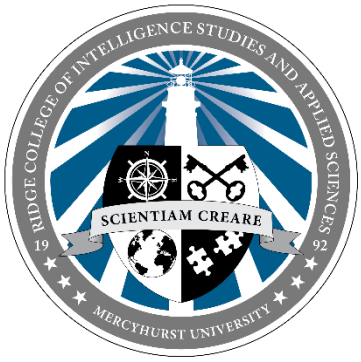

FULANI HERDSMAN MILITANCY & RESOURCE SCARCITY IN SUB-SAHARAN AFRICA: A QUANTITATIVE ANALYSIS

ROBERT O. OGUM

A Thesis

Submitted to the Faculty of Mercyhurst University

In Partial Fulfillment of the Requirements for

The Degree of

MASTER OF SCIENCE
IN
APPLIED INTELLIGENCE

RIDGE COLLEGE OF INTELLIGENCE STUDIES AND APPLIED SCIENCES
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DEDICATION

I am dedicating this thesis to my mother, who so tolerantly dealt with a lack of visits and phone calls during my two years of graduate school. I love you very much Mom.

ACKNOWLEDGEMENTS

I would like to thank Associate Professor Dr. Orlandrew Danzell for taking on primary readership of this thesis and performing all the duties that position carried. Dr. Danzell's guidance was instrumental in executing the regression models using STATA software. I also give thanks to Assistant Professor Dr. Leslie Guelcher for taking on secondary readership for this thesis. In addition, I also would also like to thank Dr. Danzell's undergraduate assistant, Kyle Webber, who helped me compiled the dataset for the quantitative models. Lastly, I would like to thank my family, who put up with me being consumed with two years of graduate school.

ABSTRACT OF THE THESIS

Fulani Herdsman Militancy & Resource Scarcity in Sub-Saharan Africa:

A Quantitative Analysis

By

Robert O. Ogum

Master of Science in Applied Intelligence

Mercyhurst University, 2020

Professor Orlandrew Danzell, Chair

This thesis explores the relationship between resource scarcity and civil conflict perpetrated by pastoral herdsman of the Fulani ethnic group in sub-Saharan Africa. This thesis uses a dataset of 50 African countries segmented by country and year from 1970 to 2015. The study uses probit regression to determine the relationship between resource scarcity and levels of violence enacted by pastoral Fulani herdsman in sub-Saharan Africa.

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LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
UCDP	Uppsala Conflict Data Program
PRIO	Peace Research Institute Oslo
SCAD	Social Conflict Analysis Database
GSDRC	Governance and Social Development Resource Center

INTRODUCTION

Introduction to the Problem

The major goal of this thesis is to explore the relationship between resource scarcity and communal violence perpetrated by nomadic pastoral cattle herdsman of the Fulani ethnic group in sub-Saharan Africa. In recent years, militant groups of Fulani herdsman have become an increasing threat across the Sahelian region of Africa, with thousands of individuals killed and injured in attacks and skirmishes (Ubelejit, 2016). As climate change accelerates and the Sahelian region becomes more arid, Fulani herdsman are driven to find lusher pastures for their large herds. This impetus directly places Fulani herdsman at odds with agricultural communities as the Fulani herdsman and their multitudinous cattle enter areas not historically roamed, frequently destroying crops. Tensions between herdsman and farmers, exacerbated by resource scarcity, has led to rampant security instability and in some cases armed conflict between pastoralists and farming communities. Rapidly increasing national populations, intensive agriculture that limits access to water sources, competition for available grazing land, and increasing changes in weather patterns brought on by climate change, create multifaceted determinants for conflict. The severity of herdsman-farmer violence is so grave that in 2015, the Global Terrorism Index branded the Nigerian Fulani militant herdsman as the fourth deadliest terrorist group in the world, trailing only the infamous Boko Haram, ISIS and Al-Shahab (Buchanan, 2015). There are numerous academic works exploring the relationship between resource scarcity and violence. Fewer studies, however, directly address the subject of resource competition and Fulani herdsman violence. Previous studies exploring Fulani herdsman violence are limited in scope and typically are focused on individual administrative districts within a single country. In

addition, existing research studies are largely qualitative in nature and do not empirically examine the causal path that explains herdsman-farmer violence as is the case with this study. This thesis provides a comprehensive, quantitative, transnational-focused examination of the herdsman-farmer conflict and provides insights into the factors that promote violence among Fulani herdsman and host communities. This thesis will be empirical, exploring the relationship between resource scarcity and conflict, and includes several control variables that are likely to predict Fulani herdsman attacks.

Background of the Problem

Nomadic Fulani herdsman have occupied the Sahelian region of Africa for hundreds if not thousands of years (Fulani, 2018). The impact of European colonization from the mid nineteenth century onward and the formation of independent African states have only recently placed national borders around the traditional range of Fulani herdsman, which stretches from Gambia to Ethiopia, spanning across the Sahel and jutting southward into tropical Africa (McGregor, 2017). Despite their migratory history, Fulani herdsman face stiff resistance in areas where they have not traditionally roamed, driven by the need to find verdant pastures for their large cattle herds. Droughts and infrequent rains have led to a decrease in viable grazing area land, leading Fulani herdsman to seek more lush areas, often in agricultural communities where grazing land is limited, or access is restricted (Ubelejit, 2016). This competition for resources is leading to attacks between herdsman and agricultural communities. In addition to simple resource scarcity, there are religious implications to the conflict, as the Fulani are mostly Muslim, practicing Sunni Islam, and many of the groups they come into conflict with especially in the southern part of Nigeria are Christians (Akinwotu, 2018). Fulani herdsman attacks regularly take on a terroristic tone.

Ubelejit (2016) describes the modus operandi of the assaults. The Fulani assailants, "… operate with sophisticated arms such as rifles and AK-47, attacking at midnight, on Sundays, killing indiscriminately, and looting properties" (Ubelejit, 2016).

The farmer-herdsman conflict has expanded and is an intensifying security concern in the Sahelian region. During Nigerian President Muhammadu Buhari's (who is of the Fulani ethnic group) 2018 state visit to the USA, one of President Donald Trump's main agenda topics was the protection of Christians against massacre by Fulani herdsman (Curry, 2018), (Mikailu, 2016). Despite the concern for Christian by President Trump, the herdsman-farmer conflict is a very pertinent African security challenge that warrants further academic study to accurately understand and mitigate the problem. The trends of rising national populations in Africa, increased incidence of drought, increased average temperatures (leading to increased evaporation and aridity), and desertification, logically suggest that the herdsman-farmer conflict is poised to expand, and that the worst is yet to come.

Statement of the Problem

The relationship between resource scarcity and Fulani herdsman militancy has not been adequately explored by large-n quantitative or mixed methods academic studies. Most studies that explore this topic are very local, focusing on solitary administrative districts or subregions within a country. Few, if any studies have taken a broad look at sub-Saharan Africa to examine the relationship between resource scarcity and Fulani herdsman militancy.

Purpose of the Study

The purpose of this thesis is to determine the relationship between resource scarcity and Fulani herdsman militancy in sub-Saharan Africa. This study will contribute substantially by expanding knowledge on the relationship between African security and

environmental scarcity. This thesis seeks to use empirical approaches that may be able to inform policymakers and other stakeholders of the causes of the farmer-herdsman conflict and enable remedial actions to be taken to thwart or mitigate violence.

Research Questions

The major research question of this thesis is: What is the relationship between resource scarcity and violence perpetrated by nomadic Fulani Herdsman in sub-Saharan Africa?

Definition of Terms

Fulani or Fulbe

As defined by the Encyclopedia Britannica (2014),

> Fulani, also called Peul or Fulbe, a primarily Muslim people scattered throughout many parts of West Africa, from Lake Chad, in the east, to the Atlantic coast. They are concentrated principally in Nigeria, Mali, Guinea, Cameroon, Senegal, and Niger.

Climate

As defined by NASA (2019), climate is, "the long-term regional or even global average of temperature, humidity and rainfall patterns over seasons, years or decades".

Resource Scarcity

As defined by Bahung, Gledistch and Theisen (2008) resource scarcity is, "a low per capita availability of a renewable resource, such as freshwater" (p.7).

Sahel

As defined by the Encyclopedia Britannica (2018), the Sahel is, "semiarid region of western and north-central Africa extending from Senegal eastward to Sudan. It forms a transitional zone between the arid Sahara (desert) to the north and the belt of humid savannas to the

south. The Sahel stretches from the Atlantic Ocean eastward through northern Senegal, southern Mauritania, the great bend of the Niger River in Mali, Burkina Faso (formerly Upper Volta), southern Niger, northeastern Nigeria, south-central Chad, and into Sudan."

Militancy

As defined by Okoli and Ogayi (2018), "Militancy is a form of extremist civil action that is based on the abusive application of militarized aggression by a non-state group in order to progress a cause" (p.129).

Arable Land

As defined by the Food and Agriculture Organization of the United Nations [FAO] (n.d.), arable land "refers to land under temporary crops (double cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years)."

Instability

Per the Governance and Social Development Resource Center (2005), "describing a country or region as unstable suggests the presence of political, economic, or social upheaval."

Nature of the Study

This thesis utilizes a dataset of 50 African countries (Appendix A) separated by country and year. The data set years range from 1970 to 2015. Data will be gleaned from open sources of high credibility such as the World Bank. The dependent variable will be civil conflict, which is operationalized by two variables named *armed conflict* and *instability*, both quantitative variables. There are two independent variables, *livestock production* and *arable land*. There are ten control variables which explore socioeconomic factors that explain communal violence. In this thesis, I hypothesize that resource scarcity spurned by climate

change is increasing incidences of violence by Fulani herdsman. The primary scarce resource is viable grazing land, which is being decreased due to several environmental factors including climate change and increased agricultural output. I contend that a decreased area of viable grazing land is causing Fulani herdsman to head south of the Sahel and launch attacks against agricultural communities to ensure access to grazing fields. There are complex links of causation between resource scarcity, numerous interacting variables, and Fulani herdsman attacks, which will be discussed in the literature review.

Relevance and Significance of the Study

Fulani herdsman militancy is a growing trend in the Sahelian region Africa as population growth, climate change and increased agriculture have placed herdsman and farmers in fierce competition with one another for access and control of viable grazing land. Globally, climate change is an accelerating trend and problem, and Africa is one of the most vulnerable and affected continents (Venkatesh, 2018). In addition, the population of Africa is growing at the fastest rate of all continents (“Population”, 2018). The confluence of increasing population, climate change, and increased agricultural production is leading to violence between herdsman and agricultural communities, who find themselves in stiff competition with farming communities. This study will determine if there is a statistically significant causative relationship between resource scarcity and Fulani herdsman violence, and if so, to what level does the causation extend to. The results will be instrumental in assisting non-governmental organizations, charities, governments, and other stakeholders in understanding one of the largest security challenges of the Sahelian region of Africa.

Assumptions and Limitations

The researcher admits that the variables for *armed conflict* and *instability* are not solely indicative of Fulani herdsman violence. Moreover, the study encompasses nearly all of the countries Africa, and not only Sahelian countries where the violence is occurring. However, the inclusion of all African countries allows for variation on the dependent variable.

Organization of the Study

This thesis is comprised of five distinct sections, with this introduction serving as the first. The second section reviews the extant literature devoted to Fulani herdsman militancy and the roles that resource scarcity, population growth, climate change, and other relevant factors take part in the onset of conflict. The third section details the quantitative method utilized to answer the research questions for the thesis. The fourth section provides the results of the empirical analysis. The final section will be a conclusion and implications section, also highlighting potential future research opportunities related to this study and its findings.

LITERATURE REVIEW

Introduction to the Literature Review

Extant literature points to an age-old conflict between the agricultural and pastoral communities. While historically such conflicts have occurred in Asia, Middle East, and the Americas, the African continent has been the epicenter for recent armed conflict between agricultural and pastoral communities (Smith 1969; Okoli and Ogayi 2018). Research abounds on the relationship between resource scarcity (sometimes referred to as environmental scarcity) and the onset of violent conflicts (Homer-Dixon, T. F., 1999); (Barnett, 2008); (Gleditsch, 1998); (Buhang et al, 2008). The phenomenon has been studied from a global view by Nils Petter Gleditsch (1998), who conducted a range of works, which includes in-depth critiques of the quantitative methods utilized by scholars. Gleditsch's 1998 journal article cautioned researchers against overly simplistic, bivariate models of the relationship between climate change and violence. Thomas F. Homer-Dixon's (1999) research also provides a thorough discussion of the topic, in both lay and methodological terms, and is heavily referenced in this literature review. This literature review will also include a brief overview of the academic discourse regarding resources, as well as several paradigms of resource-based violence. In addition, there will be a review of academic works concerning population growth and climate change.

In terms of the impact resource scarcity is having on has on Fulani herdsman violence, no continent-wide empirical study exists that utilizes regression analysis and adequate controls. However, this literature review includes several case studies and descriptive quantitative research on the topic (Ubelejit, 2016; Evans and Kelikume, 2019; Chigozie and Odoh, 2012; Fasona and Omojola, 2005).

The vast discussion in this thesis is on pastoral herdsmen the Fulani ethnic group in sub-Saharan Africa. The reliance of the Fulani on pastoralism, their patterns of transnational and interstate migration, and their livelihood's susceptibility to environmental scarcity makes the Fulani an ideal study group. In addition, the Fulani claim the title of the largest nomadic ethnic group in the world (Mikailu, 2016). The Fulani ethnic group's unique history and lifestyle create a sort of pronounced in-group out-group dynamic across in many of the regions they roam. As such, the Fulani have many unique qualities that make them an ideal ethnic group to study. The following literature examined provides a summation of extant knowledge on the convergence of resource scarcity, population growth, and Fulani herdsman violence in Africa.

Theoretical Framework

Herdsman Militancy

According to Okoli and Ogayi (2018), "Militancy is a form of extremist civil action that is based on the abusive application of militarized aggression by a non-state group in order to progress a cause" (p.129). The same scholars expound on two kinds of militancy. The first being, "Spontaneous, and often incidental, eruptions of violence in the context of civil unrest" (p.129). The second is, "The systematic perpetration of violence by an established militia or non-armed state group" (p.129). Thomas Homer-Dixon (1999) outlines five types of violence that are likely to manifest due to environmental scarcity, which include ethnic clashes (Homer-Dixon, 1999). Ethnic clashes are an accurate description of the violence in the farmer-herdsman conflict and is encapsulated under the term militancy. Overall, the body of extant literature describes the farmer herdsman-violence as civil conflict. In this thesis, Fulani herdsman militancy will be described as a form of civil conflict.

Resources

For this thesis, it is important to explore the academic classification of resources, which play a huge part in the understanding of the herdsman-farmer conflict. According to Homer-Dixon (1999), "…. natural resources can be roughly divided into two groups: nonrenewables, like oil and minerals, and renewables, like freshwater, forests, fertile soils, and the Earth's ozone layer" (p.47). Furthermore, "A non-renewable resource consists of a stock, which is the total quantity of the resource available for consummation" (p.47). Homer-Dixon continues, "A renewable resource has both a stock and a flow, which is the restoration of the stock unit per time" (p.47).

Additionally, resources can be excludable, meaning that access to the resource can be accessed only by property rights (Homer-Dixon, 1999). An example of a nonexcludable resource example is fresh air, which is available to all people and cannot be restricted in its use (Homer-Dixon, 1999). According to the academic classification of resources as described by Thomas F. Homer-Dixon, viable grazing land is a renewable resource that has a stock and a flow, which is dependent on rainfall and topsoil to regenerate its stock. However, the stock and flow of grazing land is highly influenced by climate change and human activity. Decreased or erratic rainfall decreases the replenish rate of grazing. Furthermore, desertification can destroy whole swaths of grazing land by eroding the topsoil. Lastly, human activity such as increased agriculture consumes a greater area of land, decreasing the stock of grazing land.

Africa is no stranger to resource-based conflict. Such phenomenon is often called the "resource curse". Bloomberg et. al. (2011) conducted a study on terrorism and natural resources in sub-Saharan Africa. The researchers discovered that while sub-Saharan African

countries suffer from less terror attacks in comparison the world at large, their economies suffer more damage due to such attacks (Bloomberg et. al.,2011). This is due to a less diversified economy that is susceptible to the loss or decrease of a primary source of income from a natural resource (Bloomberg et. al.,2011). Furthermore, the research reveals that sub-Saharan African countries are less equipped to deal with terrorism, leading to a greater impact of terrorist events versus developed Western countries (Bloomberg et. al., 2011).

Resource Scarcity

As mentioned in the definitions section, the term *resource scarcity* is defined by Bahung, Gledistch and Theisen (2008) as, "a low per capita availability of a renewable resource, such as freshwater" (Buhaug, Gleditsch, & Theisen, 2008, p.7).

Thomas Homer-Dixon (1999) declares that scarcity can manifest in three ways: supply induced scarcity, demand induced scarcity, and structurally induced scarcity (Homer-Dixon, 1999). Supply induced scarcity is precipitated by a decrease in the in supply of a resource, either in quality or quantity (Homer-Dixon, 1999). Demand induced scarcity is caused by an increase in demand which can be spurned by a rise in population (Homer-Dixon, 1999). Structural scarcity is caused by changes in relative access, such as one ethnic group creating laws to favor their access to a resource (Homer-Dixon, 1999). A clear example of structural scarcity is Nigeria's indigeneship policy, which grants land rights to sedentary farmers (Eke, 2018). Per Eke (2018), "Changes in land distribution laws in the late 1970's made it easier for indigenous farmers to acquire land through state and local governments, while the access of Fulani herders became more constrained due to their status as settlers" (Eke, 2018, p.13). An extreme example of structural scarcity in Africa is

apartheid era South Africa, where a white majority owned 86% of the land, including the most fertile regions (Percival, Homer-Dixon, 1998).

Ubelejit's (2016) work provides a good summary of how scarce grazing land foments attacks by Fulani herdsman:

> Communal conflicts between Fulani herdsmen and host communities usually arise when grazing cattle are not properly controlled and consequently graze on cultivated plants like cassava, maize etc. in farms of host communities. Attempts by the owners of such farms to register their grievance of destruction of their livelihood (food crops and cash crops) by the cattle of Fulani herdsmen is always stoutly resisted thereby degenerating into communal conflicts. Host communities sometimes register their grievances by placing restrictions on movement and gracing of cattle in designated areas and enforcing compliance through coercive measures decreed by the host community vigilante which may take the shape of killing stray cattle or arresting and prosecution defaulters. When the communities attempt to moderate their activities or request their exit, the Fulani herdsmen become aggressive and attack the host community sometimes with the assistance of hired mercenaries. Fulani herdsmen normally attack their target communities at the time they are most susceptible such as mid-night or prayer days, when they are in their churches, incessantly killing people with sophisticated weapons, looting properties, and burning houses. (p.27)

Neo-Malthusism, Economic Optimism, and Distributionism

Notions of resource scarcity driving violence are not novel and competing paradigms have diverged from simple X (resource scarcity) causes Y (violent conflict) arguments to modern arguments that absolve fears of violence due to mitigating factors. Homer-Dixon (1999) sheds light on the leading academic paradigms that are used to understand environmental scarcity and violence. As expounded by Homer-Dixon (1999), there are three main competing paradigms on resource scarcity and violence. These three paradigms are

Neo-Malthusism, *Economic Optimism*, and *Distributionism* (Homer-Dixon, 1999). According to Homer-Dixon (1999), Neo-Malthusians, "claim that finite natural resources place strict limits on the growth of human population and consumption; if these limits are exceeded, poverty and social breakdown may result" (p.28). Economic Optimists, "... say that there need be few, if any, strict limits to population and prosperity. They say that properly functioning economic institutions, specially markets, provide incentives to encourage conservation, resource substitution, development of new scare resources, and technological innovation." (p.28). Distributionists, "... say that the real problem is the maldistribution of resources and wealth. Poverty and inequality, in their view, are causes, not consequences of high population growth rates and practices that deplete resources" (p.28).

The notion of resource scarcity directly causing violence, or ecoviolence as it is sometimes referred to, fits into the neo-Malthusian paradigm. Eighteenth century English scholar Thomas Malthus deduced that increases in population, creating scarcity of resources, would lead to mass starvation. Malthus predicted that population would grow exponentially while food production would grow linearly, leading to catastrophe (Agarwal, 2019). Neo-Malthusian notions are simplistic concepts that scholars such as Gledistch have cautioned academics about. Such caution is warranted given that Malthus's original dystopian conclusions never came to fruition.

Interactions

Homer-Dixon (1999) delineates two types of interactions that influence the three causes of scarcity. The first is *resource capture*. "Resource capture occurs when a fall in the quality and quantity of a renewable resource interacts with population growth to encourage powerful groups within a society to shift resource distribution in their favor" (p.73). The

second type of interaction is *ecological marginalization.* “Ecological marginalization occurs when unequal resource access joins with population growth to cause migration to regions that are ecologically fragile, such as steep upland slopes, areas at risk of desertification, tropical rain forests, and peri-urban squatter settlements” (p.73).

Per the above interactions, the phenomenon of herdsman farmer conflicts can be characterized as an example of resource capture. Fulani herdsman attacks are seemingly a strategy for Fulani herdsman to capture more grazing areas rather than to succumb to ecological marginalization by remaining in areas that are becoming less fertile due to climate change.

Population Growth and Violence

Population growth is the central argument within Malthus’s theory, and remains a vital component of neo-Malthusian interpretations of resource scarcity driven violence. Coccio (2018) conducted a study to determine if high population growth drives terrorism. The author’s theoretical framework is the “rooted-in poverty hypothesis,” which uses poverty as an explanation for terrorism (Coccio, 2018). The study included 132 countries and gleaned data from the Global Terrorism Database. Annual population growth from the years of 1975-2002 and 2002-2015, served as the explanatory variable. Control variables included Gini coefficients of each country (a measure of income inequality), Freedom House standardized scale of 2015 (a measure of democratization), GDP per capita, ethnic fractionalization, the Human Development Index, and an index called Kaufamn political stability 2000. The study’s ordinary least squares regression model found a statistically significant positive relationship between annual population growth and fatalities from terrorist attacks (Coccio, 2018). Coccio concludes that, “… in average- terrorism is also correlated to high growth

rates of population, combined with poverty, high income inequality and political instability of countries, ceteris paribus" (p.9). In essence, while poverty by itself is not the key determinant of political violence, coupled with dire economic growth, scare resources, and increased population growth, violence is a likely outcome.

Urdal (2005) tested neo-Malthusian theories of population growth and violent conflict, only to find inconclusive results among his quantitative models. The study tested if countries with high population growth, and high population growth relative to permanent cropland are more likely to experience civil conflict. In addition, Urdal tested if countries with high urban growth or host large refugee populations are more likely to experience armed domestic conflict. Urdal's research design took the form of a large-n logistic regression model. The quantitative model was organized by year and country and spanned from 1950-2000. All sovereign states and colonies were included. The main dependent variable of conflict was operationalized via the PRIO-Uppsala dataset, which is published by the Journal of Peace Research (Urdal, 2005). Control variables included operationalized measurements of development, regime types and economic growth. Urdal conducted six different regression models with varying levels of support for against neo-Malthusian notions. Ultimately, Urdal found that, "High population growth is not in itself associated with armed conflict" (p.426). The finding is caveated, as Urdal continues, "When land scarcity combines with high population growth, there is generally a positive association with conflict…" (p.426).

Kahl (1998) conducted a case study to identify the drivers of an out-of-pattern bout of ethnic conflict between 1991 and 1993 in Kenya, which was and still is known as peaceful and relatively prosperous sub-Saharan African country. In this study, Kahl concludes that rapid population growth, combined with arable land scarcity led to the Kenyan head of state

sanctioning ethnic violence in a bid against multipartyism (Kahl, 1998). Kahl admits that, "The causal connection between population growth, environmental pressure, and civil strife is rarely direct and obvious" (p.84). However, Kahl's research interweaves a succinct casual chain through the lens of resource scarcity and population. The case study takes note that a large proportion of Kenya's land is semi-arid (Kahl, 1998). In addition, between 1979 and 1989, Kenya saw a 40% increase in its population (Kahl, 1998). Kahl compares this with reliable data that shows that the per capita available hectares of arable land decreased greatly from 1969 onward (Kahl, 1998). Other factors such as rapid urban growth and high unemployment growth, an increased percentage of landless rural inhabitants, added pressure to what would become a spat of ethnic conflict that lasted from 1991 to 1993 (Kahl, 1998). The ensuing conflict was deadly. Kahl (1998) reports, "By the end of 1993, at least 1,500 people had been killed and more than 300,000 internally displaced as a result of ethnic clashes" (p.93). The spat of ethnic strife was largely contained to regions of Kenya's best farmland (Kahl, 1998). The government was heavily involved in the conflict as the Kenyan head of state manipulated and inculcated violent sentiments between pastoralists and farmers (Kahl, 1998). In 1992, multiparty elections were held, and the ethnic violence abated (Kahl, 1998). This case study seemingly supports neo-Malthusian notions with arable land as the key scarce resource fomented by rapid population growth, albeit on a qualitative level.

Climate Change and Violence

In 2018, United Nations Secretary General Antonio Gutierrez described climate change as humankind's greatest threat (Wright, 2018). Climate change serves as an additional factor in the assortment of neo-Malthusian notions. Climate change operates as a driver of resource scarcity in the farmer-herdsman conflict, mainly by decreasing the total

area of viable grazing land. This occurs via a decrease in rainfall and subsequent desertification, which strips the ground of its topsoil, making it infertile. Climate change can manifest itself in many ways, include droughts, flooding, and other weather-related calamities. Hendrix and Salehyan (2012) performed a large-n study using manifestations of climate change (droughts, and flooding) to determine how environmental factors spur conflict in Africa. The study encapsulated all African countries with populations above 1 million, spanning from 1990 to 2009. The main dependent variables were social conflict and armed conflict. The explanatory variable, climate change, was operationalized by a measure of deviation from average rainfall patterns. The rainfall data was obtained from the Global Precipitation Climatology Project. Armed conflict was obtained from the UCDP/PRIO Armed Conflict Dataset and social conflict operationalized with data from the Social Conflict in Africa Database (SCAD). The study's controls included variables operationalized for democracy (Polity 2), development, economic growth, and population (both growth and static). Logistic regression was utilized for the armed conflict model and negative binomial regression for the social conflict model. Hendrix and Salehyan's study found a curvilinear relationship between social conflict and years of drought and flooding. Social conflict was greatest in wetter years, which represent years of flooding. The study also indicated that armed conflict has a positive relationship with increased rainfall. In addition, the research revealed that too much rain at one time can be just as destructive or more destructive as a drought. The scholars foreshadow that climate change will cause more social conflict due to more extreme climatic events.

Another study (Koubi, Bernauer, Kalbhenn, Spilker, 2012) seeks to examine a causal link between climate change, economic growth, and violence. The scholars hypothesized that

climate change hinders economic growth, leading to violence. The study utilized a dataset of 50 African countries from 1980 to 2004. Climate change was operationalized as a measure of deviation in the 30-year average of precipitation and temperature. The study used several controls including GDP, population, ethnolinguistic fractionalization, terrain, and oil exports. The quantitative model consisted of a two-stage logit regression. Ultimately, the study failed to find any statistically significant link between climate change and violence by way of a diminished economy.

Barnett and Adger (2007) explores the impact of climate change and human security. The study describes how climate change can be especially detrimental on human security in highly agricultural economies. Such economies have millions of individuals whose livelihoods are directly tied to access to natural resources. The study gives the example of East Timor, where 85% of the population depends on agriculture to earn a living (Barnett and Adger, 2007). Decreased access to vital resources such as land in an agrarian country increases the risk that individuals join armed groups (Barnett and Adger, 2007).

After exhaustive research in his 1999 book, which provided a very broad examination of environmental scarcity and violence, Homer-Dixon concluded that, "...scarcity of renewable resources--or what I call environmental scarcity-- can contribute to civil violence, including insurgencies and ethnic clashes" (p.177).

Seiyefa (2019) contends that climate change is undermining the security of West African countries. Droughts and other climatic calamities foment migration to burgeoning urban centers, where structural inequalities, ethnic rivalries and lack of resources compel individuals and groups to engage in criminal activities to survive (Seiyefa, 2019). This is manifested in political corruption, organized crime, or wholesale armed movements.

Psychological Paradigms and Violence

A more psychological paradigm in understanding the Fulani herdsman conflict is also unveiled in extant literature. Though a quantitative study, this framework can add a qualitative touch to the entire thesis. Akinyemi et al, (2017) use relative deprivation theory to understand the herdsman-farmer conflict. Relative Deprivation Theory is defined by Akinyemi et al, (2017) as:

> The basic precondition of civil strife, and that the greater the deprivation the greater the magnitude of strife. Relative deprivation in turn is produced by discrepancy between what people think they are entitled to and what they are actually getting. As deprivation increases, frustration and anger will ensue. These psychological states will produce aggression. At the level of aggregates, many aggressive acts and tendencies will produce civil strife. (p.5)

Although not a pillar of the neo-Malthusian theory, relative deprivation theory could also prove useful in explaining the increase in herdsman killings which often take on a retaliatory and vengeful undertone. In a study called *Staff to Gun: Fulani herdsman in Nigeria*, Tope Akinyetun (2016) delineates that Fulani herdsman have seeming changed their grazing tactics from "mere land grazing to barrel-induced land grazing" (p.39). Akinyetun (2016), also claims that, "The domination of other groups, with or without force is a major feature of the Fulani" (Akinyetun, 2016, p.40). The brutality of recent clashes may indicate that perhaps there is more going on within the psychological dynamics of the conflict than a simple resource scarcity model can explain. The larger historical context of ancient Fulani states and relations with other ethnic groups must be understood in descriptive manner. Once British administration had been established in Northern Nigeria, the Fulani had conquered the sedentary farmers (Anthony, 2014). This conquest occurred despite the Fulanis being

outnumbered four to one (Anthony, 2014). Thomas Homer-Dixon also discussed Relative Deprivation Theory. Homer-Dixon (1999) writes:

> The extent and the degree of grievance caused by environmental scarcity is a function of relative deprivation, but this relative deprivation must be measured at the level of specific subgroups within a society, and it is powerfully influenced by local contextual factors, such as the group's blame systems and conceptions of economic justice.(p,144)

Protection of livelihood is likely a major factor in the nexus of relative deprivation and the brutality of Fulani herdsman attacks. Per Abbas (2012) in his study of conflict between Fulani Pastoralists and Farmers in Northern Nigeria, noted that Fulani own 90% of Nigeria's livestock. Subsequently, livestock comprises one-third of Nigeria's agricultural GDP (Abbas, 2012). Relative deprivation theory helps explain the recurrent conflicts between ethnic groups. Surulola Eke's (2018) study, analyzing herder-farmer conflict in Nigeria's Middle Belt Region provides a conflict model based on the intersection of economic, structural, and socioeconomic factors. Eke goes on to expound how Fulani pastoralists found themselves in political power during British colonial rule (Eke, 2018). However, power has shifted since the end of colonialism (Eke, 2018). Eke describes how the government policy of indigeneship has given power to farmers in the Middle Belt (Eke, 2018). Eke describes how Fulanis are now essentially guests, having to broker grazing rights with agrarian communities (Eke, 2018). Eke writes, "resulting from the apparent imbalance in the structure of resource distribution is the creation of the feeling of relative deprivation. The emergent environment is one where competition over scarce resources, such as land and water, easily escalates into full-blown confrontation" (p.13). Eke contends that contends that

structurally based inequality over land rights take precedence over factors such as population growth (Eke, 2018).

Scholars Østby et al (2009) conducted a quantitative study to discover the role that inequalities over the benefits of resources had with levels of civil conflict in sub-Saharan Africa. Their research included 22 countries and covered the period of 1986 to 2001. Civil conflict was measured through the UCDP/PRIO Armed Conflict Dataset. The study utilized a sophisticated model that measured regional relative deprivation with a formula that included data for household assets. The study also utilized interactions for the presence of diamonds and oil. The quantitative model did not find a statistically robust linear relationship between the variable employed for regional relative deprivation and conflict. The scholars surmised that the relationship could be curvilinear. In the end, the researchers concluded that, "relative deprivation, or inequality, may enhance the risk of conflict under certain conditions, rather than having a strong triggering effect" (p.317). The researchers also discovered that regions with natural resources are significantly more at risk of conflict than regions without natural resources.

Review of the Research Literature

The major consensus around scholars is that climate change is directly causing the farmer-herdsman conflict. Other works point to government policies as a major factor in the conflict. Ubelejit's (2016) examination of Fulani herdsman and communal conflicts and climate change makes the case that climate change is the main cause of the herdsman-farmer conflict. Ubelejit points to desertification of the Sahelian region as the main catalyst for Fulani migration, and subsequently the conflict with agrarian communities. Ubelejit notes that, "The Fulani herdsman are completely dependent on resources of the natural

environment and this makes them go all out to get these resources thereby making them susceptible to resistance when they fight back and communal conflicts tantamount" (p.30).

To summarize the causal link between climate change and violence, I turn to Ubelejit. Ubelejit, (2016), concluded that,

> Conflict with different host communities by Fulani herdsmen is a survival strategy that is perpetrated by climate change. The only reason why Fulani herdsmen migrate long distances to communities whose indigenes would eventually challenge and oppose their modus operandi is because of the search for green pastures and water. There immediate environment is bereft of these pasture because of desertification and other environmental challenges. Most Fulani communities are in the Sahel zone which has been taken over by desertification thereby compelling the Fulani herdsmen to migrate towards coastal areas in search of pasture and water. (p.31)

Studies on Fulani Herdsman in Nigeria

There is perhaps no better region to study the incidence of Fulani herdsman violence than the region of Northern Nigeria (Odoh, Chigozie 2012), (Fasona and Omojola, 2005). Northern Nigeria is A Sahelian region with the large majority of Nigeria's agricultural output and a long history of Fulani pastoralism. This Sahelian region area is also highly vulnerable to climate change. Odoh and Chigozie (2012) report on the desertification of this region, "The Sahel creeps south by approximately 1,400 square miles a year, swallowing whole villages" (p.117). Governance also plays a large role in the conflict. The colonization of Nigeria, which used indirect rule in the north leaves a legacy of domination on ethnic groups of the south. In addition, Nigeria has Africa's largest population, which according to the World Bank, was over 195 million (Nigeria, 2019). A high population combined with a large Sahelian region makes Nigeria the central focus of many studies on herdsman-farmer conflict.

Olabode & Ajibade's (2010) examination of whether environmental factors increased the likelihood of the herdsman-farmer conflicts seeks to answer the direct research question of how and what is causing violence by Fulani herdsman within a certain administrative district of Nigeria. The researchers outline that cattle traditionally are the most important objects in Fulani society, being an indicator of wealth. These cattle require grazing lands and sometimes stray onto land that is used for agriculture. The scholars surmise that desertification is pushing herdsman farther south in search of greener pastures (Olabode & Ajibade, 2010). The scholars isolated the study to the Oke-Ero local government area in Kwara state Nigeria. This state is in the southwest of the country. The scholars selected this area due to its high reliance on agriculture and high incidence of Fulani attacks. The researchers issued seventy-four questionnaires to local communities including settled farmers and nomadic herdsman. The surveys queried for data on farming activities and the number of cattle kept, as well as the frequency and nature of conflicts between the farmers and herdsman. To conclude, (Olabode & Ajibade, 2010) found that:

> …the frequent causes of conflict between farmers and herdsman in Odo-Owa, Oke-Ero Local Government Area of Kwara State is the destruction of crops by cattle. It was accepted that there are competing uses of resources; and this is often so when the resource in question is land which can be put into different productive uses. (p. 271)

Fasona and Omojola (2015) provides a quantitative analysis of rainfall in Nigeria from 1940-2000. Their data indicates that rainfall in most weather stations for the northern administrative districts have negatively deviated from the mean (Fasona & Omojola, 2015). The scholars juxtapose this declining rainfall with violent Fulani clashes. The researchers concluded there is a very strong connection between climate change and the pattern of communal clashes in the country (Fasona & Omojola, 2015).The scholars give this as the

reason why Fulani herdsman have diverted form their traditional range and headed into more verdant areas in the south of the country, where rainfall has not decreased.

Gustavo Furini's (2019) research on climate change in Nigeria utilized empirical models to test the relationship between climate change and Fulani ethnic conflict. In the study, Furni focused on four states in the central-eastern region of Nigeria. That specific region is a hotbed for Fulani violence, and serves as a thoroughfare for North-South Fulani migration. The study focused on January 2010 to December 2017, a span of 96 months. Estimates of violence were obtained from the Uppsala Conflict Data Program and was specified for incidents involving the Fulani. In addition, rainfall data was included for the same period, utilizing 15 weather collection points. The relationship between violent incidents involving Fulani and precipitation patterns was illustrated using spatial regression. The study found, "46.4% more deaths in communal conflicts involving the Fulani ethnicity occurred in the dry season (November to April) than in the rainy season (May to October)" (p.49). However, the research was not able to establish a strong relationship between less rainfall and deaths. The researcher also concluded that based on the seasonal increase in violence, decreased rainfall due to climate change could worsen the incidence of violent conflict.

Mali

Benjaminson, Alinon, Buhang, & Buseth (2012) and his fellow scholars conducted a mixed methods study on land use and conflicts in the inland Niger delta of Mali, specifically the administrative district of Mopti which straddles the center of Mali and contains the Niger river inland delta. Their study, concluded that in this regional area, land use conflicts are driven more by political and economic contexts rather than climate change. (Benjaminson,

Alinon, Buhang, & Buseth, 2012). For the quantitative portion of the study, the scholars compared rainfall data with available land use conflict grievances data from local courts. The authorized utilized a case study method to execute a case study of an attack on Fulani herdsman. The study admits that although there were periods of drought in the 60's and 70's, rainfall has continued to increase in recent years. The study concludes that in the case of Mali, agricultural encroachment, political decentralization and rent seeking behavior among the government as more explanatory of land use conflicts in Mali.

Ghana

Ghana serves a stark difference from Nigeria both in scale of the conflict, and perception of the Fulani, as well as economic development. Ghana's economic development has been bolstered by its peaceful existence. In addition, the population is much lower than Nigeria, measuring at nearly 30 million according to the World Bank (Ghana, 2019). The Northern Sahelian region of Ghana serves as the area of study in the research of Soeters et al (2017). The article provides insight on the background of relations between the Fulani, who arrived later, and local sedentary populations. Per the study, Fulani nomads first emigrated to Northern Ghana in the 1960s and 1970's due to a Sahelian drought. (Soeters et al, 2017). Before settling, Fulani had previously entered Ghana every dry season, subsequently migrating out at the onset of the rainy season. The impetus of drought logically places resource scarcity as the major causative factor for the Fulani to have settled in Northern Ghana. However, unlike Nigeria, where Fulani are considered inhabitants, many Ghanaians do not Consider Fulani to be Ghanaians, and Fulani are not an official ethnic group in Ghana (Soeters et al, 2017). In fact, there have been several government operations and efforts to expel Fulani from Ghana. Northern Ghana is the poorer section of Ghana and is currently

undergoing initiatives to increase agriculture especially during the dry season. Critical to the plan is the creation of smalls scale dams that allow for cultivation during the dry season. The intensified agriculture is consuming land that Fulani have used to graze. Also, more land is being cultivated near riverbanks, which retains moisture in the dry season, making it harder for Fulani herdsman to graze cattle. This quote from the article summarizes the herdsman farmer conflict in Northern Ghana:

> Relationships between sedentary farmers and Fulani pastoralists are largely defined by competing claims to natural resource use. Intuitively, the push to modernize agriculture in Northern Ghana, and the subsequent expansion of crop farming in the space, reduces the available resources for pasture, and as this article argues, increases both the frequency and the intensity of farmer pastoralist conflicts" (pg. 3).

Additional insight into the herdsman-farmer conflict in Ghana is provided by Tonah (2006). Tonah (2006) confirms that Fulani migration into Northern Ghana increased due to drought during the 1950's and 1960's. This provides further evidence that climate change is a precipitator of violence. Like the former study on Ghana, Tonah delineates that Fulani would negotiate land usage with local chiefs Some Fulani who did not have cattle would work as herders for local peoples. Tonah notes spatial separation of Fulanis and other tribes. Per Tonah, "The most frequent cause of conflicts between farmers and herders in the Volta basin is the destruction of crops by cattle" (p.160). Additionally, as more area is being cultivated, and herdsman must navigate their ways through an increasing area of crop farms. Tonah also declares an increase in dry season farming, and an unwillingness of Fulani to migrate longer distances to reach pastures that are not used for farming. Tonah concludes that:

> The increase in the population of both farmers herders in the Volta basin and competition by both groups for resources in the area has resulted in an increase in

> farmer-herder conflicts. The main cause of farmer herder conflicts in the Volta basin, just as elsewhere, are the destruction of crops by livestock and increased competition for available sources (p.173)

Review of the Methodological Literature

Gleditsch is the most respected scholar on climate change and all forms of conflict. The work of Gleditsch serves as a watchful eye against what can easily be rationalized as an overly simplistic, neo-Malthusian explanation of dwindling resources sparking violence between ethnic groups. Gleditsch (1998) declares that, "Despite numerous pronouncements on the relationship between conflict and the environment, there is no consensus on the causal mechanism" (p.383). The researcher lists some thoughtful points on climate-induced conflict studies. One critical point is the distinction between resource scarcity and environmental degradation. Gleditsch (2018) reminds readers that, all resources are scarce by some degree, and that we should not jump to immediate conclusion that scarcity in of itself precipitates violence The critical distinction being that environmental degradation is a human-made disturbance of the normal regeneration rate of a renewable resource. Secondly, Gleditsch (1998) points out that important variables are left out in many studies focused on climate change and violence. He notes that a plethora of studies are simply bi-variate and are based on what he denotes as "overly simplistic modeling" (Gleditsch, 1998, p. 387). According to Gleditsch, the greatest weakness of such shortsighted studies is the omission of socioeconomic variables. While it is plausible to assume causation between climate change and violence as per the resource scarcity model. However, this thesis empirically tests such relationships by including substantial controls to bolster the credibility of the research.

I hypothesize that a decrease in available grazing line is causing an increase in Fulani herdsman violence. Outlined below are the researcher's hypothesis statements:

H_0: There is no relationship between resource scarcity and Fulani herdsman attacks in sub-Saharan Africa.

$H_{1:}$ There is a positive relationship between resource scarcity and Fulani herdsman attacks in sub-Saharan Africa.

Chapter 2 Summary

The consensus among scholars is that resource scarcity, driven in part by climate change is a major factor in the incidence of Fulani herdsman attacks in the Sahel. Many studies would fall into suspect territory of being overly simplistic failing to tie in detailed quantitative analyses with enough controlling variables. Gleditsch (1998) gives cautionary tale to scholars as to drawing to simplistic conclusions without adequate controls, and as the researcher, I will control as many relevant factors as possible to come to a meaningful analysis. The case studies reviewed tie in the increase of violence with the effects of climate change. However, the social, political, and economic fabrics of African countries are key factors which have a huge hand in the incidences of violence by Fulani herdsman, as was described in the study focusing on the inland Niger delta. It is evident that the herdsman-farmer conflict manifests in different ways throughout the Sahelian countries. We see that the conflicts in Nigeria, and Ghana have varying factors that influence outcomes. It is hard to operationalize and quantify cultural sentiments, and customs into regression models let alone mindsets and feelings of entire ethnic groups. Yet it will be important to understand the culture of Fulani herdsman through customs, norms, and religion in a descriptive manner to come to any meaningful findings for a quantitative study.

Demographics and the historical settlement of Fulani change the dynamics of the conflicts. In Ghana, Fulani herdsman have a shorter history, are not seen as indigenes of the area. Furthermore, the system of grazing is highly dependent on local chiefs with which the Fulani negotiate with for access to grazing land. Furthermore, Ghana's development has resulted in increased agriculture and irrigation, further putting pressure on resources. In Mali, the disintegration of traditional Fulani administration over grazing lands has led to violence. Viable grazing land is a renewable resource, with total stock and a flow. Grazing land also falls under the category of an excludable resource, meaning that access to it can be granted or denied based on property rights. Population growth, combined with increased agriculture, linked with decreased grazing land caused by desertification and drought has led to Fulani herdsman employing a strategy of resource captures, aiming to shift access to grazing lands int heir favor via what Tope A Akinyetun (2016) calls, "barrel-induced grazing" (p.39). Further context to the conflict is provided by history, as the Fulani herdsman have a history of creating jihad kingdoms in West Africa and are somewhat alienated in many of the countries in which they reside. Relative deprivation, fomented by changes in governance such as land policy, provides context as to why they have resorted to terroristic attacks, especially in Nigeria's Middle Belt.

METHODOLOGY

Introduction

This section outlines the quantitative methodology used to create the analytical conclusions of this thesis. The research design includes two dependent variables, *instability*, and *armed conflict*. The two independent variables are *livestock production* and *arable land*. There are eleven control variables. The variables are abbreviated in the dataset. A dataset consisting of 50 African countries from the years of 1970 to 2015 was utilized. Data was gleaned from open sources of high reliability including the World Bank and Polity IV data series. Two probit regression models were conducted.

Research Design

Two distinct regression models were utilized for this experiment, Model 1, and Model 2. Model 1 consists of a probit regression of the dependent variable *instability* with *livestock production* and *arable land* as the independent variables, and eleven control variables. Model 1 is designed to test if there is a relationship between the dependent variable of *instability* and the two independent variables of *livestock production* and *arable land*.

Model 2 is constructed similarly to Model 1 and is also a probit regression. Model 2 estimates the dependent variable *armed conflict* with the two independent variables *livestock production* and *arable land*, the same eleven control variables utilized Model 1, listed in the previous paragraph. Model 2 is designed to test if there is a relationship between the dependent variable *armed conflict* and the two independent variables of *livestock production* and arable land and the depend variable *armed conflict*.

Dependent Variables

This thesis uses two dependents variables, *instability,* and *armed conflict*. Per the GSDRC (2005), instability "suggests the presence of political, economic, or social upheaval." As noted in the extended literature, the variable *armed conflict* was obtained from the UCDP/PRIO Armed Conflict Dataset and *instability* was operationalized with data from the Social Conflict in Africa Database (SCAD). The variable *instability* is a dummy variable that takes a value of "1" if there is an incident of political instability and "0" if they have not experience instability. The two dependent variables serve as the operationalization of Fulani herdsman attacks.

Independent Variables

The independent variables for this thesis are *livestock production* and *arable land.* *Livestock production* is derived from the World Bank's (2018) livestock production index. The variable includes "meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins." (World Bank, 2018) This variable serves as an operationalization of the pastoral rearing and keeping of cattle by Fulani herdsman. The *arable land* variable is also operationalized by World Bank (2018), "it includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded." (World Bank 2018).

Control Variables

The major goal of the regressions is to measure the effects of resource scarcity on violence perpetrated by Fulani Herdsman in sub-Saharan Africa. To home in on causality, a

host of commonly used control variables are utilized in the quantitative model. As is universally understood in social science research, demographic factors such as population, governance, and economic indicators can highly influence the likelihood of conflict in a society. *Log of population* serves as a measure of each country's population logged for skewness and is gleaned from World Bank (2018) data. In addition, *ethnic polarization* serves as a measure of the disparateness of ethnicities within each country. The variables measuring *women in the labor force* and *secondary school enrollment* serve as common measures of female labor participation and secondary education, common markers of social progress.

Various economic controls are utilized to control regulate the effects that finances exert on conflict. *Economic growth* measures GDP growth or decrease. *Log of GDP per capita* serves as a measure of the size of each country's economy given its population. The variable *oil exporters* is a binary logit variable that measures countries with significant oil exports.

Various physical geography and climate controls are utilized including *permanent cropland, drought and rpe_agri*. *Permanent cropland* serves as a measure of land utilized to rear perennial crops such as grape vineyards and fruit orchard. Lastly, Polity IV is included in the variable *rp4*, serving as a measure of democracy.

In total, these controlling variables contribute to sounder statistical models.

Selection of Participants or Cases

A total of 50 African countries from 1970 to 2015 was utilized to provide a more comprehensive view of the data. In a few cases, values specifying conflict totals were missing, evident mostly in the pre 2000s. In addition, because data from World Development Indicators are published less frequently than once a year for some countries in the analysis, there are gaps.

Data Collection

Data for the quantitative model was obtained through open sources. Data collection was simple and unimpeded. The UCDP/PRIO dataset used to create the *armed conflict* variable is freely available on prio.org. The data used for *instability* was the Social Conflict in Africa Database (SCAD). The data contains information on events such as riots and protests. The SCAD dataset is widely disseminated and can be obtained from various sources including Strausscenter.org and other academic online sources. The independent variables of *livestock production* and *arable land* were both obtained from the World Bank's website. Demographic control variables of *log population*, *egrowth*, *log of GDP per cap*, *secondary school enrolment*, *women in the labor force*, and *permanent cropland* were also obtained from the World Bank's website. The variable *rp4*, which measures democracy levels was retrieved from the Polity 4 time series, which is openly available from the Center for Systemic Peace's website. Lastly, data for the *oil exporter* variable was gleaned from US Energy Information Administration.

Data Analysis Procedures

STATA 14 was utilized to estimate the regression models. An excel file was compiled with all the variables. Before conducting the quantitative models, the data was t-set

by country and year. Several preliminary regressions were conducted until a significant finding was discovered. Probit regression was utilized due to the function's ability to regress binary variables. Furthermore, a variance inflation factor was conducted to test for collinearity.

Limitations of the Research Design

The major limitation of the quantitative model is the lack of more specific conflict data to operationalize Fulani herdsman attacks. Conflict was instead operationalized by data from UCDP/PRIO and SCAD, broader metrics of armed conflict and social upheaval. However, such a dataset does not exist, and the researcher does not have the means to create such a dataset.

Internal Validity

This thesis has a moderate level of internal validity. A variance inflation factor (VIF) was conducted on the variables, with all variables scoring well below 10 and having an overall average of 1.76 (Table 1.1). As such, the data does not appear to suffer from multicollinearity. In addition, there were numerous controls utilized from reliable sources.

External Validity

This thesis has high external validity. The researcher's primary reader holds a Ph.D. in Security Studies and is an expert in terrorism and quantitative methods of examining and understanding conflict. Due to expert guidance, the research was conducted with proper data collection and compilation methods. In addition, sufficient controlling variables were selected and included in the quantitative model.

Ethical Issues

This thesis utilized secondary sources that did not involve any human experiments. As such, there were no ethical concerns.

Chapter 3 Summary

This section has outlined the research design for this thesis. This thesis utilizes a time series of 50 African countries for the years of 1970 to 2015. The two dependent variables are *instability* and *armed conflict*. *Instability* and *armed conflict* consist of data from SCAD and UCDP/PRIO. The two independent variables are *livestock production* and *arable land* and are made up of datasets from the world Bank. The 11 control variables consist of data from the World Bank and other reliable sources. Two probit regression models computed by STATA 14 will be utilized to determine if any relationship exists between the variables. Probit regression was utilized due to the binary variables included in the study. The data is limited due to the broadness of the data used to operationalize the dependent variables. However, the quantitative model was guided by a Ph.D. in Security Studies and utilizes reliable data.

RESULTS

Introduction

This chapter discusses the scientific conclusions that are derived from the two probit regression models that were performed. It will feature a discussion on the results of Model 1 (Table 2.1) and Model 2 (Table 2.1) and their implications to the researcher's hypothesis statements. Hypothesis 1 was disaggregated into 1a and 1b to better assess the outcomes of *instability* and *armed conflict*. Model 1, a test of H1a, provides support for the researcher's hypothesis. Model 2, a test of H1b failed to yield any significant relationship between the independent and dependent variables.

Data and Analysis

This section contains the resulting data from the two regression models. Moderate support is found for the researcher's hypothesis, which is reiterated below. Multicollinearity was not a problem for the regression models as a variance inflation factor (VIF) was conducted resulting in a mean score of 1.76 with none of the variables scoring above 10.

H_0: There is no relationship between resource scarcity and Fulani herdsman attacks in sub-Saharan Africa.

$H_{1a:}$ There is a positive relationship between resource scarcity and Fulani herdsman attacks in sub-Saharan Africa. (supported)

$H_{1b:}$ There is a positive relationship between resource scarcity and Fulani herdsman attacks in sub-Saharan Africa. (not supported)

Table 1.1 Variance Inflation Factor		
Variable	**VIF**	**1/VIF**
rpe_agri	3.09	0.323856
rp4	2.79	0.358205
loggdppercap	2.14	0.466942
secschenro~t	2.01	0.498604
agriland	1.98	0.506281
womlabforce	1.81	0.551370
arableland	1.64	0.608794
logpop	1.52	0.657063
livestockp~d	1.39	0.720458
oilexporters	1.27	0.786833
ethpol_d	1.14	0.875987
repression	1.11	0.901224
egrowth	1.03	0.972286
Mean VIF	**1.76**	

Model 1 Results

Model 1 represents a 95% threshold of support for the relationship detailed in H1a. The findings suggest a solid statistically significant relationships between the two independent variables *livestock production* and the dependent variable *instability*.

Firstly, Model 1 indicates that greater *livestock production* is positively related to *instability*. The coefficient of *livestock production* stands at .005768 and is a positive relationship. The p-value for the output measures at 0.032, making the finding statistically significant.

Model 1 also suggests a strong but negative relationship between *arable land* and *instability*. As shown in Table 2.2, the p-value for this variable is highly statistically significant, with a value of 0.000. This finding is expected and moved in the expected direction. The findings suggest where there is significant arable land there is a less likelihood

of instability. However, as the extended literature notes, much of sub-Saharan Africa does not possess well irrigated arable land. Significant relationships were also found among the control variables. Other control variables of interest include *log of GDP per capita*, which is revealed to have a moderate negative relationship to *instability* with a coefficient of -.3941961 and a significance level of 0.000. Interestingly, *permanent cropland* was found to have a positive relationship with *instability* with a coefficient of .0744282. and 0.000 significance level.

Model 2 Results

Model 2 which is a test of H1b, did not yield any statistically significant relationship between *armed conflict* and *livestock production* or *arable land*.

Table 2.1 Probit Regression Models 1 & 2						
	Model 1 – Instability			**Model 2 – Armed Conflict**		
Variable	**Coef.**	**S. E.**	**P-Value**	**Coef.**	**S. E.**	**P-Value**
Livestockprod	.005768	.0026853	0.032**	-.006204	.0051658	0.230
Arableland	-.0247254	.0055401	0.000***	-.0163469	.0097094	0.092
Logpop	-.0336487	.0510005	0.509	0.315837	.0842775	0.708
Ethpol_d	.5715562	.3098622	0.015*	.6879034	.5715562	0.229
Rp4	.0062831	.0287065	0.827	-.1132986	.0981984	0.249
Egrowth	-0.184953	.3098622	0.028	-.0067166	0.133402	0.615
Loggdppercap	-.3941961	.0777118	0.000***	-.1752596	.1288539	0.174
Secschenrollment	.0059089	.0036251	0.103	-.0176005	.0068344	0.010*
Oilexport	.8876698	.1925914	0.000***	.6669175	.2859587	0.020*
Womlabforce	.0025221	.0074686	0.736	-.0168037	.0131149	0.200
Permanentcropland	.0744282	.0159231	0.000***	.0021644	.0295905	0.942
Rpe_agri	-.0771186	.1754723	0.660	.3625803	.3415883	0.288
Drought	-.2008083	.2251101	0.372	-.2228863	.3952277	0.573
Constant	1.122043	1.195871	0.348	.22689	1.950979	0.907
# of Obs.	1009			664		

Chapter 4 Summary

This study utilized two regression models. Overall, only Model 1 provides evidence to support the researcher's hypothesis. Model 1 indicates that the research models support that *livestock production* is positively related to *instability* and that *arable land* is negatively related to instability. In addition, *arable land* is negatively related to *instability*. Moreover, significant relationships were observed between *instability* and several controls. Furthermore, Model 2 did not to yield any statistically significant relationships between the independent variables and *armed conflict*. The proceeding conclusion will delve into the researcher's analysis of the regression output.

CONCLUSION

Introduction

Understanding the farmer-herdsman conflict is critical to obtaining a peaceful and stable sub-Saharan Africa. With increasing populations, more development, and greater exploitations of natural resources, Africa is becoming more connected to the interests of western countries and other nations Evaluating the relationship between environmental scarcity and violence between pastoral Fulani herdsman and agriculturalists could help avert calamities in the future by shining a light on the current problem and how the situation may deteriorate with greater strain on resources. Climate change serves as a wild card tossed into the pot of already bleak conditions. Furthermore, pastoralism continues to be a major source of livelihood for many populations, including many Fulani in sub-Saharan Africa. The findings of this research, though not conclusive, reveal that more work is to be undertaken to understand the farmer-herdsman conflict.

Summary of the Study

This study utilized a quantitative research design featuring a time series of 50 African countries spanning the years of 1970 to 2015 and probit regression to determine the relationship between resource scarcity and Fulani herdsman violence. The presence and cattle rearing activities of Fulani herdsman was operationalized via livestock production and agricultural activities were represented by measures of arable land. The control variables consisted of economic and governance and development indicators commonly used in social science research. Model 1 found support that there is a relationship between cattle rearing and instability, and arable land and instability, providing little support for the researcher's hypothesis.

Discussion of the Findings

The positive relation between *livestock production* and *instability*, suggests that resource competition between pastoral Fulani herdsman and agriculturalists is fomenting civil conflict in sub-Saharan Africa. While a coefficient of .005768 is by no means large, it does suggest a conflictual socioeconomic environment. In addition, the negative relationship between arable land and instability is logical. It is noteworthy that the *arable land* variable is a calculation of land cultivated for seasonal crops, temporary pastures, and land temporarily left fallow. It is likely that countries with greater amounts of *arable land* are simply bigger in area, resulting in more area for both herdsman and agriculturalists to utilize and thus less *instability*. Furthermore, *arable land* usually lies fallow at least part of the year and can potentially be used for grazing. Furthermore, the negative relationship between *log of GDP per capita* and *instability* is also logical given that one would expect better economies relative to population to be more stable. Moreover, the statistically significant positive relationship between *permanent cropland* and instability may be due to nature of perennial crops such as orchards and vineyards, which take up space year-round, and do not lay fallow, and cannot serve as a grazing area. Overall, due to small coefficients, the finding of the study are not particularly compelling.

Implications for Practice

The results of this study could be useful for charities, NGOs and other organizations that seek to assist in the development and maintenance of peace in sub-Saharan Africa.

Recommendations for Further Research

The key recommendation is for future researchers to compile a comprehensive dataset of Fulani herdsman attacks. Such a dataset would be instrumental in a more accurate

regression model. Furthermore, a future study would benefit by limiting the area study to the African countries in the Sahelian region.

Conclusions

By all estimations, the Sahelian region will continue to see more environmental degradation and aridity, causing Fulani herdsman to venture southward and continue the pattern of violence that exists in areas such as Nigeria's Middle Belt region. In addition, African countries are engaging in more intensive agriculture than ever before, with numerous initiatives to increase output through innovations including irrigated dry season agriculture. As was discussed further, the fasted growing continental population is that of Africa. Model 1 lends credence to the idea that *livestock production* has a slight positive relationship with *instability*. In addition, the pastoral Fulani herdsman have shown that they are willing to protect their livelihood even if it means using force. African countries, especially those in the Sahelian region, must take efforts strike a balance between pastoralists and farmers or face greater incidences of violence in the future.

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APPENDIX A

Country List

Algeria	Gabon	Namibia
Angola	Gambia	Niger
Benin	Ghana	Nigeria
Botswana	Guinea	Rwanda
Burkina Faso	Guinea-Bissau	Senegal
Burundi	Ivory Coast	Sierra Leone
Cameroon	Kenya	Somalia
Central African Republic	Lesotho	South Africa
Chad	Liberia	Sudan
Comoros	Libya	Swaziland
Congo	Madagascar	Tanzania
Djibouti	Malawi	Togo
DRC	Mali	Tunisia
Egypt	Mauritania	Uganda
Equatorial Guinea	Mauritius	Zambia
Eritrea	Morocco	Zimbabwe
Ethiopia	Mozambique	