dont votre troupeau s'abreuve ? Oui Non

Si Oui depuis quand ?

- ○ Moins d'un an
- ○ 2-5 ans
- ○ Plus de 5 ans

15) Utilisez-vous des OGM aliment bétails ? ○ Oui Non Si oui sur recommandé de Qui?

- ○ Recommendation par ONG, INRAN, AGRIMETH, ACMAD…
- ○ Connaissance personnelle et expérience

Si connaissance personnelle est-il parce que :

- ○ Recommandations ne sont pas tenables ?
- ○ Dégradation des sols de pâturages
- ○ Conditions climatiques très difficile.

16) Quels sont les facteurs affectant le rendement ? (Donnes 1 au plus frappant et continues…)

- ➢ Chaleur ___
- ➢ Inondation ___
- ➢ Sècheresse ___
- ➢ Peste ___
- ➢ Insectes ___
- ➢ Autres ___

17) Sur les 20 dernières années avez-vous observe un changement de la production (rendement) ?

- ○ Diminution
- ○ Augmentation

B. Si Diminution quelle est la raison ?

- ○ Variabilité du climat
- ○ Sècheresse
- ○ Dégradation du sol
- ○ Pollution
- ○ Inondation répétitive
- ○ Forte chaleur
- ○ Autres_____

B. Si Augmentation quelle est la raison ?

- ○ Stabilité des conditions climatiques
- ○ Engrais moins cher
- ○ Pesticide et insecticide moins chers
- ○ Réduction de la perte après récolte
- ○ Utilisation des OGM
- ○ Politiques gouvernementales
- ○ Autres_____

18) Quelle sont les contraintes de l'élevage **Ici** ? Donne 1 au plus frappant et continuez…

- ○ Température ____
- ○ Pluie ____
- ○ Type du sol ____
- ○ Surface cultivée ____
- ○ Manque d'aliment bétails ____
- ○ Manque de variété ____
- ○ Main d'œuvre ____

V. PERSONNELLE

5.1. AGRICULTEURS

19) Quelle a été la quantité de mil semée ?

En termes de Botte	En termes de sac	En termes de Tiyya

A. Quelle est votre production en mil (***Pennisetum glaucum) ?***

En termes de Botte (damma)	En termes de Sac (Bouhou)	Autres mesures :

B. Quel est le prix du Sac ou de la Botte de mil?

Période de récolte	Période de soudure
Sac = _____ FCFA	Sac = _____ FCFA
Botte= _____ FCFA	Botte= _____ FCFA

20) Quelle a été la quantité du Haricot semée ?

En termes de sac	En termes de Tiyya

A. Quelle est votre production de Haricot *(Phaseolus vulgaris)?*

En termes de Sac	Autres mesures:

B. Quel est le prix du Sac de Haricot (*Phaseolus vulgaris) (en FCFA)?*

Période de récolte	Période de soudure
Bag=	Bag=

21) Quel est le coût total de production (estimation)?

Intrants	**Cout estimé en FCFA**
Main d'œuvre	
Semence	
Pesticides	
Insecticides	
Engrais/ Fumier	

22) Recevez-vous une aide financière auprès des membres de la famille?

○ Oui ○ Non

Si oui estimez SVP: ---------- FCFA

23) Pratiquez-vous de l'élevage domestique?

○ Oui ○ Non

Si Oui énumérez SVP:

Animaux	Nombre
Chèvre/Bouc	
Mouton	
Volaille	
Bœuf/vache	

24) Pratiquez-vous '' un peu'' de commerce?

○ Oui ○ Non

Si oui estimez SVP: _____

25) Avez-vous accès aux microcrédits ?

☐ Oui ☐ Non

5.2. ELEVEURS

26) Quelle est votre production animale ?

Tête de moutons	Tête de Chèvres	Tête de Bœuf/Vache	Tête de Chameaux

27) Quel est le coût total de production animale (estimation)?

Intrants	**Cout estimé en FCFA**
Main d'œuvre	
Aliment bétail	
Dépense santé animale	
Autres	

28) Recevez-vous une aide financière auprès des membres de la famille?

○ Oui ○ Non

Si oui estimez SVP: ---------- FCFA

29) Pratiquez-vous de l'agriculture ?○Oui ○Non

Si Oui,

A. Quelle a été la quantité de mil semée ?

En termes de Botte	En termes de sac	En termes de Tiyya

B. Quelle est votre production en mil (***Pennisetum glaucum) ?***

En termes de Botte (damma)	En termes de Sac (Bouhou)	Autres mesures :

C. Quelle a été la quantité du Haricot semée ?

En termes de sac	En termes de Tiyya

D. Quelle est votre production de Haricot *(Phaseolus vulgaris)?*

En termes de Sac	Autres mesures:

30) Pratiquez-vous ‘‘ un peu’’ de commerce?

◯ Oui ◯ Non

Si oui estimez SVP: ……..FCFA

31) Avez-vous accès aux microcrédits ?

Oui ☐ Non ☐

VI. CONFLITS ENTRE AGRICULEURS ET ELEVEURS

32) Que ce qui cause la **rareté** des ressources (eau, terre cultivable, bon rendement) ? (Dégradation des sols, changement climatique, pression démographique, compétition, punition divine, migration, vente des terres aux étrangers…: **Ne guidez pas !**)

33) Connaissez-vous des conflits dans cette zone ○ Oui ○ Non

Si oui, de quel type :

- Entre Agriculteurs et Eleveurs (AE) ○
- Entre Eleveurs et Eleveurs (EE) ○
- Entre Agriculteurs et Agriculteurs (AA) ○
- Entre Etat et Communauté (EC) ○
- Conflit Foncier (accès à la terre) (CF) ○
- Conflit Tribalo-ethnique (TE) ○

34) Quelles sont les principales causes des conflits (**AE**) dans votre zone : **Ne guidez pas !** ?

Causes	**Rang (1 pour la plus importantes et ...)**
L'empiétement des aires de pâturages	
Semis dans les couloirs de passage	
L'empiétement des points et cours d'eau	
Pâturage délibéré des bétails sur les récoltes	
Pauvreté/Rareté des ressources	
Feux de brousses (à l'aveugle)	
Refus de verser la dîme locative	
Surpâturage	
Mauvaise gestion des contentieux/ Pouvoir Public	
Corruption/Autorités Locales	
Actes de cruauté sur l'animal	
Non-respect des délais de fin de récoltes	
Différence culturelle	
Autres	

35) SVP, pouvez-vous nous donner le nombre de conflit (AE) qui ont eu lieu cette saison ici ?

Nombre de conflits	Nombre de morts	Perte économique (en nature ou en CFA)

36) Quelles sont les conséquences des conflits dans votre zone ?

- - -

5.2. Appendix B: Focus Group Discussions Guide

Guide d'entretien focus group : Causes, Conséquences et gestion des conflits armés inter-groupes au Niger

DONNEES GENERALES	
Nom du superviseur : _____	**Date de l'enquête : _____/_____/_____**
Région : _____	
Type de focus : _____	
Nombre total de personnes présentes : _____ *Nombre de femmes présentes : _____* *Nombre d'hommes présents : _____*	

Présentations et exposition des objectifs du focus group : déterminer les effets du changement climatique dans la communauté, identifier les sources de conflits de manière générale (entre éleveurs et agriculteurs, spécifique) et les méthodes de résolution. ***NB*** *: Toute opinion restera anonyme.*

Q.1. Quels sont les activités pratiquées dans votre zone ? (Travaux champêtres, élevage, commerce…) ; Quels sont les techniques, les technologies utilisées ?

Q.2. Quels sont les différents Types de Conflits dans votre zone qui nuisent à vos économies et à la vie sociale ? (AE, Foncier, Ethnique, Mouvement Djihadiste, Avec l'Etat, **…Ne guidez PAS)**

Q.1. Quels sont les canaux par lesquels l'insécurité (Terrorisme) affecte vos activités économiques et votre vié sociale ?

Q.3. Connaissez-vous des jeunes qui ont rejoint des Mouvements Armés ? Si oui pourquoi ? Les difficultés dans l'agriculture, Les inégalités économiques, Les crises Politiques, La mauvaise compréhension de la religion, Les problèmes fonciers, Les clivages ethniques, La corruption… **Ne Guidez pas !**

Q.4. Connaissez-vous des enfants de Diffa qui ont migré vers la capitale, les pays voisins ou ailleurs ? Si Oui, Pourquoi ? Sinon Pourquoi ? un revenu meilleur, retrouver de la famille ou des amis, raisons de sécurité (instabilité politique, Djihadisme en cours), Manque d'emploi...

Q.5. Quelle est la qualification de ses migrants selon leur destination ? En général, sont-ils mieux nantis une fois ailleurs ? Comment ?

Q.6. Selon vous, quelles sont les causes principales des conflits dans cette zone ?

Q.7.Quelle est la fréquence des conflits entre éleveurs et agriculteurs dans cette zone ?

Q.8. Avez-vous entendu parler des changements climatiques ? Quelles sont ses causes et

conséquences sur vos communautés ?

Q.9. Qu'en pensez-vous de la relation CC et les conflits entre ces acteurs ? Décrivez la relation CC et Conflits.

Q.10. Quelles sont vos mesures pour faire face à ces changements/risques liés aux changements climatiques ? est-ce qu'elles sont appuyées par une organisation/projet en lien avec la résilience au changement climatique ?

Q.11. Quels seraient les besoins de vos communautés pour mieux faire face aux changements climatiques et éviter les conflits ? (Identifier les besoins et le type d'appui)

Q.12. Quels sont les facteurs fragilisant la cohésion sociale entre les groups vivant dans cette zone ? *Comment faire face à ces facteurs* **?**

Q.13. Comment a évolué la cohésion sociale après l'éclatement de conflit et qu'en est-elle devenue aujourd'hui ?

Q.14. Existent-ils des comités de gestion des conflits au niveau village et quels sont leurs rôles ? Comment est-ce qu'ils procèdent ?

Q.15. Si ces comités n'existent pas : est-ce que ces genres de comités seraient pertinent à mettre en place ? et si oui, avec quelles structures existantes pourrait-il être en lien ?

Q.16. Quels sont les facteurs favorables et les facteurs défavorables à la prévention des conflits entre ces acteurs ? (Dans le passé et de nos Jours)

Q.17. Avez-vous des recommandations à faire pour la mise en place d'un système durable de prévention des conflits ? ***Si vous êtes le décideur aujourd'hui***
Q.18. Avez-vous des recommandations à faire pour la mise en place d'un système d'adaptation aux changement climatique selon l'acteur ?

Commentaire du rapporteur

- **Merci pour votre participation -**

O

5.3. Appendix C: Interview Guide for Local Authorities and Resource Persons

Guide pour les entretiens avec les autorités locales et personnes ressources

Enquêteur :	
Date :	
Heure de début :	
Heure de fin :	
Département :	
Ville/village de :	
Nom et prénom de la personne interrogée :	
Fonction de la personne interrogée :	

Règles de base

Nous nous intéressons à toutes vos opinions et sentiments. Il n'y a pas de bonnes ou mauvaises réponses, donc toutes vos critiques et suggestions sont les bienvenues. Nous vous encourageons à donner des avis francs qui permettront de comprendre les causes et conséquences des conflits N'attendez pas que le modérateur vous demande votre avis, soyez libre de parler à tout moment.

0. Informations de bases :

Quelle est la population actuelle sur la zone que vous représenté ?	
Quelle est la part de éleveurs, et agriculteurs, de cette population ?	
Quel organe étatique est présent sur la zone ?	
Quel organe des forces de l'ordre est présent sur la zone ?	
Y a-t-il un marché sur la zone ?	□ Oui □ Non
Si oui, a quelle fréquence est-il organisé ?	

1. Quelles sont les types d'activités habituellement exercées par la population locale ?

Bien détaillé les types d'activités dans le village et les acteurs (jeune, femme, homme, réfugiés, retournés, autochtones, etc.)

2. Que pensez-vous de la pertinence de ces activités, par rapport aux besoins des populations ?

3. Selon vous existe-il des opportunités à saisir, autres que l'agricultures et l'élevage dans votre localité ?

Détailler les opportunités en termes de débouchés

4. Avez-vous des statistiques sur les conflits de manière générale ? Si oui, SVP :

Années	**Type de conflit**		**Nombre de conflits enregistrés**	**Nombre de morts**	**Perte estimée**	
	AE	Autres	…	…	Tête de bétails	Agricole

4. Selon vous quelles sont les causes de conflits de manière générale dans cette zone ?

Et entre éleveurs et agriculteurs en particulier ?

5. Pensez-vous que les changements climatiques en fait partie des causes ?

Si oui, comment décriez-vous ce lien ?

6. Existent-ils des compétences au niveau local pour prévenir ou résoudre ces conflits ?
(Décrire les types de compétences existants selon l'ampleur du conflit)

7. Existe-il un système de renforcement des capacités pour ces acteurs au niveau local (centres de formation sur les conflits, etc.) ?
Si oui, quelles sont les structures en charge de ce renforcement des capacités (ONG, Gouvernement, etc)?

8. Selon vous existe-il des barrières à la mise en place des politiques de prévention de conflits de manière générale ? entre éleveurs et agriculteurs en particulier ?
Décrire les barrières (accès difficile, forte concurrence entre les acteurs, insécurité sur les axes, etc.)

9. Suggestion et attente de la mise en œuvre d'une paix durable entre ces acteurs ?

Terminer l'entretien et remercier vos interlocuteurs !

5.4. Appendix D: Interview Guide for Technical Service

Guide pour entretiens avec les Services Techniques//Conflits

Enquêteur :	
Date :	
Heure de début :	
Heure de fin :	
Département :	
Ville/village de :	
Structure représentée	
Nom et prénom de la personne interrogée :	
Fonction de la personne interrogée :	

Règles de base

Nous nous intéressons à toutes vos opinions et sentiments. Il n'y a pas de bonnes ou mauvaises réponses, donc toutes vos critiques et suggestions sont les bienvenues. Nous vous encourageons à donner des avis francs qui permettront de comprendre les causes et conséquences des conflits. N'attendez pas que le modérateur vous demande votre avis, soyez libre de parler à tout moment.

1. **Pouvez-vous nous décrire l'organisation de votre filière ?**

Préciser en particulier les éléments actuels au niveau de la formation, de l'organisation des employés, des employeurs, les difficultés liées au contexte

2. **Quels sont les partenaires avec qui vous aviez l'habitude de travailler dans le cadre des conflits ?**

Préciser les partenaires et les types d'activités, les formations mises en place

3. **Quels sont les activités indispensables et disponibles dans la zone pour la vie économique actuellement ?**

Veuillez préciser les activités, leur niveau de développement actuel et problème

4. **Selon vous, quelles sont les causes de conflits (Rébellion, terrorisme…) et/ou entre éleveurs et agriculteurs ?**

Veuillez préciser les causes directes et indirectes

5. **Pensez-vous que les changements climatiques en font parties des causes ?**

Si oui, Décrivez le processus

6. **Quels sont vos domaines d'intervention dans la gestion des conflits ?**

Précisez la population à qui ils s'adressent : agriculteurs, éleveurs, de manière groupée ou séparée

7. **Avez-vous des recommandations à faire pour la mise en place d'un système durable de prévention des conflits ?**

Si oui, précisez le type de formation en fonction de la période, durée des sessions de formations et la population bénéficiaire (adultes, jeunes, femmes, etc.)

Terminer l'entretien et remercier vos interlocuteurs !

5.5. Appendix E: Interview Guide for NGOs

Guide pour les entretiens avec les ONG intervenants dans la gestion des conflits

Enquêteur :	
Date :	
Heure de début :	
Heure de fin :	
Département :	
Ville/village de :	
ONG représentée	
Nom et prénom de la personne interrogée :	
Fonction de la personne interrogée :	

Règles de base

Nous nous intéressons à toutes vos opinions et sentiments. Il n'y a pas de bonnes ou mauvaises réponses, donc toutes vos critiques et suggestions sont les bienvenues. Nous vous encourageons à donner des avis francs qui permettront de comprendre le problème lié aux conflits. N'attendez pas que le modérateur vous demande votre avis, soyez libre de parler à tout moment.

Bilan des actions menées dans la zone en faveur des populations

1. **Quelles sont les actions menées en faveurs des populations ?**

Décrire les actions et les bénéficiaires cible

2. **Selon vous, quelles sont les causes des conflits (Terrorisme, Rébellion, AE ?**

Spécifier les principales causes aux causes indirectes

3. **Pensez-vous que les changements climatiques en sont pour quelque chose dans ce type de conflit ?**

Si oui, expliquez le lien probable

4. **Quels sont les succès et échecs lors de la mise en œuvre de vos interventions dans les conflits ?**

Spécifier le type d'intervention et les difficultés s'y rapportant

5. **Avez-vous des recommandations à faire pour la mise en place d'un système durable de prévention des conflits ?**

6. **Avez-vous des recommandations à faire pour la mise en place d'un système d'adaptation aux changement climatique selon l'acteur ?**

Terminer l'entretien et remercier vos interlocuteurs !

5.6. Appendix F: Countries of the Bottom Billion

Afghanistan	Kyrgyz Republique
Angola	Lao PDR
Azerbaijan	Lesotho
Benin	Liberia
Bhutan	Madagascar
Bolivia	Malawi
Burkina Faso	Mali
Burundi	Mauritania
Cambodia	Moldova
Cameroon	Mongolia
Central Africa Republic	Mozambique
Chad	Myanmar
Comoros	Nepal
Congo, Democratic Republic	**Niger**
Congo	Nigeria
Côte d'Ivoire	Rwanda
Djibouti	Senegal
Equatorial Guinea	Sierra Leone
Eritrea	Somalia
Ethiopia	Sudan
Gambia	Tajikistan
Ghana	Tanzania
Guinea	Togo
Guinea-Bissau	Turkmenistan
Guyana	Uganda
Haiti	Uzbekistan
Kazakhstan	Yemen
Kenya	Zambia
Korea, Democratic Republic	Zimbabwe

Source: Paul Collier (2011) in the book WAR, GUNS and VOTES: Democracy in Dangerous Places