

AN ABSTRACT OF THE THESIS OF

Taylor Lucey for the degree of Master of Science in Forest Ecosystems and Society presented on November 3, 2017.

Title: A Political Ecology Lens for the Nutrition Transition in Rural, Kedougou, Senegal.

Abstract approved:

John C. Bliss

Kerry E. Grimm

The nutrition transition is a global phenomenon in which populations move from low socioeconomic status (SES) to high SES and from high physical activity to low physical activity. Rising rates of urbanization and non-communicable diseases in West Africa may indicate an advanced phase of the nutrition transition; however, through a case study in rural, Kedougou, Senegal, this study suggests that the transition is not homogeneous across the country based on comparisons with other regions and national statistics in Senegal. From April – October 2016, qualitative methods were used to address three research objectives: 1) to determine how diets were changing, 2) to understand what was influencing changes in diet, and 3) to explore some of the implications of change in diet. Participant observation, one-on-one and joint interviews (n=25 total informants), and a 60-day food log were triangulated with peer-reviewed literature and global health statistics to answer the objectives. Dietary changes included widespread use of bouillon seasoning, vegetable oil, and white rice, as well as a loss of local, traditional foods and medicines (e.g. *Parkia biglobosa*, *Vitellaria paradoxa*, and dairy). Informants were concerned about

their changing diets and subsequent changing health, but felt that these changes were out of their control. A political ecology lens shed light on various scales of power dynamics that influenced health and diets in the region: household scales (gender roles), regional scales (gold mining industry), and international scales (globalized, dependent food systems). Informants living in forest communities are changing their forest use, habits or patterns, which includes collection of food resources from the forest. This study suggests that these changes in forest use and a subsequent change in diet (substitution of forest resources with imported foods) have health implications. Future research should examine the implications of changing diets on the environment because changes in forest use might be changing forest stewardship and management of forest resources. Future research concerning longitudinal, anthropometric data could also offer information about long-term nutritional deficiencies across generations from changing diets in the region.

Keywords: West Africa, globalization, gender, political ecology, rural, gold mining, diet, nutrition transition, health, political ecology

©Copyright by Taylor Lucey
November 3, 2017
All Rights Reserved

A Political Ecology Lens for the Nutrition Transition in Rural, Kedougou, Senegal.

by
Taylor Lucey

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Science

Presented November 3, 2017
Commencement June 2018

Master of Science thesis of Taylor Lucey presented on November 3, 2017

APPROVED:

Major Professor, representing Forest Ecosystems and Society

Head of the department of Forest Ecosystems and Society

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Taylor Lucey, Author

ACKNOWLEDGEMENTS

I first must express thanks and appreciation for the community in which I served as a Peace Corps Volunteer. This research could not have been possible without the various members of Woulaba who helped me with my Pulaar language skills, introduced me to key informants in the region, and became my second family while I lived in Kedougou. I also want to thank Peace Corps Senegal for the cultural, technological, and language skills I gained during my service, especially Papis Ndione, my Pullo-Fuuta language teacher. I would also like to thank my Pulaar translator, Macire Diallo, who patiently helped me through challenging language hurdles as I made my way through translations. None of the interviews would have been possible without the support of my community and the supportive staff in Peace Corps Senegal. I would also like to thank every individual whom I encountered in Senegal who always offered nothing but peaceful words and hospitality during my time in-country.

I also want to thank my committee and my major advisors, Dr. John Bliss and Dr. Kerry Grimm who supported me across an ocean during my Peace Corps service. They offered me support while I was on OSU's campus before, during and after my service, which kept me connected to the OSU community. They helped me fulfill my research objectives, offered advice, and guidance throughout the writing and brainstorming processes. I would also like to thank Dr. Reem Hajjar who helped me work through NVivo so I could begin analyzing my data as well as Dr. Hannah Gosnell for her thoughts and feedback during committee meetings.

I would also like to thank the College of Forestry and Michele Justice in the International Programs Department at OSU for the teaching assistantships and graduate assistantships that made it possible for me to support myself while I attended classes and finished my research. I also want to thank Jessica Bagley in the College of Forestry who helped me stumble through paperwork and got me caught up in the Forest Ecosystems and Society Department when I returned home from Peace Corps.

I could not have done this research without the support of my colleagues at OSU, friends, Peace Corps friends, and my friends from home on the east coast. I would especially like to thank Ian-Huei Yau who also served in Peace Corps Senegal in the Kedougou region and helped make beautiful maps for my thesis. Thank you to my support network on both east and west coasts for not only helping me troubleshoot problems with my research, but for always exchanging excellent conversation and company during hikes, trail runs, mountain bike rides or over a beer.

Finally, I would like to thank my family who has always been supportive of my work and travel endeavors from my first volunteer research position in Indonesia as an undergraduate, to timber jobs in Alaska. Thank you for always being my fan club and offering me your unwavering love and support. I would especially like to thank my mom whose career as a writer has shaped my writing skills since I was young and is always a source of inspiration to me. Thank you for reading my thesis and giving me feedback, Mom!

CONTRIBUTION OF AUTHORS

Dr. John Bliss and Dr. Kerry Grimm provided extensive feedback and guidance on all sections of my thesis. They also provided me with advice and assistance while I was conducting research in the field. They shared suggestions and their personal experiences that aided me in executing my research methods.

TABLE OF CONTENTS

	<u>Page</u>
1 INTRODUCTION	1
2 Literature Review.....	8
2.1 Nutrition Transition	
2.2 Pulaar Identity in Kedouogu, Senegal	
2.3 Political Ecology	
3 Study Site	30
4 Methods	33
4.1 Participant Observation	
4.2 Key Informants & Participant Selection	
4.3 Interviews	
4.4 Analysis	
4.5 Limitations	
5 Results	42
5.1 Diets in Rural Kedougou	
5.2 Factors Influencing Change in Diet	
5.3 Perceived Health Implications of Change in Diet	
5.4 Gender	
5.5 Gold Mining	
5.6 Revisiting the 'Biocultural Model'	
6 Discussion.....	83
6.1 Pulaar History & Political Ecology	
6.2 Food Sovereignty & Globalization	
6.3 Political Ecology of Health	
6.4 Gold Mining	
7 Conclusion	102
8 BIBLIOGRAPHY.....	106

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
Figure 1. Map of the 14 Regions of Senegal & Bordering Countries.....	1
Figure 2. Pelto, Dufour, & Goodman's (2012) 'Biocultural Model'	23
Figure 3. Study Site Map.....	30
Figure 4. Adaptation of Pelto, Dufour, & Goodman's (2012) 'Biocultural Model'	80

LIST OF TABLES

<u>Table</u>	<u>Page</u>
Table 1. Informant details.....	38
Table 2. Food log results.....	47
Table 3. Forest species with nutritional and cultural value.....	48

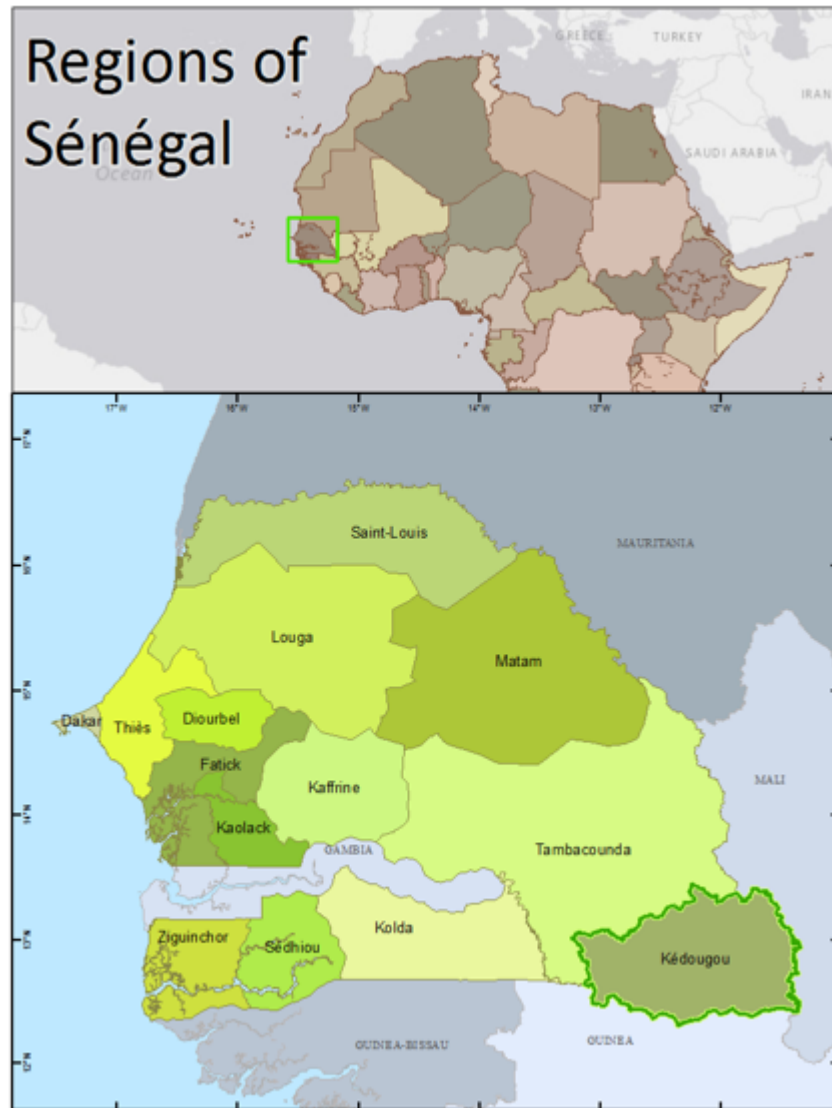


Figure 1. The 14 regions of Senegal and bordering countries.

1 INTRODUCTION

West Africa is a rapidly growing, but understudied region of the world (Rafei 2014). It is currently experiencing some of the largest rates of urbanization globally, with a projected two-thirds of the population living in urban areas by 2050 (Bosu 2015). Rapid urbanization and changing socioeconomic status (SES) are catalysts for

what is known as the nutrition transition. The nutrition transition takes place when these rapid changes lead to a sudden shift from low SES and high physical activity to high SES and low physical activity (Popkin 2002). The transition usually leads to declining consumption of ‘traditional,’ local foods and increasing consumption of ‘western,’ imported foods. During urbanization, local foods become more expensive than imported foods because they are less readily available in urban areas (Yates-Doerr 2015). This makes cheap, readily accessible, and non-perishable imports attractive substitutes. Urbanization also often shifts livelihoods away from the home and away from physically intensive labor such as subsistence farming. In many cases, this has resulted in eating at least one meal outside of the home every day, which are typically cheap, fast food and other pre-made high-cholesterol and high-sugar meals (Olayiwola, Soyibo, & Atinmo 2004; Yates-Doerr 2015).

Patterns of the nutrition transition in West Africa have revealed an increase in non-communicable diseases (NCD). NCDs are chronic illnesses that develop slowly over time such as hypertension, type 2 diabetes and obesity. West Africa has been facing rising rates of hypertension since 1980 (the highest globally), the highest projected increase of type 2 diabetes in the world, as well as increasing numbers of overweight children in the past 30 years (Bosu 2015; Naik & Kaneda 2015; Rafei 2014). Yates-Doerr (2015), who examined the ‘scarcity of micronutrients’ in post-war Guatemala, described the nutrition transition theory as a predictable pattern believed to be inevitable by the international scientific health community. While there is evidence

for the nutrition transition across the globe, Yates-Doerr (2015) claimed that it puts developing countries, which are assumed to still be in the earliest phases of the transition, in a more or less ‘permanent stage.’ If they are in a permanent stage, burdened with the earliest phases of the nutrition transition, then it assumes that later phases of the nutrition transition are inevitable for all countries following in the shadows of a rapidly globalizing world.

Bosu (2015) claimed that changes in trade policy or individual behavior are unlikely solutions to the nutrition transition because ‘transnational’ companies produce appealing calorie-dense, low-nutrient foods. Policies are particularly difficult to change in countries where demand is high for cheap, packaged calorie-dense foods and economic growth supersedes public sector goals such as education or healthcare (Omwami 2011). In Africa, these foods appeal to young children, require little preparation, and in some cases, are the largest corporations in the country (Olayiwola, Soyibo, & Atinmo 2004). Poor infrastructure, inefficient public transit, and lack of parks or other recreation facilities also contribute to low levels of physical activity in urban areas of West Africa (Olayiwola, Soyibo, & Atinmo 2004). Given these daunting facts, it might seem that the nutrition transition and its burden of NCDs are inevitable. There are, however, variations in the effects of the nutrition transition throughout a country due to disparities in SES, infrastructure, literacy, and health or nutrition programs. Factors such as residence (urban versus rural), gender, education level,

employment, and age are also determinants of the nutrition transition at the household level (Bosu 2015; Olayiwola, Soyibo, & Atinmo 2004).

While individual behaviors and variables may influence the rate of the nutrition transition at the household level, political ecology arguably sets the stage for greater, yet imperceptible influential variables. Political ecology examines the interconnectedness of political, social and economic forces that alter the physical environment (Basset 1994; Blaikie 1985; Fairhead & Leach 1998; Thone 1935; Wolf 1972). Political ecology is used throughout this study to discuss some of the underlying forces changing diet, human health and forest use in the study site.

Although political ecology factors may be different across the globe, the term is often most associated with power – which people and institutions have power over other groups of people (Peluso & Ribot 2003). The economic, social and political powers affecting an environment determine individuals' ability to access resources (Blaikie 1985; Peluso 1996). In Senegal, *accessibility* to markets, transportation, and functional infrastructure is extremely varied throughout the country. These variations contribute to individuals' ability to obtain employment, nutritional foods, education, and healthcare. The concept of 'access,' defined as “the *ability* to derive benefits from things,” (Peluso & Ribot 2003, p. 153), applies to factors influencing the varying stages of the nutrition transition throughout Senegal. This concept applies to this study because as individuals become more dependent on globalized food systems and imported, or 'delocalized foods,' they become less dependent on local forests for food

resources. As individuals become more dependent on delocalized foods, the ability to derive benefits from local natural resources is diminished (Buchmann, Prehsler, Harl, & Vogl 2010). Without access to free, local nutritional foods resources, development of undernutrition or overnutrition can occur (Richmond, Elliott, Matthews, & Elliott 2005).

Access to nutritional foods or knowledge about nutritional foods can have real health consequences across multiple generations. Keeping West Africa's emerging NCDs in mind, a new paradox known as the 'dual-burden' household has been found around the globe (Doak et al. 2005). Found primarily in low SES households, the 'dual-burden' or 'double-burden' household is one in which overweight and underweight individuals are in the same household (Doak et al 2005). This paradox can also exist within the same individual if they are overweight or obese. For example, an individual may become obese due to overconsumption of nutrient-poor foods such as white rice, corn, soda, etc. Typically, the dual-burden paradox is observed between an overnourished mother and malnourished child – a consequence of pairing overconsumption of nutrient-poor foods with little physical activity. There is a documented pattern of malnourished mothers raising undernourished children who then are at a higher risk for developing NCDs later in life (Mahajan et al. 2004). Unfortunately, this is barely scratching the surface of the development of obesity and other NCDs because as Yates-Doerr (2015) pointed out, being "overweight, rather than being *opposed* (italics added by author) to underweight, is proving to be a related form

of malnutrition” (p. 45). Women in urban areas, burdened with childcare and household work, are limited in their ability to be physically active, which might put them at greater risk to the dual-paradox and development of NCDs; this is particularly true in countries where it is culturally inappropriate for women to participate in physical activity. Women in rural areas, however, are burdened not only with childcare and household work, but maintain physical activity through farming, collecting firewood, carrying water from wells, and a host of other physically-demanding chores. Women living in environments where they no longer are required to participate in physically intense labor (such as the labor required for subsistence livelihoods), are at greater risk for the burden of chronic NCDs such as obesity (Ngianga-Bakwin & Stranges 2014).

Putting aside the complexities of addressing the burden of NCDs, the dual-burden household, therefore, presents an even more difficult challenge for policymakers. Health policies addressing specific NCDs or clinicians advising an obese individual in a household for example, risks ignoring the dual-burden paradox (Yates-Doerr 2015). There is a risk of unintentionally reducing available calories in a household for undernourished individuals while attempting to address an overweight individual (Doak et al. 2005). Furthermore, as mentioned above, an overweight individual may also be malnourished from overconsumption of low-quality foods, such as overconsumption of carbohydrates.

The case study described in this paper does not attempt to measure the nutrition transition that might be taking place in each region of Senegal, but presents a qualitative case study about changing diets and health implications in one rural region. Although there have been meta-analyses examining the nutrition transition in West Africa and Sub-Saharan Africa (e.g. Abrahams; Mchiza, & Steyn 2011; Buso 2015), qualitative case studies present a unique perspective on how the nutrition transition is affecting individuals and what is influencing behavior. Meta-analyses provide an important overview, but an initial one of the nutrition transition. They fail, however, to acknowledge the differences between regions or households of a country. This case study sheds light on the perceived factors influencing changes in diet, as well as perceived health consequences and causes of change.

While some meta-analyses examined the nutrition transition regionally and continentally (Abrahams Mchiza, & Steyn 2011; Ngianga-Bakwin & Stranges 2014), there is a knowledge gap in the specific sociopolitical factors that create regional and geographic differences in the nutrition transition. While this study does not attempt to examine the nutrition transition in each of the 14 regions of Senegal, it does examine the unique connection that the study site's population in Kedougou has to forest resources (with few forest use restrictions). These connections indicate that the Kedougou region might be experiencing the nutrition transition at a different rate than the national average, as presented by Abrahams, Mchiza, & Steyn (2011). I explore and discuss some the underlying political ecology factors at play, such as those mentioned

above: household scales (gender roles), regional scales (gold mining industry), and international scales (globalized, dependent food systems), which may be associated with the differences in the nutrition transition in Senegal. The research objectives were to: 1) describe changing diets in the Kedougou region, 2) explore why diets might be changing, and 3) investigate changing forest use and future health implications.

2 Literature Review

2.1 Nutrition Transition

More than three-quarters of the world's NCD-related deaths occur in low- to middle-income countries such as Senegal (WHO 2017). Although Omran (1971) was recognized as first to document an 'epidemiologic transition' in which NCDs were becoming more prevalent than communicable diseases, it was Popkin (2002) who created the five-phase 'nutrition transition.' In Popkin's (2002) five phases, he included not only the social and economic factors that can influence a country's ability to move rapidly from low SES to high SES, but the transition from low to high physical activity. The five phases of the nutrition transition included '1) collecting food (hunter-gatherer), 2) famine, 3) receding famine, 4) nutrition-related NCDs, and 5) behavior change' (Popkin 2002). These phases vary over time and space, but he claimed that food shortages have occurred in populations over time, 'stratifying populations.'

Populations that dominated food resources during a time of famine rose faster in SES than those that did not. Though this is a 'hypothesized famine,' based on archaeological evidence of diminishing stature in humans, Popkin (2002) claimed that

many regions of the world are still in this phase of the nutrition transition. Regions in the famine phase suffer from chronic famine and periods of food shortages. It is only at the end of the famine phase that social stratification occurs. In the third phase, nutritional food resources are reintroduced into diets and famine recedes. In the fourth stage, consumption of processed foods, saturated fats, and sugar takes place, leading to development of NCDs. In the fifth phase, behavioral changes occur due to education and leads to a healthier lifestyle.

2.1.1 Nutrition Transition in Senegal & Sub-Saharan Africa

To illustrate the nutrition transition, Abrahams, Mchiza, and Steyn (2011) analyzed data from 40 countries in Sub-Saharan Africa. They created a scoring system of zero to six based on the nutrition transition phases described by Popkin (2002). A score close to zero indicated that a country was in the famine phase. A score of six indicated that a country had a ‘western diet’ with a “high energy intake, low IMR [infant mortality rate], and stunting and a high prevalence of obesity” (Abrahams, Mchiza, and Steyn 2011, p. 3). Most of the countries (26 out of 40 total) in Sub-Saharan Africa scored either zero or one; meaning that they are in the famine phase of the nutrition transition. Abrahams, Mchiza, and Steyn (2011) found that infant mortality rate declined with exclusive breastfeeding and protein intake, and that the rate of undernourished children in Sub-Saharan Africa was still very high. The average rate of stunted children under-five was 39.7% and the average rate of children under-five who were underweight for their age was 21.1% (Abrahams, Mchiza, and Steyn

2011). They also found that the average mortality from NCDs was 826 per 100 000 and the average daily energy from protein was 9.8% (Abrahams, Mchiza, & Steyn 2011). Senegal was slightly better than the average and better than its neighboring countries Mali, Guinea, Gambia and Guinea-Bissau. In Senegal, 20.1% of children under-five were stunted, 14.5% children under-five were underweight for their age, and average daily energy from protein was 10% (Abrahams, Mchiza, and Steyn 2011). However, mortality from NCDs was slightly higher than the average with 852 per 100 000 (Abrahams, Mchiza, and Steyn 2011).

2.1.2 Malnutrition in Kedougou

Senegal scored a four on the nutrition transition scale, which put the country fifth out of all 40 Sub-Saharan Africa countries examined (Abrahams, Mchiza, and Steyn 2011). Scoring fifth indicated that Senegal was one of the farthest along in the phases of the nutrition transition. This revealed that Senegal has adopted one of the most ‘western diets,’ and therefore is more at-risk for developing NCDs. Senegal is among many countries in Sub-Saharan Africa that cumulatively produces more staple crops than ‘functional diversity’ foods (e.g. meat from livestock and vegetables), which is at least partially responsible for the lack of dietary diversity, low daily protein intake, and Senegal’s advanced phase of the nutrition transition (Remans et al. 2014). This could influence the overconsumption of nutrient-poor foods as mentioned earlier, putting Senegal at the forefront of NCD development.

Senegal's phase in the nutrition transition might be less clear, however, depending on regional variations. In Kedougou for example, health statistics show that communicable diseases and chronic malnutrition are still more prominent than NCDs, which could indicate a different phase of the nutrition transition than 'phase four,' as concluded by Abrahams, Mchiza, & Steyn (2011). In Kedougou, 32.4% of children under-five are stunted, 23.2% are underweight, and about 3.7% are overweight (WHO 2012).¹ This is a stark contrast from the country's capital, Dakar, where 5.7% children under-five are stunted, 7.7% children under-five are underweight, and 11.8% are overweight (WHO 2012). Kolda, a southern region in Senegal (south of the Gambia and west of the region of Kedougou; Figure 1), has a similar climate and forest cover as Kedougou. In Kolda, 34.7% of children under-five are stunted, 25% are underweight and 3.8% are overweight (WHO 2012). If the nutrition transition is taking place in Senegal, it is not revealing the same phases in every region across the country. Kedougou additionally has a maternal death rate of 921 per 100 000 live births, which is more than twice the national maternal death rate of 434 per 100 000 live births (ANSD 2013). Life expectancy is also almost ten years lower in Kedougou at 55 years, while the national average stands at 64.8 years old (ANSD 2013).

Despite Abrahams, Mchiza, and Steyn's (2011) conclusion that Senegal scored fifth out of the 40 countries in Sub-Saharan Africa they examined (one of the farthest

¹ WHO (2012) data is two and three standard deviations below the mean for underweight, stunting and wasting; overweight data is one to three standard deviations above the mean.

along in the nutrition transition), Kedougou may still be in the famine phase of Popkin's (2002) nutrition transition. While Senegal's national average might claim that 70% or more males and females are physically inactive, this is not true for the entire country, especially for regions where subsistence farming remains the primary livelihood (Naik & Kaneda 2015). Kedougou is far from the capital, ethnically diverse, remote, has few public services, and poor infrastructure. According to Birner and Resnick (2010), the remote, dispersed nature of small farmers, like the subsistence farmers in Kedougou, would make it more difficult for rural communities to band together and pursue common interests. Birner and Resnick (2010) found that due to small farmers' "limited access to education and communication and transportation infrastructure" (p. 1445), it is not only difficult for farmers to be heard in any policy or decision-making activities, but also makes them 'risk averse' when considering economic endeavors.

Due to differences and distances between farmers, they often make choices based on survival, not based on binding together with other remote communities to advocate for the development of the region (Birner & Resnick 2010). Some communities in Kedougou have also expressed frustration with the government's pursuit of its own agendas, rather than providing the region with developmental strategies, basic infrastructure and facilities, or jobs (USAID 2009). One of the government's agenda includes furthering development of the region's gold mining sector, which is discussed in more detail later.

2.2 Pulaar Identity in Kedouogu, Senegal

Diets of Pulaar people in southeastern Senegal are shaped by the physical environment, political ecology factors, and a host of other elements that are touched on in this study. One undisputed and important part of Pulaar history is that Pulaar people were originally migratory cattle-herders (Azarya & Eguchi 1993; de St Croix 1972; Gordon 2000). As herders, they were pagan or animistic; sedentarization was a result of Islamization and ultimately affected the economic, political and social structures of Pulaar life (Harnischfeger 2006; Shimada 1993). This social stratification of the estimated 12-25 million native Pulaar speakers in Africa occurred because of several Islamic wars (or *jihads*) (the first taking place around 1810 in Nigeria) and later colonization, but Pulaar identity was initially tied to cattle-herding (Shimada 1993; Simpson 2004). Wealth in Pulaar culture was determined by the number of heads of cattle that one owned.

There are varieties of the Pulaar language and different orthographic systems. Pulaar people can also be referred to as Fulbe (plural), Fulani, Haalapulaar, and Pullo (singular Pulaar person) in literature. There are also various spellings and dialects of the Pulaar language. There are low rates of Pulaar literacy and the Pulaar linguistic varieties are influenced by more dominant languages in regions where Pulaar-speakers are present. Pulaar speakers can be found across West Africa in countries including Senegal, Gambia, Guinea, Mali, Guinea-Bissau, Ghana, Nigeria, Niger, Cameroon, Sudan and Burkina Faso. The Pullo-Futa group in southeastern Senegal (Kedougou

region) is part of a larger region, majorly located in northern Guinea, known as the Futa-Djallon. Many of the individuals in the study site have relatives in the Futa-Djallon or are originally from Guinea; however, this study was only located in the Kedougou region of Senegal. Throughout this study the term ‘Pulaar’ is used to distinguish the Pullo-Futa people who live in the Kedougou region of Senegal.

It is important to review a brief history of Pulaar people in southern Senegal because they settled in various regions of the country for different political, social, and economic reasons, and differences exist between those in northern Senegal and southern Senegal, where Kedougou is located. Sedentarization either restricted or encouraged Pulaar peoples’ ability to farm, maintain livestock and pursue other livelihoods.

Although most Pulaar people claim pastoralist, cattle-herding roots, Pulaar groups in Senegal either became sedentary due to wealth or poverty (Azarya 1993; de St Croix 1972). Pulaar people in northern Senegal (Futa-Toro) settled with their accumulated wealth (herds and slaves) and hired out younger Pulaar people or other ‘*Maccube*’ (slaves) to care for their animals and work in their fields (Azarya 1993). This wealthier, settled group of Pulaar people then invested in politics, education and religious studies while poorer, settled Pulaar people in Kedougou owned very few heads of cattle and committed themselves to subsistence farming (Azarya 1993). Although both northern and southern Pulaar people would identify as Pulaar, Muslim, and Senegalese, it is difficult “to reconstruct ‘traditional’ Fulbe (Pulaar) identity, [and]

one must exhibit caution: Fulbe society and culture is and has always been dynamic,” (VerEecke 1993, p. 146).

For the context of this research, the history of the now settled Pulaar people in the Kedouogu region cannot be forgotten. Their sedentarization cannot be clumped in with the aristocratic Pulaar groups in northern Senegal nor elsewhere in West Africa. Although the Kedougou region is primarily Pulaar-speaking, many people are the former descendants of ‘*Maccube*’ (slaves) and settled due to poverty and persecution in neighboring countries, adopting the Pulaar language and culture along the way (Euguchi 1993; Harnischfeger 2006). Also important for the context of this study is the identity of Pulaar people as originally migratory, cattle-herders; cattle ownership and dairy products are still a large part of Pulaar identity for settled and migratory groups. Dairy products (and meat) provide a consistent source of protein for families who possess cattle. Cattle are also a sign of wealth and connected to the Pulaar identity. Pulaar identity and social organization play critical roles in individuals’ abilities to access nutritious foods, household distribution, and livestock care and management. This is touched on later in the results and discussion sections.

2.3 Political Ecology

As mentioned briefly above, the term ‘political ecology’ is one that is used to examine the political, social and economic forces on an environment. The field of political ecology continues to shift over space and time as more layers are added to the varying scales of power and control affecting access. Maintaining an understanding of political ecology as the economic, social, and political powers that affect the control of resources is an important aspect of this case study. Prior-, during-, and post-colonization, power dynamics have shifted *access* to natural resources, which have shaped diets, nutrition and the overall health of people in the region.

Political ecology is not a new term in literature, but it has arguably been developing arguably since the early twentieth century with Thone (1935). Thone (1935) was often referred to as the first person to make the connection between the environment and greater, external forces in what he called ‘the fight for grass.’ In the ‘fight for grass,’ Thone (1935) compared the fight for control of land between North American Tribes and European settlers to a fight for land use between migratory-herders and farmers in Mongolia. Almost forty years later, Wolf (1972) introduced the idea that power dynamics within individual households was just one power scale in a larger system, especially regarding decision-making. Wolf (1972) also criticized the structure of capitalism which he believed was designed to “strip the laborer of his means of production and to deny him access to the product of his labor” (p. 202). Wolf’s (1972) criticism applies to many contexts; however, in countries that were

colonized, there is a clear power disparity between institutions (colonizers) and producers (e.g. agriculture, manufacturing). A political ecology lens where natural resources are concerned exposes how power and control are shaping individual behavior, access to natural resources and the lasting effects on the physical landscape (Blaikie 1985).

Blaikie (1985) later made the connection between politically-, economically-, and socially-driven factors and soil destruction in developing countries with the term 'political economy.' He claimed that conservation of soil, as much as destruction, have become political agendas for groups who are usually physically removed from the affected areas of soil destruction (Blaikie 1985). He specifically pointed to government assistance programs that introduce new seed varieties, pesticides and fertilizers as the source of dramatically altering the soil after extensive use (Blaikie 1985). Government intervention in Blaikie's (1985) example can be seen as both the inflicted wound on soil and the bandage to heal it, "complet[ing] the vicious circle" (p. 3). Though the government's intention was to make the soil more productive, there is a clear power and control dynamic that government programs can have on the soil in a way that does not equal the effects that producers can have on the soil. Examples of governments' ability to control land and decision-making regarding access, are strongly apparent in land grabs experienced throughout East Africa, Kenya, and Madagascar (Obeng-Odoom 2015).

This study uses Peluso and Ribot's (2003) definition the term of 'access' as it relates to natural resources and how social networks operate to derive benefits from natural resources. Peluso and Ribot (2003) specified that 'access' is unequal and, "some people and institutions control resource access while others maintain their access *through* those who have control" (p. 154). Access, power and control of resources in the context of this study are interwoven with the nutrition transition because institutions are capable of distributing resources and how individuals access resources. Using a political ecology lens, one can understand the there is an overlap between the nutrition transition and how individuals gain access to health information and nutritious foods.

2.3.1 Political Ecology & Globalization

Globalization is a process by which people, ideas, and governments become integrated through international trade and investment, usually aided by technological advancements. If globalization is examined through a political ecology lens, it is where much of the control and power over resources exists. Corporations, politics, and other transnational organizations drive much of the globalized trade, demand, and markets. 'Globalization' in this study refers to the increased ease with which 'goods, services, technologies, capital, populations and knowledge' can be shared or traded internationally (Kennedy, Nantel & Shetty 2004). Globalization has provided both improved access to diverse foods to those who can afford it as well as unhealthy fast

foods (Kennedy, Nantel, & Shetty 2004; Olayiwola, Soyibo, & Atinmo 2004; Popkin 2002).

While there were histories of powers (e.g. ethnic, caste, and religious) prior to the sedentarization of Pulaar people in addition to French colonization, globalization added a whole new layer to power dynamics. Globalization removes power from areas of the world where people are most affected. This is in line with Blaikie's (1985) argument that destruction and repairs are thrust upon people and environments, which have no participation in the decision-making process. Furthermore, globalization encourages commodification of local foods (turning them into commercial, sellable and purchasable items) and delocalization of foods (consumption of imported foods, rather than local foods) eaten throughout the world (Kennedy, Nantel & Shetty 2004; Peltó & Peltó 1983). Historically, specialty items like tea, sugar and coffee that were the only delocalized items being traded internationally (Peltó & Peltó 1983). Advances in technology provide additional ways for individuals to be influenced by global trends.

Urbanization plays a role in both globalization of food systems and the nutrition transition. Increased urbanization pulls individuals away from rural, agricultural livelihoods (Peltó & Peltó 1983). Once individuals leave an environment in which food can be produced locally, food must be purchased or made with imported ingredients. Nigeria, for example, experienced a population increase as well as a rural to urban migration from 1980-2000 (Olayiwola, Soyibo, & Atinmo 2004), followed by a sharp rise in imported foods from 1998-2009 (Doak et al. 2005). Food prices also rose and

despite increases in domestic production, there was a need to import foods (Olayiwola, Soyibo, & Atinmo 2004). Urbanization, increased food imports, and a rise in food prices led Nigeria into a precarious dependency with global markets seated at the helm of food security.

The 2008 food crisis exposed the vulnerability of some countries to global, economic shifts. The crisis pushed some countries into food insecurity and malnutrition. A global, interdependent relationship is common for other African countries that struggle to produce enough food, leaving them more vulnerable to shocks during times of global economic and political shifts (Hadley & Crooks 2012; Olayiwola, Soyibo, and Atinmo 2004; Resnick 2013). In Cameroon, for example, urbanization and dependency on imported foods was a dangerous combination during the 2008 food crisis, which led to malnutrition in urban areas (Sneyd 2013). According to Sneyd (2013), rural people reverted to consuming many traditional, or 'wild foods' foods during the crisis; meanwhile, urbanites were forced to depend on whatever cheap, non-perishable imports were available. Rapid urbanization and insufficient domestic crop production also caused Senegal to suffer during the 2008 food crisis as well (Resnick 2013). According to Ba et al. (2009), Senegal imported almost two-thirds of its food resources and in less than a five-year period, 43 rice importers dropped to seven, only four of which controlled 63% of the total rice imports (Resnick 2013). Furthermore, during colonization, Senegalese farmers were encouraged by France to grow peanuts and export them back to France; in exchange, France began

importing white rice from Thailand and Vietnam which they sent to Senegal (Resnick 2013). Unfortunately, drought and changing international import policies in the 1980s, followed by Senegal's currency being devalued in the 1990s, pushed up the cost of white rice imports by 100% in Dakar (Resnick 2013).

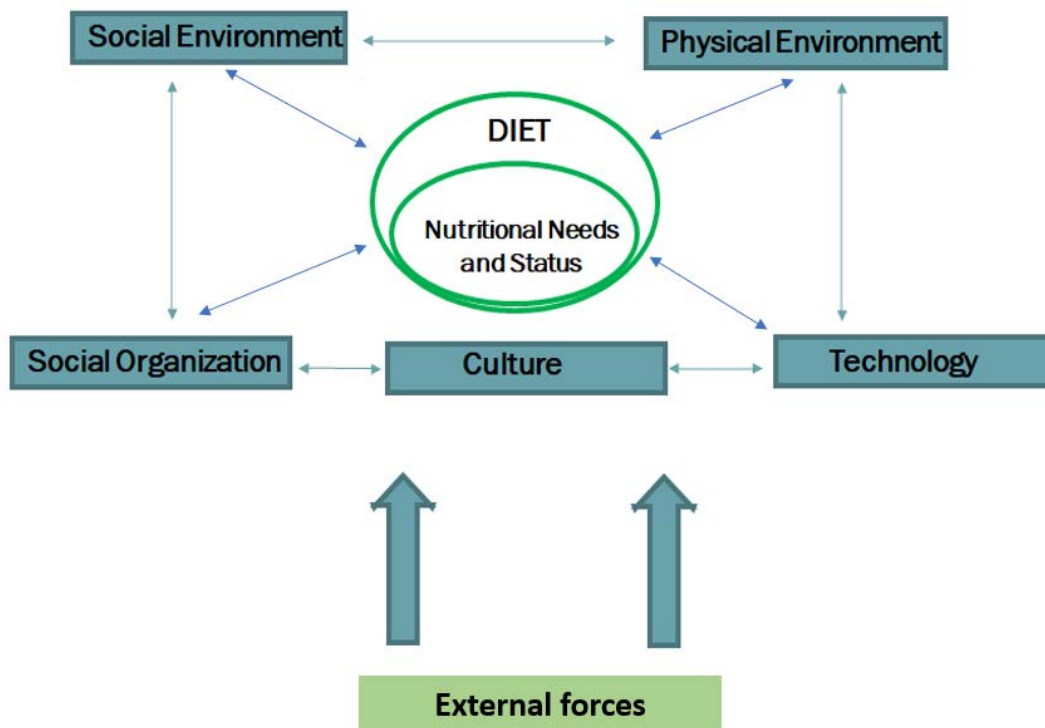
While the numbers in Senegal seem shocking, there was a similar trend in other places post-independence such as Ghana, Cote d'Ivoire, Nigeria and Kenya (Birner & Resnick 2010; Olayiwola, Soyibo & Atinmo 2004; Omwami 2011). Birner and Resnick (2010) found that most African countries discriminated against agriculture post-independence and favored import crops. Small agriculture and public-sector needs were ignored in favor of what was viewed as economy-boosting, large private farms that produced cash crops (Birner & Resnick 2010; Omwami 2011). This relationship encouraged exploitation of resources and a heavy focus on economic development, rather than education, infrastructure, or health. A globalized, dependent relationship with food systems serves as a reminder of political ecology power dynamics. The further removed individuals are from accessing or producing healthy, local foods, the less power they have over decision-making in their own diets.

2.3.2 Political Ecology & Health

Although there has been extensive research connecting political ecology to economics, the environment, human geography, and epidemiology, there is a knowledge gap between political ecology and health (Jackson & Neely 2015; Mayer 1996; Mayer 2000; Richmond et al. 2005). Mayer (1996) discussed political ecology's

influential role in “understand[ing] phenomena in their contexts” (p. 441), such as disease on a micro-level. There is evidence for the political ecology of diseases, but Mayer (1996) asked, relevant for this study, a question relevant to this study and for future studies looking more closely at the nutrition transition: ‘[I]s there a political ecology of health as well?’ Through examining factors that influence diet, there is a connection to health and nutrition. Taken from Pelto, Dufour, and Goodman (2012), the figure below (Figure 2) presents the ‘biocultural’ elements influencing diet, nutritional needs and status on an individual level. The elements in rectangles do not affect diet and nutrition in every environment equally, but they are present within most cultures. *Social environment* is the external environment at large (e.g. societal dynamics). *Social organization* encompasses societal norms at the household level, but also political and economic factors (e.g. gender roles related to accessing food). *Culture* includes ‘thoughts and ideologies’ related to food such as preferences and rules for food present at ceremonies (e.g. beliefs about what a pregnant woman can and cannot eat). *Technology* encompasses all of the tools and methods used in order to process, purchase, store and cook food. *Physical environment* is the one from which food resources are found or cultivated, including physical landscape barriers (e.g. climate and soil conditions).

Figure 2. Pelto, Dufour, and Goodman (2012) 'Biocultural' Model.



The outer cloud of 'external forces' includes the elements of globalization described above, as well as governmental and other institutional frameworks that encourage or prevent access to food resources (e.g. global food and oil prices). 'External forces' are not only current forces, but also the ripple effects felt from decisions made throughout history. For example, colonizers drew maps to benefit from natural resources and forever affected access to land and other resources (Basset 1994). Even prior to colonization, social stratification occurred within cultures, across ethnic groups, and caste systems, etc. (Azarya & Eguchi 1993). Colonization, however, shaped future agricultural policies, first to benefit colonizers and then to boost

economics and manipulated control and access of other natural resources (Omwami 2000). Other literature examining elements of the nutrition transition, such as NCD development or sedentary lifestyles have placed blame on the individual, as mentioned above by Yates-Doerr (2015) and Brewis (2011). When examining the nutrition transition, one cannot place blame on individual choices or lack of nutritional education; to do so would be to ignore history and political gains that shaped ecology, land use and ultimately the health of people in colonized countries.

The definitions of ‘food security’ and ‘food sovereignty’ combined with the term ‘access,’ are two themes present throughout this study; the interactions between these terms also tie together the political ecology and health lenses. The term ‘access,’ as it was defined above, relates to political ecology and is used throughout this study because it additionally determines an individual’s 1) ability to access land nutritional foods are grown, 2) ability to access nutritional foods at markets, and 3) ability to access education about nutritional food sources. Having the *power to access* food resources also belongs in the realm of ‘food security’ as well as ‘food sovereignty’ because they both require decision-making power. In other words, the power to make dietary decisions based on preference, nutritional content, cultural values, etc. and not simply based on availability or income. There are some key differences between ‘food security’ and ‘food sovereignty’ that should be explored before tying them into the context of this study.

The Food and Agriculture Organization of the United Nations' definition of food security: "Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life," (FAO 2002). Although the FAO (2002) 'food security' definition is used throughout this study, it does not completely fit the context in the Kedougou region, which is explained later in the results. The FAO (2002) food security definition is additionally flawed because it ignores the critical aspect of access in a globalized world, which is contingent upon the "social control of the food systems" (Patel 2009, p. 665). The term 'food sovereignty,' on the other hand, incorporates social control, which includes control over food and nutritional resources (Declaration of Nyeleni 2007). Food sovereignty also acknowledges the right to access culturally appropriate food, freedom from oppression and inequality (redefining control over food resources), and food resource sustainability for future generations (Declaration of Nyeleni 2007). The term 'food security' is used later, but it is defined in the context of this study, bringing together both the FAO (2002) definition and elements of 'food sovereignty' definitions from the Declaration of Nyeleni (2007) and Patel (2009).

'Social control' over food systems, as mentioned above by Patel (2009), is missing from the 'food security' definition and plays into the political ecology lens of health and nutrition. Social control implies a power dynamic that might determine an individuals' control over food resources and nutrition. Jackson and Neely (2015) and

Yates-Doerr (2015) both pointed to the ‘fatal ideology’ that all individuals have responsibility for their own bodies, which implies equal access to the necessary tools for healthy bodies. King (2010), among a long history of others, (Basset 1994; Blaikie 1985; Peluso & Ribot 2003; Wolf 1972), described how unequal access to land, natural resources, nutrition, and education are determined by varying scales of power. Yates-Doerr (2015) stated that the nutrition transition is assumed to be a global phenomenon, however, due to power dynamics may be unevenly *affecting* or *affected by* human geography, health, and access to natural resources in different contexts.

This case study is unique because it more closely examines the nutrition transition in rural, Kedougou, Senegal, through a political ecology lens. If some regions of Senegal are moving to a phase of the nutrition transition in which NCDs are becoming prevalent, then it could warrant a reassessment of future national health-planning. This could be pertinent if the nutrition transition is in different phases throughout the country, as mentioned previously. The research objectives address a ‘contemporary phenomenon’ (Yin 1984) – the Nutrition Transition – within the context of Kedougou, Senegal.

2.3.3 Political Ecology & Gender

Before moving on from the topic of political ecology, an investigation of political ecology and gender is necessary. Household and family roles are typically gendered in subsistence-farming communities (Rocheleau & Edmunds 1997). For example, men might be responsible for clearing and plowing fields, while women are

responsible for weeding, seeding and harvesting crops, as well as collecting non-timber forest products (e.g. bush fruits and tubers) (Schreckenberg 2004). Even though women are responsible for food collection and farming, they are seldom allowed to own land throughout Sahelian Africa, even when they are the primary users of trees (Kiptot & Franzel 2012; Rocheleau & Edmunds 1997). Women's access to land ownership and land management, therefore, is a subject determined by power dynamics. Because a woman's right to own or cultivate land is regulated by her husband or other males in her life, she is limited in terms of which crops she grows and does not have control over which trees her male counterpart decides to clear from a field (Schreckenberg 2004). Interestingly, households with higher incomes, urban households, or female-headed households, were found to have more nutritional diversity in Malawi; this finding concluded that female-headed households devoted more time to diverse agricultural systems (Jones, Shrinivas, & Bezner-Kerr 2014). This is pertinent when considering communities in this study because the households in which informants lived were primarily rural, subsisting on farming, and male-headed. In addition, households headed by multiple females were found to be more food secure than households with multiple males in Niger (Zakari, Ying, & Song 2014).

Even though female-headed households are more food secure or have been found to have more nutritional diversity in some cases, Detraz (2017) concluded that women are among 'marginalized' and 'discriminated' groups. Women in rural, farming communities in Africa are responsible for daily chores such as collecting firewood or

bush foods, which makes them more vulnerable to suffering from environmental change if resources are degraded from climate change (Detraz 2017). Women in Guinea and Kenya were also found to be discriminated against, regardless of education or participation in wage employment (Glick & Sahn 1997; Wanjala & Were 2009). Women's participation in decision-making, Detraz (2017) argued, is where gender 'intersects with power relations,' which is relevant to decisions made about the environment and policy. If women are institutionally, culturally, socially, and educationally discriminated against, it limits their ability to participate in decision-making. Those limitations constrain their ability to gain agency and advocate for resource issues and their advancement in society.

Colonial institutions further stratified gender roles in Africa (Omwami 2011; De Giusti 2016). For example, after Kenya's independence in 1963, students attending universities were pushed through the system more quickly to fill newly available government positions (Omwami 2000). Women were excluded entirely from education, just like any plans for public services, with the aim of working towards economic development (Omwami 2000). The effects of patriarchy in governmental and social institutions were compounded by the patriarchal culture present within the household, shaping gender attitudes and women's ability to enter labor markets or pursue education (De Giusti 2016). Non-governmental organizations and government programs aimed at addressing girls' and women's education have only been marginally

successful because programs are designed by an already biased, patriarchal system that was in place during and prior to colonization (De Giusti 2016; Omwami 2000).

Early marriage is another hurdle in some parts of Sub-Saharan Africa because it hinders on women's abilities to participate in education (Delprato, Akyeampong, Sabates, & Hernandez-Fernandez 2015). Delprato, Akeampong, Sabates & Hernandez-Fernandez (2015) found that poorer girls were the most likely to be married early and the least likely to continue school. Though the numbers are declining over time, 31.4% of girls ages 18-22 in Senegal were married as children (under 18 years old) (World Bank 2016). Girls' enrollment in 2012 for primary education was around 74% and around 27% for secondary education in Senegal (UNESCO 2012); however, 2014 data revealed that 51% of women have no education (WHO 2014).

Gender inequalities are not unique to Sub-Saharan Africa, however, the inequalities listed above greatly disadvantage women. Women's access to education is limited by social, political and economic institutions as well as social norms and hierarchies at home (Rocheleau & Edmunds 1997). Women's roles in the food security and nutritional diversity of their families is an important factor influencing health and nutrition in the study region (Jonas, Shrinivas, & Bezner-Kerr 2014). Women are charged with housework, raising children, and collecting foods for nutritional diversity, but using a political ecology lens, it becomes clear that they are marginalized within the strict confines of social barriers and all decision-making (including land use) falls on their husbands.

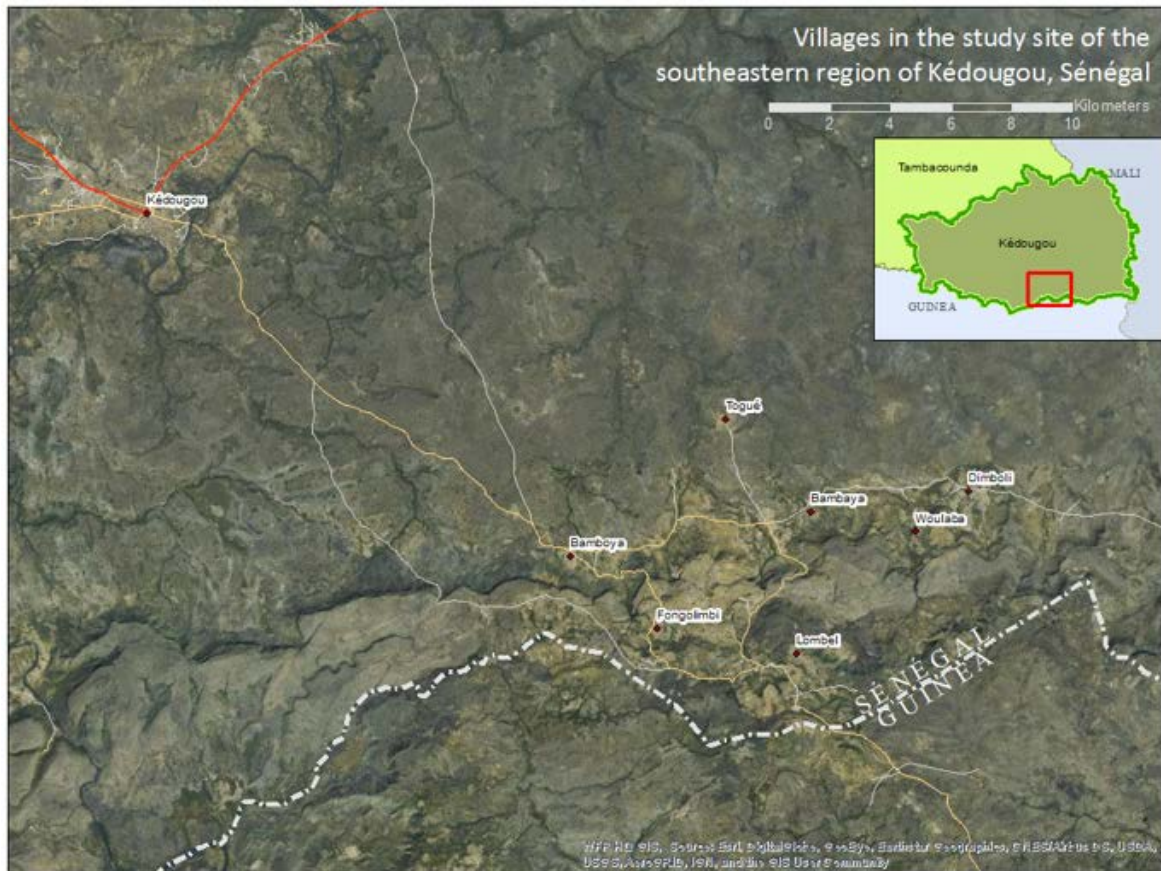


Figure 3. Study site map with village names in the southern Kedougou region.

3 Study Site

To address the research objectives above, I conducted research in the southern region of Kedougou, Senegal, where I was living at the time of the study. I chose the study site because at the time of the study, I was living and serving as a Peace Corps Volunteer in the region (December 2014–November 2016). The study site represents a unique perspective because despite the fact that most people still live rurally, extract food resources from the forest, and are subsistence farmers, they are still consuming imported foods. Examining changing diets in Kedougou region was additionally ideal

because the region is changing rapidly. Kedougou's population also doubled in the last two decades and has an expanding gold mining industry..

The region of Kedougou is in the southeastern corner of Senegal, bordering Guinea to the south and Mali to the east. The city of Kedougou is approximately 695 km southeast of Senegal's capital, Dakar, and 52 km south of the Niokolo-Koba National Park. Kedougou became its own region, encompassing 16,800 km² in 2008 with the small city of Kedougou as the capital. Approximately 37,000 people live in the city of Kedougou and about 150,000 people live in the region (ANSD 2013). Although the population has more than doubled since 1976, about 75% of the population still lives in rural areas; it also has the lowest immigration rate out of all the regions in Senegal (ANSD 2013). Kedougou city has an active, daily market where residents of rural villages come to buy, sell, transport and trade goods.

Multiple languages and ethnic groups are present in the region, including Pulaar, Bassari, Bedik, Dialonké, Mandinka, Bambara, Wolof, and Diaxanké. Kedougou is also commonly known as the Fouta-Djallon (also spelled Futa-Diallon), which incorporates northern Guinea and is dominated by Pulaar speakers. The region receives an influx of people during the dry season (October-May) from other West African countries, including Nigeria, Niger, Burkina Faso, Mali, Mauritania, Guinea, and Guinea-Bissau, who come to work in both large- and small-scale gold mines on the border of Mali.² Many of these temporary migrants return home during the rainy

² E.g. Sabodala Gold Mine, Teranga Gold Corporation. <http://www.terangagold.com>

season or work elsewhere because the mines are too dangerous (primarily because they are at risk for floods) and roads are difficult to cross when rivers and streams are too high.

The study site had some limitations that are expanded on later. One important limitation was the fact that many individuals in the region knew each other, were blood-relatives, or relatives by marriage. This could potentially influence informants' responses because of shared perspectives or cultural values. Shared culture, however, could also possibly be the reason for the theories derived from this study.

Circumstantially, informants might share experiences, values, culture, and beliefs, despite having some distance between villages. However, similar belief systems and cultural values could be advantageous for the study site because informants still lived in forest communities, primarily worked as subsistence farmers, and were experiencing changes in the region at a similar rate, as touched on above. Changes in the region could include dietary changes, technological changes, urbanization, improved infrastructure, the appearance of rural health clinics, and the expanding gold mining industry.

4 Methods

As I mentioned earlier, this case study examined the ‘contemporary phenomenon’ of the Nutrition Transition in a rural, West African context. To address the research objectives, I used in-depth interviews and participant observation. Conducting participant observation also contributed to snowball sampling and gaining the trust of community members, and key informants (Bernard 2011). I also maintained daily, detailed field notes in a journal at night and during the day, as I casually visited compounds and villages or when I conducted work-related trainings as part of my Peace Corps service.

I collected data from April 2016 through October 2016 to get a full range of meals eaten before, during and after rainy season. I interviewed individuals in the Pulaar-speaking city of Kedougou and seven rural, Pulaar-speaking villages, all of which were about 30 km southeast of Kedougou city: Woulaba, Togue, Bambaya, Bamboya, Dimboli, Lombel, and Fongolimbi (Figure 3). Ethnically, Bamboya, is split between Pulaar and Dialonké, however, all members of the community can speak Pulaar. Woulaba, Togue, Bambaya, Bamboya, Dimboli, and Lombel are rural villages with between 250 and 600 residents. Fongolimbi is a larger village on the border of Guinea and has a population of about 2,300; it has military posts, a weekly market, a forest service office and the mayor’s office.

I chose key informants based on work and personal relationships that I built during my Peace Corps service. I chose each rural village in the study site either because they had hosted a Peace Corps Volunteer in the past or they were hosting a Volunteer at the time of the study. During participant observation, I observed a trend in conversation about diets in the region: people in the study region were concerned about their changing diets and linked it to decline in their health. I formed semi-structured interviews for selected informants in the region, which are described in further detail below. The theories that emerged from these conversations and observations were grounded in the data (Glaser & Strauss 1967). Grounded theory was the best appropriate approach to forming research questions because most of the questions I asked developed from conversations I had with informants and during participant observation (Creswell 2007). Furthermore, my position as a Peace Corps Volunteer grounded me in the cultural context and aided in adapting research questions as information arose. All of the interviews followed a format in which I posed the same set of semi-structured questions, but as conversations took place, information arose that guided conversations. The following section describes aspects of the methods, research collection and analysis that I used to address the research objectives listed above.

4.1 Participant Observation

I used participant observation throughout the study to aid my understanding of social dynamics. As part of participant observation, I maintained a 60-day food log of all the meals I ate in the study region. I typically conducted participant observation

over shared meals or tea, and later used the information to form interview questions. I also used notes from participant observation to pre-test interview questions and to discuss contradictions between interviews and behavioral observations I made with key informants.

I maintained a personal food log of meals eaten with community members over a 60-day period in the study area. I recorded meals two to three times per day from June 2016 until mid-September 2016 to capture foods eaten during the month prior to the rainy season (early June), during the rainy season (late June through October) and after the rainy season when the annual harvest takes place (September through October). I used the log primarily as a reference tool for capturing meal preparations, ingredients, and availability of certain foods. I compared participants' responses about meals and ingredients from today and from their childhood, and then triangulated them with meals that I consumed in the study site to ensure that responses from informants were reliable. Although there is limited data about diets in Kedougou, I also compared my findings with peer-reviewed literature, examining diets in the region (de St. Croix 1972; Lestrangle 1977). A possible limitation of this study is that informants may have forgotten meals or specific foods that they ate as children or even the day of the interview. I used the food log, persistent observation, and other ethnographic studies such as Lestrangle (1977) and De St. Croix (1972) for triangulation purposes to minimize these possibilities (Lincoln & Guba 1985). Informants' contradictory

statements as well as contradictory observations are discussed later in the results section.

In addition, I took photographs of products sold in local markets referenced by participants and forest species. This included rural, weekly markets, as well as the daily market in Kedougou. When possible, I took photographs of food preparation methods and at large ceremonies such as weddings and naming ceremonies.

4.2 Key Informants & Participant Selection

During the time of the study, I was living with a host-family in the village of Woulaba. I slowly built personal relationships with people in Woulaba during village ceremonies such as weddings, naming ceremonies and religious gatherings. I also built work relationships through performing agroforestry trainings that I held as a Peace Corps Volunteer in the study site. Work and social relationships offered new opportunities for me to gain contacts in the region and helped identify key informants. Key informants were the main resources for snowball sampling, which is a qualitative research approach used to select study participants based on references or introductions provided by key informants (Bernard 2011).

Key informants also they offered advice and suggestions about cultural norms or who else might be interested in talking. I used snowball and purposive sampling for participant selection (Bernard 2011; Palinkas et al. 2016). Community members who were more familiar with Peace Corps or who had worked directly with Peace Corps Volunteers were more interested in participating.

I interviewed a total of 25 informants (12 males and 13 females); I conducted twelve one-on-one interviews and seven joint -interviews (Table 1). I interviewed informants in all eight study site villages with ages ranging from about 21- to 90-years old (Table 1). Most individuals in the Kedougou region, including informants, did not know their exact ages because culturally, people did not celebrate or keep track of

birthdays and most individuals did not possess identifications cards. The ages presented in Table 1 are based on informants' closest estimates of their own ages.

Table 1. Informant Details

Village Name	Joint Interview/ One-on-one	# Males/Females Interviewed	Approx. Age(s) ¹
Bambaya	0 / 1	1 / 0	65
Bamboya	0 / 2	0 / 2	60, 65
Dimboli	3 / 2	2 / 4	21, 35, 55, 60, 70, 80
Fongolimbi	0 / 1	0 / 1	70
Kedougou	1 / 0	2 / 0	50, 60
Lombel	2 / 0	2 / 2	45, 50, 60, 80
Togue	0 / 3	2 / 1	30, 40, 70
Woulaba	1 / 5	3 / 3	26, 45, 50, 55, 60, 100
Total	7 / 12	12 / 13	

¹ Informants estimated their age within a range of five to ten years.

To protect the identity of my informants, I did not include specific details about social status. Most individuals were familiar with each other because the villages in the study site are small, so I provide only general information about social status. All informants worked at least part of the year as subsistence farmers except for one individual who owned a small shop in Dimboli. One other informant from Togue was a community health worker, but also participated in subsistence farming with his family. Most of the female informants were involved in informal commerce activities such as selling bush fruits or garden vegetables. I also interviewed three village chiefs and one chief's wife.

As I stated above, most of the interviews I conducted were with informants whom I knew personally and with whom I had a relationship. An interviewer's tone of voice, presence, the order in which they ask questions, and a host of other minute

interactions that occur during an interview may influence how informants respond (Bernard 2011). Although these relationships helped me gain trust with informants, some biases existed due to the pre-existing nature of the relationships that I had with participating informants. This made it easier for some informants to open up to me, but also made it more difficult for me to access other informants with whom I did not spend an extended amount of social time, such as older men. Despite these biases during participant selection, availability and voluntariness of participants was an important aspect to purposive sampling (Bernard 2011). I typically chose participants based on their knowledge base, ability to communicate, availability and willingness to participate (Bernard 2011).

4.3 Interviews

As I mentioned above, key informants in Woulaba gradually led to the expansion of my social networks in all of the villages in the study site and aided in sampling for interviews. Before interviews or any audio-recording began, I approached village chiefs, key informants, elders and other important members of the communities in the area with details about the study to seek appropriate permissions. All interviews were either audio-recorded or conducted simultaneously with notetaking, with the permission of informants. I conducted interviews in locations where informants felt most comfortable. I encouraged communication in informants' personal huts for privacy, but due to cultural norms, men either asked their wife or another family member to sit in on the interview with them. To maintain cultural

norms, these situations led to joint-interviews in some cases. Occasionally, with male informants, we sat outside of their hut in their compound. I was typically invited to eat with informants in the middle of the interview and they usually preferred to take a break to eat, and then continue the conversation afterwards.

Interviews were designed to last about 45 minutes, but lasted anywhere from 30 – 90 minutes, depending on the informant. I reached saturation at 19 interviews as I mentioned above; saturation is a point in the research collection process in which no new information or themes are uncovered (Bernard 2011; Trotter II 2012). I asked informants questions about current and childhood meals and illnesses. As I mentioned before, I would typically approach a potential informant with the main research objectives and then inquire if they were willing to participate. If an informant agreed to participate, we would find a date and time for me to return and follow a set of semi-structured interview questions. I always started interviews with culturally appropriate Pulaar greetings and an explanation or re-explanation of what the interview was for and the types of questions that I wanted to ask. We also usually spent time discussing farming or other village activities before the interview began. After the first few questions, the conversations took on a casual form of their own, with the interview questions peppered throughout the conversation. I conducted the interviews in Pulaar, but transcribed the dialogue in English. A local, native Pulaar speaker who was also

fluent in English cross-checked the transcriptions to obtain the most accurate translations possible and ensure reliability (Kvale and Brinkmann 2009).³

4.4 Analysis

After I transcribed the interviews, I analyzed the data, grouping common themes that emerged (Kvale and Brinkmann 2009). I triangulated informants' responses with participant observation and peer-reviewed literature to avoid bias. I used QSR International's NVivo 11 for Windows to create and analyze themes. After I uploaded data into NVivo, I coded it, creating 'nodes' (themes) first, and then examined which were the most common themes across all interviews. These themes led to creating a code book, which gives a description of the theme, how common it was for all of the interviews, and example quotes that were coded with that theme. I also used NVivo for queries in which overlaying themes can be examined together. I triangulated data collected from participant observation (including the food log), interviews, and peer-reviewed literature to triangulate my findings with pre-existing findings.

4.5 Limitations

During participant observation, my role as a Peace Corps Volunteer additionally could have affected the data. For example, the food log data might be

³ A Pulaar-English dictionary administered by the Peace Corps was also used for reference. Bettison, J. and Bettison, K. (2005). *Pular-English Dictionary with English-Pular Index*, 2nd Ed. Pioneer Bible Translators: Conakry, Guinea.

skewed for two reasons 1) I gave my host family a small sum of money for food each month (20,000 CFA or about 40 USD, which is required by Peace Corps), and 2) I was usually treated as a special guest at other informants' homes. If people knew I was coming to spend the day with them, either casually or to do an interview, I would be offered 'better' or more expensive meals for lunch; this usually meant dishes that people thought I preferred, such as oil dishes with white rice. However, when I showed up unannounced at a compound in the study site, the dishes did not vary much from what I was eating in my host family's compound, which is primarily from where food log data came from.

5 Results

In Kedougou region, both men and women participate in subsistence farming, but only women are responsible for cooking meals. Informants often said that men's roles were supplying the grains for meals and women were responsible for making the meal taste good (providing ingredients for sauce). However, women are not only responsible for making the meal taste good, but for farming, harvesting grains, processing grains (with a mortar and pestle in rural areas), storing grains, as well as collecting and processing any leaves or vegetables that might accompany the meal. Gender roles make it difficult for women past the age of 13 to go to school regularly and make it extremely difficult for them to participate in any work beyond the home or selling bush fruits and leaves at local markets.

The differences in household roles affected the way both genders answered questions during interviews. Male informants claimed that diets changed because women stopped processing or collecting traditional Pulaar foods and consequently stopped cooking with them, which is expanded on further in the following sections. Women said that they needed money for everything now so they spent more time trying to earn it instead of trying to make traditional foods. They also claimed that even if they cooked with traditional foods, their families refused to eat what they had prepared because their children preferred imported substitutes. The following sections show the main dietary findings in the study site, what informants' felt was influencing the change in diet, and the perceived implications of that change.

5.1 Diets in Kedougou

The word '*Cosani*,' in Pulaar, can refer to hand-spun cotton fabric, dyed with indigo (*leppi*), specific meals, and many other aspects of Pulaar culture. '*Cosani*' can also be names of traditional or cultural Pulaar meals that people reported their parents ate during their childhood. I make the distinction for the term '*cosani*' because it is not exactly 'traditional' nor 'cultural,' but rather a combination of the two and it is intertwined with Pulaar identity – '*cosani*' foods were connected to Pulaar people's identity in the region. In this section, '*cosani*' foods are those that informants identified as traditionally or culturally Pulaar foods such as '*mbori*,' a corn porridge flavored with tamarind (*Tamarindus indica*), soured milk (*kossam*), and '*lecciri e haako*,' a corn couscous with leaf sauce.

Most of the female informants over the age of 40 knew how to make what they referred to as ‘*cosani*’ foods such as ‘*ojji*’ (smoked, fermented African locust bean seeds – *Parkia biglobosa*) and shea butter (*Vitellaria paradoxa*), the two most frequently mentioned ‘*cosani*’ foods lacking from current diets. Male informants over the age of 50 recalled their mothers gathering in village-wide groups to process grains and cook ‘*cosani*’ foods together.

In Kedougou, Pulaar culture, ‘*cosani*’ foods also can overlap with ‘*lekki bale*’ or literally, ‘black medicine’ (also called bush medicine). ‘*Lekki bale*’ incorporates medicinal treatments through verbal prayers to treat any manner of illnesses, including mental illness. The term ‘*cosani* medicine’ in this section distinguishes between ‘*lekki bale*’ and modern medicine (e.g. antibiotics, vaccinations, etc.). I only asked informants about ‘*cosani*’ medicines that referred to items collected from the bush such as bark, roots and leaves used to treat physical ailments. Although some informants did discuss treatments for mental illness, including prayers used to dispel genies (evil spirits), these were culturally taboo topics. ‘*Cosani*’ medicines throughout this study is used to identify treatments for physical illnesses, although there was usually always a prayer component to their use.

Informants consumed and cultivated specific tree and shrub species as a part of their regular diet, such as cassava leaves (*Manihot* spp.), but some species were only used for medicinal purposes such as neem (*Azadirachta indica*). Informants collected and processed other species, however, for both medicinal and dietary purposes, such as

baobab leaves (*Adansonia digita* L.), which were commonly used for most sauces. Buchmann, Prehsler, Harl & Vogl (2010) also found across eleven ethnic groups (included Pulaar) in West Africa, that 90% of people eat both baobab leaves and fruit daily. Some species served all three dietary, cultural, and medicinal purposes, such as shea butter (*Vitellaria paradoxa*). In literature, ‘*cosani*’ foods could also be categorized with ‘wild foods’ (Sneyd 2013) and non-timber forest products (Buchmann, Prehsler, Harl & Vogl 2010; Schreckenberg 2004).

Informants’ most commonly ate ‘*gossi*’ for breakfast, which is a white rice porridge, sweetened with white sugar. A white rice dish with hand-ground peanut butter, salt, baobab leaf powder, and bullion-seasoned sauce, ‘*marre maffe*’ or ‘*maffe tiga*,’ was usually on the menu for lunch. ‘*Marre maffe*’ is a national dish in Senegal, sold and eaten throughout the country. Dinner was usually ‘*lecciri e haako*,’ a corn couscous with leaf sauce, made with local leaves (e.g. cassava, amaranthus, and leptadenia leaves) baobab leaves, salt, and bouillon seasoning.

Although there is limited longitudinal data for the Kedougou region, an ethnographic study from the late 1970s compared Pulaar, Bassari, and Boin (a Bassari group that adopted Pulaar culture) diets in the Kedougou region, through several informants who maintained 12-month food logs (Lestrangle 1977). The total 168 recorded meals contained 58% rice, 35% millet/fonio/corn, and contained 4% potatoes (Lestrangle 1977). By comparison, the 60-day food log from this study, showed that meals contained 56% rice, 44% fonio/sorghum/corn, and 5% potatoes out of the total

171 recorded meals (Table 2). Lestrangle (1977) also interviewed 41 Pulaar women and found that ‘cow butter’ (or cow oil) and soured milk were added to the common rice and peanut sauce dish, ‘*marre maffe*,’ described above.

Although the current grain base I recorded from this study appeared to be very similar to meals eaten in the 1970’s in the region, corn became more popular and dairy was no longer a common addition to meals. Informants complained of the complete absence of dairy in meals. Counter to the 1970’s food log, my food log showed that 91% of the meals contained bouillon seasoning and 9% contained sugar (Table 2). Out of the total 171 meals (from the 60-day food log), only 12% contained dairy, 5% contained yams/tubers, .01% contained ‘*ojji*,’ and less than .01% contained shea butter. The most common, reoccurring ingredient that was always available rurally and present in all the savory dishes was bouillon seasoning, or ‘*Jumbo*⁴,’ as most informants referred to it.

⁴ ‘*Jumbo*’ is a common brand of bouillon seasoning, typically sold as a small cube, but it is how informants refer to almost all bouillon seasoning.

Table 2. 60-Day Food Log Results

Ingredients	Cosani food?	# Total Meals	% Total Meals
Rice	No	79	56
Corn	Yes	57	40
Fonio (<i>D. exilis</i>) or sorghum	Yes	5	4
Dairy	Yes	12	9
Leaf sauces	Yes	60	43
Bouillon seasoning	No	129	91
Sugar	No	12	9
Yams/tubers	Yes	7	5
<i>Ojji</i> (<i>P. biglobosa</i>)	Yes	2	.01
Shea butter (<i>V. paradoxa</i>)	Yes	1	<.01
Total meals		171	

Out of the total meals from the 60-day food log I maintained, 43% contained a variety or a combination of leaves for sauces, including Amaranth (*Amaranthus cruentus* L.), Leptadenia (*Leptadenia hastate*), moringa (*Moringa oleifera*), cassava (*Manihot* spp.), and baobab (*Adansonia digita* L.) leaves (Table 3). The most notable difference in diets from previous generations to the current generation was the addition of bouillon seasoning, cheap oils (i.e. vegetable and peanut oil), and white sugar.

Table 3. Forest species with nutritional and cultural ('cosani') value

'Cosani' Species	# Total Informants (%)
Shea (<i>V. paradoxa</i>)	23 (88)
African locust bean (<i>P. biglobosa</i>)	20 (77)
Moringa leaves (<i>M. oleifera</i>)	13 (50)
Wild tubers/ yams (<i>Dioscorea</i> spp.)	13 (50)
Baobab (<i>A. digita</i> L.)	12 (46)
Leptadenia leaves (<i>L. hastate</i>)	12 (46)
Amaranth leaves (<i>Amaranthus</i> spp.)	8 (31)

Although informants lamented the lack of 'cosani' foods, most of them described several of the 'cosani' foods as part of what they had eaten the day of the interview. I asked informants to describe the ingredients of the meals they ate the day of the interview and what they expected to eat during other meals, which included two of the 'cosani' meals, which were typically made with baobab leaves and other local leaves. All the informants' names have been changed to pseudonyms to protect their identity. Camara described below '*lecciri e haako*' and '*maare maffe*,' both of which were identified as 'cosani' by informants.

I ate corn couscous (*lacciri*) for breakfast... *Lacciri* is composed of peanuts, *Jumbo*, and onions. And leaves and beans [for the sauce] ... We usually eat rice with peanut sauce (*marre maffe*) for lunch. This has onion *Jumbo*, black pepper, cabbage, tomato [paste]... The women bring *Jumbo*, salt, onions; they buy it all [for sauce]. They don't collect ingredients for sauce. (Camara).

What is notable and consistent with the my 60-day food log above, however, is the presence of '*Jumbo*' in both 'cosani' meals and the delocalization of foods Camara ate. Camara said that the women 'bring' the ingredients, rather than 'collect' it, meaning that they purchased ingredients, rather than harvested them from the bush.

Informants often reported that in the past they ate more corn, sorghum, millet, and fonio (*Digitaria exilis* – an ancient grain native to West Africa), instead of white rice. They said that in the past, they only sweetened dishes with local honey, and flavored savory dishes with ‘*ojji*,’ salt, and local hot peppers. They also claimed that they ate more meat because they owned more livestock and slaughtered it in the village, rather than selling it for money. Food security was also more also precarious in the past, which informants, such as Keita, said pushed them to collect ‘*cosani*’ foods from the bush.

For farming [in the past], it was *fonio*, peanuts, corn, a little rice... You ate it all little by little.... You would hunt for antelope and bring back the meat to dry it out. If there was some leftover, you could sell it. After that, everything you ate was just what you farmed... If you farmed through the month of August and your crops weren’t ready yet, you were going to starve. So you ate leaves and roots of trees... fruits from the bush, bush meats, and honey (Keita).

Informants additionally said that they added dairy products to most of their meals, such as raw milk, soured milk, and ‘*neban nai*’ (cow’s oil⁵) in the past. During pregnancy and after giving birth, members of the village or relatives in nearby communities would offer women and their newborn babies fresh cow’s milk.

Informants of all ages said that they used preventative medicines in the past from various parts of local trees, because there was no health clinic. They said now that there was a hospital in the city of Kedougou and local health clinics, people no longer collected ‘*cosani*’ medicine.

⁵ Cow oil’ or ‘*neban nai*’ the layer of fat, used for as a cooking oil, that is scraped off the top of fermenting, raw cow’s milk – ‘cow oil’ was also mentioned in Lestrangle (1977).

The generation today is only eating what [tastes] delicious... They don't eat bark, they don't eat roots, they don't eat 'ojji.' They don't eat dried baobab leaves (*sule*), they don't eat anything. It's just oil...it's not shea butter. It's vegetable oil. Aside from [vegetable oil], there is the green tea brewed with white sugar (*ataya*). People in the past were eating honey and shea butter, bark, roots, tubers/yams (*kape*)... This is all health for the body (Souare).

The statement above, that the new generation eats 'nothing,' was one that rang true for most informants who felt that the food today lacked nutrients that 'cosani' foods contained. Informants believed that as people continued to deviate from 'cosani' foods, their health would suffer. Before delving into the implications of changing diets in the region, it is important to explain what informants perceived as the influential factors changing their diets. Understanding that diets are changing in the region is only the tip of the iceberg when examining the power relations that might be determining access to different food resources – local or imported.

Although most rural villages in the study site had very few televisions – the village of Woulaba, for example, had two televisions powered by solar panels that were charged with car batteries – it was common for people to get together and watch television. Soap operas filmed in large cities such as Dakar or other countries such as Spain, Brazil, and India were very popular. These shows often displayed wealthy, well-dressed actors eating white rice and oil dishes. Popular bouillon seasoning brands were advertised in drama shows, cooking programs, and as vital ingredients to meals. Female informants often said that if you didn't add bouillon seasoning such as 'Jumbo' to a meal, then their family wouldn't eat it or that if you cooked with 'Jumbo,' then you couldn't cook with 'ojji' because you got used the flavor. It is important to remember

while reading the following sections that '*Jumbo*' goes beyond mere popularity in West Africa and can be found in meals as commonly as one might find salt in the United States. Most informants believed that '*Jumbo*' was the source of many of the new illnesses people in the study site are facing today, but it remained strongly present throughout most meals.

5.2 Factors influencing change in diet

I asked informants a series of questions about what they thought was influencing the change in their diet and the most common responses were: technology, people refuse to eat '*cosani*,' access/availability, the current generation is the 'money generation,' government, and food security. Although I describe themes in order of salience, all the informants touched on multiple themes that had reoccurring political, social and economic undertones throughout the interviews.

5.2.1 Technology.

Technology, including mechanized farming equipment, herbicides, pesticides, gas-powered processing machines, and transportation, was the most salient theme reason informants provided for why diets had changed. Most informants said that mechanized farming equipment (including bicycles and vehicles) were not available until recently. Informants claimed that regular transportation between rural and urban communities only became available in the last decade. Improved farming equipment made it easier for people to cultivate more land. Chemical fertilizers, pesticides, and governmental seed programs changed seed preferences and farming methods. Grinding

machines were also offered to rural villages by government and non-governmental organizations throughout the region to more easily process grains and shea fruits for shea butter. Male informants complained that women could no longer process grains or shea by hand anymore, that they refused to, or that they didn't remember how; women who continued to process shea, preferred to sell it commercially. Transportation allowed people in the region to sell goods at farther distances, instead of selling or trading items locally.

The women today can't make [*ojji*, shea butter, cow oil]. They can't eat what we ate in the past. The body, if it isn't used to work, then they can't pound grains for the whole family to eat. If we have rice and corn, it's just the [grinding] machine that we use. They can't collect water from the river and carry it on their heads back to the compounds. (Tunkara).

With the addition of gas-powered grinding machines, two changes followed: 1) women could individually process more shea for profit and 2) women needed money for gas to power the machine. This altered social organization because women had a more individualistic, profitable way of turning '*cosani*' goods into commercial items. Better transportation such as a daily car, which began taking passengers between rural areas and Kedougou in the last decade, also allowed women to transport '*cosani*' foods (as well as non-native fruits such as mangoes – *Mangifera indica*), such as bush fruits, shea, and '*ojji*' more easily. Grinding machines led to more rapid commodification of shea and allowed women a new way to participate in commerce, but male informants complained that it led to a decline in local consumption of shea.

There's no shea... People stopped picking it. [People] don't suffer anymore. People are lazy; it takes too much time to prepare shea butter. They would rather get money and buy shea butter. If you have a rooster, you go and sell it and buy some shea butter (Koulibaly).

Informants claimed that people would rather make money and buy shea butter than make it by hand (if they have no grinding machine). If people did not have shea, informants said that those people would rather buy a fast, easy-to-use cooking oil such as vegetable or peanut oil. This was a common sentiment for all informants: that is was a 'them' and 'me' division. In reference to the culture and other Pulaar people, informants said 'they' (others) stopped or 'they' (others) refuse to eat it, but rarely did informants say 'we stopped' to include themselves in trends occurring.

Technology may have made farming less physically intensive for people (who could afford it), but it also changed the composition of fields. Shea and African locust bean trees (*Parkia biglobosa*), which normally were left alone in fields (Boffa 1999), were being removed in some cases, in favor of larger, tillable land that accommodates mechanized equipment. More intensive farming equipment coupled with a cultural norm that native trees such as shea and African locust bean are not seeded, puts the forest at risk for losing native species, despite their high local value (Kiptot & Franzel 2012). Although not a huge source of income for individual household's income (about 2.8% of the total income in Benin – another West African country), shea was found to be a valuable food source during food insecure times (Schreckenberg 2004).

Not all informants touched on the disappearance of ‘*cosani*’ trees, but some said that the trees were farther away or smaller. Given the use of chemical pesticides and fertilizers on rotating fields, regeneration could have been both slow and difficult. Many informants believed that the introduction of pesticides and fertilizers were changing the soil; they said now their crops would not grow without it. Some informants even expressed fear about what was happening to their bodies as a result of the chemical applications, because they saw how efficiently the chemicals killed weeds and insects. Tunkara felt that it was both the food and chemical applications on crops that were to blame.

What God gave us in this household here is chronic illnesses of small children... all the time they are sick, but it is the food... *jumbo*, *mami tomate*, *mami dore*, *adja* (bullion seasoning brands) ... The rice, we farm it to have a lot of it; we add chemicals and fertilizers. If you grow it or buy it, you are just eating all of those chemicals that are there. If you eat chemical products, you’re just going to get sick (Tunkara).

Advancements in transportation additionally took rural villagers to the urban area of Keodougou and beyond where popular foods (most notably vegetable oil and bouillon seasoning) seen on television were not only sold in small shops, but also advertised on bright, colorful billboards, shopping bags, clothing, and taxis. Kedougou transportation has allowed women to easily commodify ‘*cosani*’ foods and city ads encouraged people to purchase white rice, oil, and bouillon seasoning, leading to delocalization of foods in rural areas.

5.2.2 People refuse to eat '*cosani*.'

Technological advancements may have facilitated the narrowing availability of '*cosani*,' but informants also claimed that once people stopped eating it, they refused to eat it. Informants felt that people refused '*cosani*' because the newer foods were cheaper, easy to use, available, and accessible. They also felt that this was true for modern medicines – once vaccinations and antibiotics became available and people discovered they were successful, they refused to use '*cosani*' medicines. I asked informants why they thought people refused '*cosani*' and stopped collecting '*cosani*' medicines. Seck, an older woman from Bamboya, said that people topped '*cosani*' because they were encouraged to stop by the government. She then added that the immediate success of modern medications influenced people to stop as well.

We changed now. They said, 'change.' They brought medicine. They work. We didn't know surgery... [The people] got better, this is why we stopped our traditions. Let's follow what white people (*toubabs*) are doing (Seck).

Non-*cosani* medicine such as vaccinations, pills, and surgery were frequently referred to as '*toubab* medicine' or white person medicine. Seck was not the only one who felt that people stopped eating '*cosani*' foods or using '*cosani*' medicines because 'white person medicine' became available. This also highlights the globalization elements of available modern medicines in rural places. Older informants continually complained that if they offered their children '*cosani*' medicines or foods, children refused them.

He won't eat it! If you boil mango bark, and say, "Drink!" He'll say, "It's bitter, it's bitter! I don't drink that!" He'll refuse. You know *Tubaako* medicine (another word for white person), they say it is delicious. They'll drink that. Our bark is bitter (Seck).

Now that children attended school more regularly, they spent less time following their parents around, which meant spending less time learning what their parents learned as children. The knowledge that older generations had gathered from collecting and preparing '*cosani*' foods is no longer essential for the current generations' survival. Furthermore, now that there was a hospital, there was no need to learn about '*cosani*' medicines.

Everything we did and worked in the past, our children don't know...If this child (gestures) is sick and you make him bark, [people will] say, 'Take him to the hospital.' But our parents, we watched what they did. If the baby was sick, I would go and bring him a little [bark or roots] because my dad taught me... What we saw, they don't know (Seck).

Younger generations, on the other hand, felt that modern medicines were a better alternative. Kesso a young, rural health community worker from Togue, preferred modern medicine because it required prescribing a measured dose to treat an illness. Kesso and others said that if people treated themselves with '*cosani*' medicine, they would never remember how much they had taken or how long they should take something to treat themselves. He also stated that although it was common for people to drink steeped, '*kankeliba*' leaves (*Conbretum micranthum*) to lower their blood pressure, people now added powdered milk and several tablespoons of white sugar to it, negating the intended benefits. As people in the region have moved further away

from ‘*cosani*’ medicines, some informants felt that it was fear that caused people to refuse to use them.

Do you know ‘*boroboro*’ (*Amaranthus cruentus* L.)? We ate this as well, but children now, they refuse to eat it. They’re afraid of it, but if it’s rice and oil, or rice and peanut sauce, they’ll eat it. They’re afraid of *cosani* foods now... If they say tubers/yams bring illnesses, we don’t trust this because we didn’t get sick. If someone said, ‘Stop eating this,’ but you didn’t get sick from it, would you stop? (Nahaso).

When pushed further, Nahaso claimed that the fear of ‘*cosani*’ foods was based on unfamiliarity with the species. Other informants stated that if someone got sick today, people no longer said ‘take them to the shea trees’ anymore; the automatic reaction was to take someone to the rural clinic.

New, or ‘delicious foods’ such as white rice, oil, and bouillon seasoning easily replaced ‘*cosani*’ foods in the region, just as carefully measured, powerful modern medicines replaced unfamiliar, ‘*cosani*’ medicines. To ‘refuse’ eating ‘*cosani*’ foods and to replaced them with modern foods in rural Kedougou, has implications for household preferences, expectations, income, and Pulaar identity, which is explained later.

5.2.3 Access & availability.

Due primarily to technological advancements, informants perceived a change in access or availability of new foods and medicines in rural villages. They often commented that in the past, there was nowhere to buy food because no one was selling it or that even if it had been available to buy, no one had any money to buy it. I asked

Nene, an older woman living in Dimboli, where she bought her vegetables and ingredients for her sauces.

I pick baobab leaves and I pound it into [dried] powder. I give it to the children [to sell in Kedougou] and they buy me vegetables [such as] ‘*Jumbo*’, onion, bitter tomatoes (*Solanum aethiopicum*) (Nene).

Despite the cost of a bus ticket to the city, which was 2 000 CFA (4 USD) roundtrip from Dimboli, women like Nene (above) would rather spend the time to collect extra baobab leaves and sell them for profit to buy ‘new’ and ‘delicious’ foods. It was common for women in the area to collect local fruits and sell them in Kedougou, especially during hot season (February-May) when farming was not possible. Farming was not possible during these months because it is too hot and dry and even with irrigation in places where other people live along the Gambia River, the heat of the sun is too intense for most crops. Women sold buckets of mangoes, baobab leaves or fruit, tamarind fruits, and other bush fruits as they came into season to purchase grains in preparation for ‘starvation season.’ The starvation season is at the beginning and middle of rainy season (May-August); these months are most difficult because grains are not ready for harvest, but grain stores are diminishing.

My mom would sell mangoes [in Kedougou] and buy salt. Later on, she bought *Jumbo*. We stared at it and asked ‘What is this??’ My mom said, ‘It’s *Jumbo*!’ (she laughs)... I don’t like it! ... Yeah, I just put it in [the food], I’m used to it now. If you don’t put it in now, your food doesn’t taste good. Now your mouth is used to it... Now all the children are used to it. If you don’t add any, they say ‘This is gross!’ They say they won’t eat it because everyone is used to *Jumbo* now (Diallo).

Transportation provided a new potential for women to earn income, but it also pushed them to sell larger quantities of fruits to earn more money for the cost of

transporting buckets of goods as well as the price of a bus ticket. Diallo was among the few women in the study site who had a husband that earned a regular income as a mason. She reflected on her first time seeing '*Jumbo*,' when her mother brought it home from Kedougou after selling mangoes. Her mother, like all the older members of the communities in the study sites, used to walk to Kedougou to sell their goods.

Availability changed, even if access to transportation costed money. If women could not afford to buy '*Jumbo*' locally, it arrived via a daily car and was sold at one of the two local shops in Dimboli or in Fongolimbi. Some women or groups of women would sell bush fruits in Kedougou just to buy '*Jumbo*' in bulk and resell it in the village to make profit.

After accompanying my host-mother to the city to sell mangoes and speaking with women in the market, many women confessed that they barely made any profit with the additional costs of transportation. During mango season, the small market streets were flooded with colorful, plastic buckets overflowing with the sticky, orange fruits. I saw well-dressed people climb down from vehicles and haggle for several bulging buckets of fruit. The women said that these vehicles bought buckets of the fruits from them and then resold them in gold mining towns for even higher prices.

As women shoved their way into the crowded marketplace in Kedougou, they also made plans to buy large sacks of imported white rice, oil, dried fish, and other foods that they could not obtain in rural areas. Some men participated in selling fruits in the market as well, but they primarily sold charcoal, livestock, woven baskets made

with palm leaves, or hand-made bamboo furniture. Although most people were primarily subsistence farmers, the additional income allowed people in rural areas to more easily meet their needs during food insecure times prior to harvest season (September – October).

[E]verything we farm, we have a little. If we don't have it, and we have assets, we buy a cow or a goat. Or we buy peanuts if we don't have any peanuts. Or we buy corn if we don't have corn (Ba).

Informants claimed that some people did sell fruits, tubers and yams when their grain stores were low in the past, but there was very little to buy. Older informants frequently said that people used to walk very far distances because there were no bikes or cars and they carried their food with them if they traveled.

[Y]ou carried your food on your head. You carried... baobab leaf powder, hot pepper, vegetables, and corn. All of this you would carry on your head... They didn't *sell* it (food)! (Niang).

Although cheap, imported foods such as bouillon seasoning and white rice became available for sale in rural areas, the concept of 'access' was one that often arose from informants often mentioned. According to informants, access to education, trade, transportation and wage work improved. Transportation and improved infrastructure has now made it possible for people to regularly access markets, even if they must sell larger quantities of fruits and other rural products to afford ticket prices. Though the new foods listed throughout this study may have been available for a couple of decades, they weren't completely accessible to rural villages until there was

regular transportation and people had an easier way of commodifying rural products to sell for money.

5.2.4 The ‘money generation.’

Informants perceived a greater desire or need for money for many of the reasons listed above: to afford modern medicines, foods and clothes. Overall, informants said that in the past, there was ‘no money’ and that people didn’t know what it was. They also reported that everything was more expensive today than in the past. This theme is intertwined with the previous themes of technological advancements and access/availability. People had faster ways of farming or processing grains, but they also had to pay to use the new machines and purchase pesticides/herbicides. New products became available in the villages, such as ‘*Jumbo*,’ but access had only improved in that new products were affordable for both the sellers and the consumers. Baye lived in Lombel and worked daily in a community garden with other women, where they worked together to cultivate garden vegetables or fruits such as eggplant, cabbage, lettuce, papayas and bananas.

Our generation is the money generation (*Jamanu men woni jamanu kalisi*) ... The work is money work. If you work until you have your money, then your heart rests. If you don’t have it, you are running... No one sits; not a woman, not a man, not a child. Everyone is working for a salary, looking for money. A brand-new baby is looking for money. An old person is looking for money. Now is ‘*jamanu kalisi*’ [the money generation] (Baye).

The women in Lombel sold the fruits and vegetables at the weekly market in Fongolimbi (about 3 km away) or in Kedougou (about 35 km away) and added the earnings to a ‘money pot.’ On a rotating schedule, each woman from the village would

have control of the pot of money to make large purchases such as clothing or medical needs, similar to a rotating and credit savings and loan association (Dupas 2011).

While people worked primarily for subsistence when they were younger, they now worked to earn money.

Another example of '*cosani*' food that informants felt was missing from diets were dairy products. Informants mentioned soured cow's milk, raw milk and cow oil, as touched on briefly above. These were staple foods in Pulaar communities in the past and it was common for informants to complain that dairy was no longer available and had become inaccessible because it was too expensive now. Another informant in Lombel, Diop, complained that women no longer had time to milk or care for cows (as well as other livestock), because they preferred to make money from selling garden vegetables.

What made cow oil less available? Work changed. Early on, we had a lot of soured cow's milk (*kossam*) and a lot of oil... Now, the women work for the garden... Now you don't milk cows as often and '*kossam*' is expensive. Now you can't have '*kossam*.' It's changed forever (Diop).

While women primarily complained about needing money and never having enough for essentials, men complained about not having access to '*cosani*' foods, such as dairy. Diop firmly believed that since women stopped milking cows, less milk was available and resulted in it being too expensive. Other informants felt similarly; since women started working to earn money, they didn't have time to take care of livestock or milk cows. I heard women talk about how difficult it was to own and care for livestock, but they did not say they no longer had time to milk cows. Female

informants preferences to sell ‘*cosani*’ for money was a common complaint among male informants, especially regarding shea butter. Male nformants said that shea, like dairy, was also regularly available in the past because women gathered together to make it as a community as mentioned earlier; however, processing ‘*cosani*’ was now an individual activity that women did to earn money for their individual needs or their family’s needs.

5.2.5 Government.

Most informants were under the impression that new foods or other gifts (i.e. the plows and processing machines mentioned above) simply came from ‘the government.’ Informants had mixed feelings in the region about the roles government or other aid organizations played. Some informants thought grain seeds were different now and that ‘new’ seeds came from the government.

We have fast-growing seeds now. It was Senegal who brought it... It’s Senegal who brought rice (Nene).

The Kedougou region is in southern Senegal, on the border of Guinea and many people referred to all regions north of Kedougou as ‘Senegal.’ People in the region frequently referred to branches of the government, aid organizations, or development agencies simply as ‘Senegal’ or as just ‘the government.’ During my conversations with most informants, it became clear there was a distinct divide between people living in the region and aid or government agencies as outsiders, not unrelatable to people in the region. Even if the agencies had Senegalese staff or local staff who spoke Pulaar, people in the Kedougou region were aware of the differences in SES between

themselves and people who worked for the government. These differences were immediately apparent because government employees usually had a higher level of education, dressed differently, and traveled to rural places in private vehicles.

A common feeling among informants was that there was more ‘suffering’ in the past and that ‘peace’ is felt when they had enough to eat – this sentiment played into the overall theme of food security. While I sat with Tiam, an older woman from Togue, she explained that she was among a handful of children who were chosen to remember family lineages and prayers written on small pieces of paper, which were then braided into her hair. She said that one of those prayers was for a time of peace in Senegal. Peace is to [have enough to] eat. You see, the time has come now, the government is making money and giving out rice (Tiam).

Seck, an older woman who lived in Bamboya, blamed the declining consumption of bush meat directly on the government because the government ‘clings to the bush’ now, and hunting is illegal. When she was a child, she said that hunting was common, but that even seeing wild animals was rare now. A hunter in Dimboli, Diahkaby, said that the most noticeable changes to farming were government-sponsored trainings, free pesticides and donated plows. While he, among others, agreed that food security had improved because of the governmental gifts, he too was fearful of the government’s hold on the bush. In addition, hunters were discouraged from hunting due to health risks; when I arrived in Senegal in September 2014, there were

frequent radio and television warnings against eating bush meat because it might contain the Ebola virus.

Whether or not the government's role influenced dietary changes in the region, most informants believed that it affected their ability to access certain types of food. Some people believed that it was the government preventing them from hunting bush meat, while others felt that the government's gifts of rice or seed programs improved their diets greatly because it made them feel more food secure.

5.2.6 Food Security.

People in the region claimed that there was a change in food security, which affected their diet, either because of technological advancements, available foods for sale, 'wage work' or external aid. Informants claimed that they only ever relied on 'cosani' foods such as bush fruits, tubers/yams, 'ojji,' and leaf sauces because they had no other options during food insecure times (starvation season).

If all you did was farm, and you had nothing, you would go to the bush and dig up tubers/yams (*puri*) and put it on the fire... Tubers/yams were our savings accounts (Djitte).

Informants perceived that food security influenced a change in their diet. Informants repeatedly said that everyone 'suffered' more in the past, or that their parents suffered more than they did. They said their parents suffered more because everything was farther away (i.e. no transportation or roads), food insecurity meant collecting bush foods for survival, they processed all their food with a mortar and pestle, and they collected water from rivers and streams (i.e. no wells).

If your food ran out [in the past], the suffering started. Then it was just bush meat and digging up tubers/yams... Us, we grew up suffering. We farmed, ate, begged, brought back bush meat, picked leaves (Seck).

Food insecurity and suffering were common topics throughout all the interviews. Less suffering, as mentioned briefly above, was a product of becoming more food secure through stable means of acquiring grains (i.e. purchasing them or receiving them as a gift from the government). Although there was no term for ‘food security,’ I asked informants if they thought people in the past or today had more food to eat.

Today people have more to eat than they used to... There weren’t even any peanuts during rainy season [in the past]. [People] only ate baobab leaves. Now the people are ‘*patrons*’ (rich or wealthy person), people eat rice until they’re full. You won’t see anyone who doesn’t have peanuts (Diallo).

‘*Patrons*’ is a word attributed to a wealthy person, who typically doesn’t have to work too hard or suffer too much. Diallo, a younger woman in Woulaba, described the kinds of foods people ate in the past such as tubers/yams and corn bran. Like most of the informants, she claimed that during food insecure times, she and her family would collect leaves and frequently eat meals composed of just boiled leaves, ‘*ojji*,’ and hot peppers if they had them. Diallo said corn bran was regularly eaten in the past, which I saw fed to chickens or unceremoniously dumped on the ground after it was pounded into the more-preferred, evenly-textured couscous for ‘*lecciri*.’ She believed that now people always have enough rice and peanuts to eat.

The common belief that people always had enough to eat can be tied to the themes of money and access – people always have enough, if they could afford it. Although I did not directly ask informants about income during interviews, they did regularly purchase small, delocalized foods (e.g. those mentioned previously such as bouillon seasoning and cooking oil) This can also be tied to the theme of people ‘refusing *cosani*’ foods because there is now a preference for new foods – they are what wealthy people eat and they are more ‘delicious.’

5.3 Perceived health implications of changes in diet

The themes technology, refusal to eat ‘*cosani*,’ availability/access, the money generation, government, and food security are deeply connected to each other. These themes do not follow a linear pattern, but instead are affecting each community, household, and individual all at once on varying scales. From the perceived changes in diet, a feeling of distress was clear for informants because they felt that their health and the health of their children was suffering due to the change in diet.

Most informants brought up changing health resulting from the introduction of new foods to their diet. When I asked what they thought were the health implications were, informants responded that there are more or different illnesses today, there is more death (people are dying younger and more often), and that people are more tired and weaker than they used to be. Informants claimed that the health consequences were a result of 1) declining use of ‘*cosani*’ medicines, 2) using bouillon seasoning, 3)

eating food that is no longer healthy, 4) using vegetable oil, or other cheap oils, and 5) eating sugar.

Although there was a rural health clinic in both Dimboli and Fongolimbi, they could only treat minor injuries and diagnose some illnesses. The clinic in Dimboli was small and only had one trained nurse who did not maintain regular hours and often referred patients to a larger clinic in the city of Kedougou for further treatment. The limited staff, remote locations, and lack of transport made it difficult for informants to obtain proper treatment. Informants said that in the past, when there was no hospital, people collected bark, roots and leaves for preventative medicine. Shea (*Vitellaria paradoxa*) was one of the species commonly used for a range of illnesses and injuries – for everything from treating sore muscles to easing labor pains to sealing open wounds.

Most informants believed that ‘*cosani*’ medicines had essential ‘vitamins⁶,’ led to good health and built strong bodies. They believed that new foods broke down bodies and could not rebuild them after a person had suffered through an illness. Some informants went as far as claiming that the new foods would kill people.

It’s going to kill us... If you get *Jumbo* and *Doli*, you eat a lot of it, you die and you just don’t have strength ...Vegetable oil will give you diarrhea... People just pursue oil and the hospital now. It’s the hospital, cigarettes, and *Adja-Doree*. That’s what we pursue, I swear to God (Koulibaly).

That death would be the result of eating new foods was a common feeling for some of the informants. They felt that now that people could regularly access these

⁶ Informants used the French word for ‘vitamin’ or the Pulaar word, ‘*dolee*,’ which translates to strength.

new foods, they had no reason to stop eating them. Informants frequently contradicted themselves by claiming that they knew that the foods were not healthy for them and they knew that '*cosani*' foods were the answer, but they did not want to eat those foods anymore.

Ah! If we stop or don't stop [eating new foods], we die. If we stop, we survive and if we don't, we die... Even if we stop, we die, but our days are a little longer... People should stop eating [non-*cosani* foods] in order to live longer because no matter what you eat, you will die one day (Koulibaly).

Frequently, informants said that they couldn't stop eating the new foods now because they were used to them. One exasperated informant, Ba, exclaimed that the younger generations just didn't know that the '*cosani*' foods were just as delicious as the new foods and contained far more vitamins; however, he proceeded to sprinkle more '*Jumbo*' on his meal during our conversation. Other informants also claimed that they didn't get sick as often when they ate '*cosani*' foods or used '*cosani*' medicines.

If people cooked [in the past], they added '*ojji*.' If you eat '*ojji*,' you don't get sick very often. You could work well. Since it changed, since *Jumbo* got here, everyone has worse health (Baye).

Informants had conflicting views on the consequences of modern medicines and foods. Some claimed that '*cosani*' foods were the reason that older people were not plagued with the same illnesses that younger people suffered from such as cyclical diarrhea, hypertension, type 2 diabetes, obesity, or the reason that children are 'not growing anymore.' Other informants felt that people 'suffered less' than they did when they were children because they had more to eat now, but now the food was less healthy, which created a new kind of suffering.

There is more food today, but now the rice isn't healthy. Getting larger from eating the grains is not good (laughs). It's what gives [people] hypertension and why they cannot work for long periods of time... Now you'll find that a very young child is sick; they have hypertension, diabetes, or they'll work a little and they'll say, 'Woo! I'm tired!' In the past, children didn't get so tired. They would work all day and then they would go pass the evening somewhere or go work somewhere else. (Tunkara).

A new form of suffering was a common sentiment shared by informants: suffering no longer was being food insecure, but was a life of chronic illnesses, especially for children. There was a common belief that children were shorter and weaker than they used to be as well – as Ba mentioned above, when discussing how younger generations will go to climb a small tree and the trees will not bend under the people's weight. Tunkara (above) and his brother, Keita, lived in the city of Kedougou with their two families. Although the men were in their early fifties, they had seen rapid changes throughout their lives, including the first lightbulb that was installed in Kedougou. Tunkara and Keita's families had gone from subsistence farming as children in rural village in the region to traveling throughout Senegal and ultimately living in the city. They both knew how to use a computer and listed specifically which illnesses they thought were rising at a distressing rate, even if they too felt that food security had improved.

Younger informants felt differently than older informants about modern medicine replacing '*cosani*' medicine. Kesso, who was in his thirties and worked as a rural community health worker in Togue, believed that modern medicines were a positive thing. Kesso supported this by saying that now there were government-funded,

annual programs for free bed nets to prevent malaria and free malaria vaccinations for children under five. There were also suddenly other, desirable medicines such as antibiotics and acetaminophen that were not accessible to all individuals in the area because of the high price. People in the region heard about antibiotic ointment and other topical or oral treatments at the rural health clinic, but it was still common for people to leave infected wounds untreated for weeks or to never treat them at all because they could not afford the medications. Other individuals applied medications incorrectly or overdosed on malaria treatments because of miscommunications between the local doctor, who could not speak Pulaar, and patients who only spoke Pulaar.

While there were some disagreements between informants about the consequences of changing diets, they uniformly felt that the new foods – bouillon seasoning, oil, imported white rice, and sugar – are having negative health impacts in the area. There was also a feeling of helplessness among older informants who said they were obligated to eat the new foods because they were now in all the ceremonial dishes at weddings, naming ceremonies, and other rituals.

5.4 Gender

In addition to food security, gender was one of the most notable, yet often silent players in diet. Household roles in Senegal are gendered, which is common in most rural areas where subsistence livelihoods dominate (Rocheleau & Edmunds 1997). Although I did not directly ask informants about gender during interviews, participant observation uncovered cultural aspects about gender that determined access to food and

nutrition. Most female informants had about the same education level (none or a few years of primary school) and regardless of age or location, it was gender that played into social status and therefore access to food resources.

I don't have a husband (anymore). What can you have without a husband? It's your husband who will look for [meat] for you. Then it's your son, but my son is not healthy...We ate [meat] until we were full [in the past]. But my husband died, my child hadn't even grown up. Where can you have [meat]? (Kalsatou).

A woman's food and nutritional access are determined by her husband or other males in her life; men's roles in women's lives determined women's food security, which was linked to informants' diets and whether they ate '*cosani*' foods. It is among the woman's primary responsibilities to cook and collect '*cosani*' foods; however, it is her husband who is responsible for providing the means: money, livestock, or permission for her to work or to collect '*cosani*.'

Women's and men's roles are designated from birth and affects their ability to access nutritional, educational, and health resources. Prior to marriage, a woman is owned by her father or other male members of the family and after marriage, she is owned by her husband. Even if her husband dies, she is owned by the younger brother of her husband or must return home to be remarried. Women are always expected to cook and collect food for the children and males in her family. Men have the responsibility of farming, as mentioned above, but so do women, even if they are not expected to farm fields as large as their husband. Women are still expected to clear, seed, weed, and harvest land that their husband owns.

Female informants in the study site did not divulge their specific household duties, nor did they complain about them. As soon as girls could walk, they began helping their mothers with chores while boys played soccer and lounged, drinking tea during non-farming seasons. Male children were expected to attend school regularly, while it was acceptable for female children to miss school because they were needed for chores at home. Women learned these roles from young ages and knew what was expected of them. As mentioned above, male informants complained that it was their wives who had changed the family's diets and the reason that they no longer ate '*cosani*.'

All the children and the women here... they don't go to the fields, they don't farm, they don't milk cows, they don't go anywhere. All they do is cook... What has changed is that there is no *ojji*. [The women] are not buying *ojji*. It's *Jumbo* that they buy (Keita).

Because of the social norms that men and women are supposed to uphold in the region, women are blamed if there is something wrong with the food. Being a guest at someone's house entails eating a meal, receiving fruit, tea or water at the very least. If it is the woman's duty to cook for her family and her guests, then it is her failure if the food does not taste good or as it is expected to taste. Now that bouillon seasoning, oil, white rice, and sugary treats are advertised heavily as being a normal part of every good Senegalese home, it would be against cultural norms to not include these new foods.

Jumbo is really bad. If you put it into grains, you will say that it is meat. But if it's not cooked all the way, you will vomit until you die. Like I said, all the products

are really bad... But they can't [stop eating them] now. They can't. The people are damaged. You can't eat food without *Jumbo* in it now (Isimatou).

Heavy advertisement, improved transportation and communication made it possible for most people to afford and integrate new foods into their diets at home. Now that there is a preference for these foods and it is socially and culturally acceptable, they have spread farther as permanent staples, even in traditional dishes. Most informants in the region did not bring this topic up in detail, aside from brief comments that they always ate the same things daily; however, one informant angrily stated that everywhere he went in Senegal, the food was the same, people wanted to eat all the same foods, and women wanted to cook all the same foods.

From Dakar to here, people eat all the same things. If the people in Dakar say, 'eat oil,' then people here say, 'eat oil.' Here, we eat baobab leaf powder, leaves, but now we all eat oil for lunch. Maybe they'll eat a little tiny bit of leaf sauce in the afternoon and then oil at night (Koulibaly).

Because gender roles maintain part of social order and social expectations, changing diet is just one step towards shifting gender roles in the region. Improved access to roads and transportation has allowed women to participate in a larger cash economy; this alone has offered a new method for women to leave home, sell goods, and earn money on their own.

Gender may also present a double-edged sword for the development of the region. Men complain about the lack of '*cosani*' and that it is their wives' faults for not making them, but women are fulfilling roles that opened up for them with a change in diet. Women have access to new social networks and information sharing while they

are selling goods in the city. Information sharing has the potential to introduce women to culturally taboo topics in rural areas like family planning and birth control; furthermore, women can access more information about these topics in the city, where there are fewer prying eyes in rural areas. This new role as seller, offers them agency, autonomy, income, and an opportunity to leave their normally tightly-closed social networks.

5.5 Gold Mining

Gold mining was also responsible for some of the infrastructure changes occurring in the region, which in turn impacted health and nutrition. The topic of gold mining was another topic that also arose through participant observation, rather than during interviews. I did not specifically ask questions about gold mining in the region; however, gold mining did play a role in the region and was contributing to changing social, economic, and political institutions locally, regionally and nationally.

As I mentioned above, women in the Kedougou market said that the only groups of people who purchased large quantities of mangoes were third-party groups who bought bulk quantities of food and then transported them to the gold mines in the southeastern corner of Senegal. During early morning hours, women rushed into the crowded market from the daily, bush car to sell mangoes or other fruits to people headed to the gold mines. While selling mangoes with my host-family in the market, I observed these third-party groups headed to the gold mines; they purchased the highest quantity of mangoes at the highest prices. Women told me that the mangoes and other

foods that these groups purchased made their way to the mines and were resold for even higher prices. If women arrived late in the morning and missed these third-party vehicles, they would be stuck in the market all day and sometimes could not sell all the goods they brought. As I mentioned above, women must pay for their transportation fee as well as extra fees for each bucket of mangoes (or other baggage) so they invariably lose money if they are incapable of selling everything they brought to the market.

Oftentimes, during the drier months, I ran into abandoned compounds in the Kedougou region and would find out later that the male head of household had left for work in the gold mines, leaving his wife and children in the city or with other family members while he was away. If the head of household or other young, male members had left for the mines, then women had a harder time accessing resources. As I explained above, women's access to money and resources is through their husband and although men are responsible for providing money and sufficient grains for their families, this was not always the case during their absence. The absence of the head of household additionally made owning and caring for livestock, as well as preparing fields, more difficult for women. Women in the region may have gained more agency through selling fruits or other products from the bush, but the burden of caring for their families, affording clothes, purchasing obligatory gifts for community ceremonies, and healthcare also fell on their shoulders. The issues were that: 1) women lacked access to resources that their husbands normally provided and 2) women were faced with

breaking social norms of when providing for their families since it was culturally their husband's role. Financial responsibilities falling on women encouraged women to become more involved in local commerce to provide for themselves and their families. Continued involvement in commerce took up more time, but new products also became available that decreased cooking time (i.e. bouillon seasoning, vegetable oil, and white rice) than when women regularly had to make '*cosani*' foods.

Mining also has the potential to increase the gender divide in the region because it is culturally inappropriate for women to work in the gold mines. Gold mining may bring about social reorganization as young men take off for work in the gold mines and women are left at home to participate in commerce or farming on their own. Subsistence farming might not be a manageable livelihood with fewer members of the household available to participate in physical labor. If food produced from subsistence farming or collecting from forest resources are no longer the main sources contributing to diets, then health is subject to change.

Also distressing for rural villages were the occasional, desperate out-of-work gold miners who raided travelers on main roads during the rainy season. As I mentioned earlier, the gold mines cannot operate during the rainy season because of the risk of flooding and collapsing of the mines. Although there were no rumors of 'bandits' on the road with firearms, they were often reported living in temporary camps in the bush and carrying machetes. They robbed locals or other travelers on the road for cash or any other items of value. People in the study region casually said that during

the rainy season they would only take the car into the city and did not want to leave the village after dark because of these ‘bandits,’ even though they knew that the ‘bandits’ were just trying to feed themselves. People in the region also mentioned that most ‘bandits’ they encountered were not Senegalese, but from other parts of West Africa.

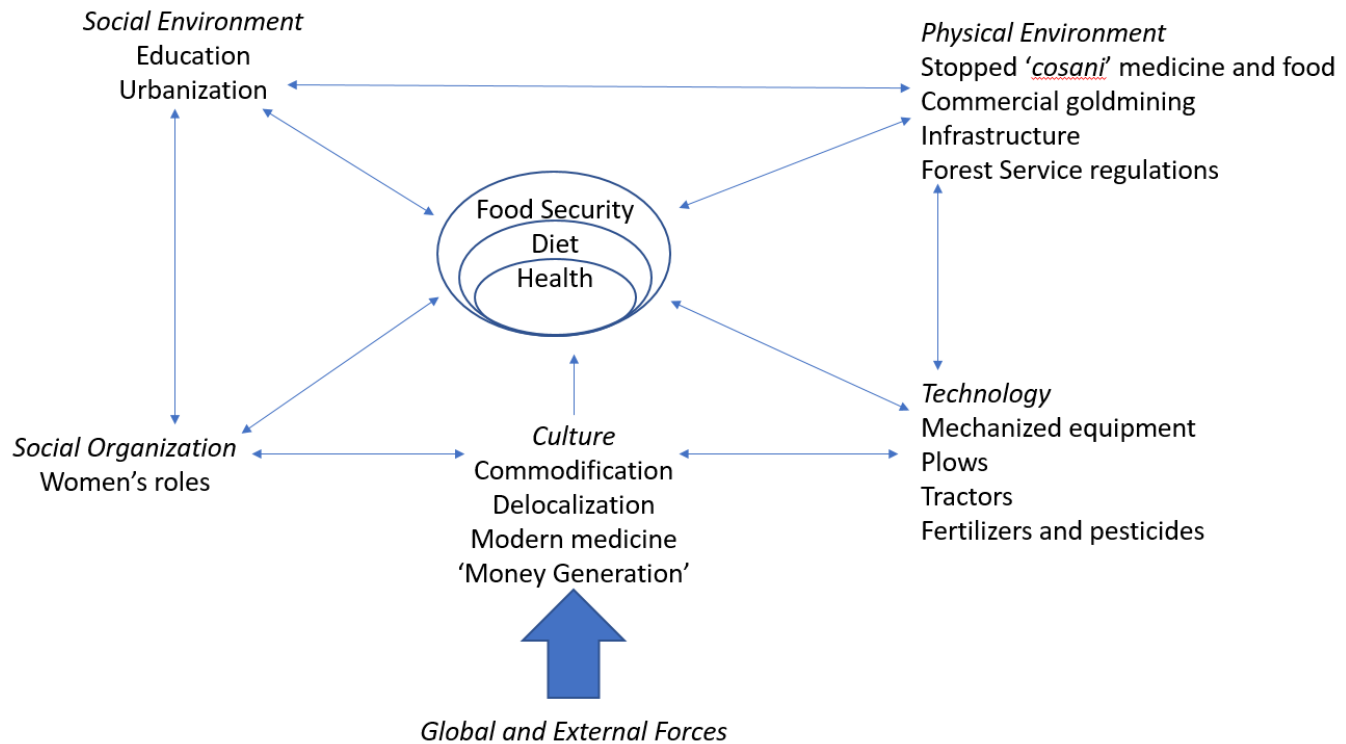
Although the bandits caused some concern on main roads, the overall development that gold mining companies brought to the region was thought to be positive. Some infrastructure improvements such as new roads and the appearance of new, air-conditioned buses purchased by international gold mining companies offered more efficient travel options. Roads to gold mining towns steadily improved and during the time of this study, a French bakery, owned and operated by another international gold mining company appeared in the middle of Kedougou, selling breads and creamy pastries. Although informants in the study region lived on the periphery of the gold mines, their livelihoods, diets, and health will likely continue to be shaped by the rapidly-growing industry around them.

5.6 Revisiting the ‘biocultural’ model

Revisiting the ‘biocultural’ figure puts the themes described above in context with diet. The themes outlined below are the themes that were discussed above in this section (results). The themes were taken from interviews and participant observation and placed into the figure; however, food security was added to the center of the figure, because of its role throughout conversations with informants. According to informants, food security was one of the main drivers of diet change in the Kedougou region. Once

people in the region were more food secure, they reduced their collection, consumption, and processing of ‘*cosani*’ foods and medicines. According to informants, food security improved, but it could be at the cost of losing free, local nutrition found in the bush, buried among ‘*cosani*’ foods (Honfo et al. 2014; Nyadanu et al. 2017). Modern medicines may have been effective, but they took away the pathway for younger generations to learn the importance of the forest the same way that their parents did. Broken down, FAO’s (2002) definition of food security would lead individuals to maintaining dietary needs and healthy bodies. Food security also affects diet for the reasons outlined above; informants said that they only collected ‘*cosani*’ foods because they *had* to for survival.

Figure 4. Theoretical model of changes in diet and health adapted from Pelto, Dufour, and Goodman (2012) for the study site. Italicized labels are the original labels from the figure (Figure 2).



Social Environment captures education and urbanization in the Kedougou region, both of which have the power to restructure the social environment. Children attended primary school more regularly in rural areas and young men yearned to move to cities where they could learn technical skills for wage work or they wanted to move to the growing gold mining shanty towns. Young men no longer see their futures strictly entrenched in agriculture and were leaving their communities for different and more lucrative opportunities, away from their villages. *Social Organization* was changing because shifting gender roles pushed both men and women to participate in

wage work and informal business endeavors in addition to subsistence farming. As mentioned above, cooking was faster and easier for women if they didn't have to spend labor-intensive hours hand-processing shea, grains, '*ojji*,' and other '*cosani*.' Instead, women could spend less time cooking with bouillon seasoning and oil. Any additional bush foods they collected could be sold for profit. In the Kedougou region, *Culture* was also changing because '*cosani*' foods are transitioning into commodities and foods eaten rurally were delocalized. The appearance of small shops and daily transit brought cheap, fast and modern foods to the doorsteps of rural villages. Rural health clinics brought skilled workers and basic, modern medicines with them as well. Availability of modern foods or medicines created a more urgent need for money, which made the new generation, the 'Money Generation.' Money's role in Kedougou culture has the power to change priorities, livelihoods, community expectations/roles, and overall ability to be food secure. While food security used to be determined by individual and community ability to collect and farm food, it was now also dependent on income.

Technology was the most common theme perceived as influencing diet, however, it is a broad term encompassing many innovations that could be influencing diets. Technology identified by informants primarily included plows, tractors, grinding machines, transportation, fertilizers and pesticides; however, cell phones, televisions, and radios were also mentioned by a few, older informants. Cell phones aided communication between buyers and sellers in nearby cities and rural communities. Televisions presented appealing advertisements of new foods and television shows

where well-dressed actors ate the kinds of foods wealthy individuals are perceived to eat (i.e. rice, oil and tea with sugar).

Physical Environment is also a large factor influencing diet, particularly for the subsistence farmers in the Kedougou region. Changing social environments and livelihoods are impacting relationships with the physical environment and forest use. People cultivated areas around their villages or the city of Kedougou, created backyard gardens, collected bush fruits, and maintained orchards of native and non-native cash-producing trees (e.g. mangoes, tamarind, pigeon pea, papaya, and sweetsop). Some tree species, like the ones informants mentioned, were still vital and used daily (Table 3). Baobab, for example, was used in almost every meal, as were a combination of leaves for leaf sauces poured over the corn couscous dish, '*lacciri e haako*.'

Although this study did not explore changes to the physical environment, the introduction of easy-to-use ingredients such as bouillon seasoning influenced women's need to produce '*ojji*' or shea butter for meals. Male informants complained that women were using the forest differently because they were selling what they collected, instead of serving it to their families. This was also said for dairy and livestock – people would rather sell livestock for money than eat it. The availability of modern medicine also influenced people in the region to stop using '*cosani*' medicines and result in commodification of '*cosani*' foods for cash to buy modern medicines from rural clinics. Both the discontinued, local use of '*cosani*' medicine and foods might contribute to a decline in forest use (and forest knowledge).

6 Discussion

The results showed that diets are changing in rural, Kedouogu Senegal. Informants in the region ate more imported products such as bouillon seasoning, cheap oil, and white sugar than they had in the past. Overall, informants said they ate fewer ‘*cosani*’ foods such as ‘*ojji*’ (fermented *Parkia biglobosa* seeds), shea butter (*Vitellaria paradoxa*), and dairy (soured cow’s milk, raw milk and cow oil). People also preferred modern medicine instead of ‘*cosani*’ medicine, despite the strong belief that people were healthier and stronger in the past when they consistently ate and drank local, preventative ‘*cosani*’ medicines. The following sections explore the main findings from the results more carefully, connecting them back to the global and political ecology contexts discussed in the literature review above. The first section, 6.1 Pulaar History & Political Ecology, examines the role that migratory Pulaar history had on health, when people in the study site became sedentary and access to resources was limited. The second section, 6.2 Food Sovereignty & Globalization, examines the role that globalization of food systems has on health; it also explores the finding that rather than limiting access, *increased* access to unhealthy foods has placed health burdens and risks on people in the study site.

6.1 Pulaar History & Political Ecology

Although it would be impossible to pinpoint the cause of nutritional deficiencies for every individual or even within the study site, there are some links between political, social and economic changes in history that open conversations

about the health implications that arose in the findings above. Using findings from this study, possible explanations of factors influencing diets and health are explained further, with a focus on a lack of protein. The first section discusses possible scales of political ecology within Pulaar people's history in the study site. This section shows how between limited access to cattle and a subsequent sedentary, agricultural lifestyle might have led to a decline in protein sources, which could be contributing to current-day health consequences. This section also explores the role globalization might have in changing people's relationships with cattle and dairy products.

6.1.1 No More Cows

One main finding was that diets changed in the region and that informants were concerned about the health consequences. Informants claimed that because of changing diets (i.e. eating new foods and declining consumption of '*cosani*' foods), people were weaker and more fatigued. Informants reported that people could no longer perform the physical labor necessary for farming or other household duties because they were now used to modern technologies (plows, grinding machines, etc.) and eating modern foods (bullion seasoning, cheap oils, etc.).

As mentioned in the literature review above, Pulaar people were historically migratory cattle herders. Pulaar people in the study site might have lost access to maintaining a migratory cattle-herding lifestyle due to Islamic wars, drought, disease that killed herds, or colonization (placed new borders and ownership on land, making it nearly impossible to maintain a migratory lifestyle); because of one or a combination

of these factors, herds shrank, people became sedentary, and began living as subsistence farmers in the Kedougou region (Euguchi 1993; Harnischfeger 2006; Shimada 1993; Simpson 2004). Similar resource and land conflicts can be seen across Africa and other parts of the world with migratory herders (Fratikin 1997; Morton 2010; Olaniyi 2015). This is not to say that every migratory group is the same, but as some groups became sedentary and others maintained migratory patterns, resource conflicts have arisen. Many of these resource conflicts arise between growing populations who are sedentary and migratory herding populations who require land and water for herders to maintain livestock.

As mentioned above in the literature review, because of Pulaar peoples' migratory cattle-herding past, dairy is an important part of Pulaar culture (Azarya & Eguchi 1993). Historically, men owned, raised, sold, slaughtered, and bought cattle, while women milked cattle (Azarya & Eguchi 1993; de St Croix 1972). The lack of dairy may have less to do with changing women's roles, like informants mentioned – that women no longer milked cows – and more to do with people becoming sedentary in southern Senegal because of political and ethnic conflicts in Guinea as well as other neighboring countries. As mentioned previously, many of the informants were originally from Guinea and still had relatives just over the border. During immigration to Senegal, the Guinean government enforced livestock taxes and Pulaar people additionally faced persecution from Guinea's 24-year dictator, Sekou Toure (Camara 2005; Fioratta 2017). These political factors could have influenced Pulaar people's

ability to own livestock or maintain large herds of cattle, if they were subjected to taxation or other restrictions. Loss of cattle and therefore a decline in dairy consumption might have influenced Pulaar identity and livelihoods. This might have also forced people to resort to subsistence agriculture livelihoods and a sedentary lifestyle. Although male informants tended to blame women in their villages for the not milking cows as the center of absent dairy, the start of the declining herds could have begun much earlier with political conflicts in Guinea.

While political and social shifts might have contributed to a loss of cattle in Pulaar people's history in the study site, health consequences could have also arisen. Lack of cattle could have contributed to the lack of meat from livestock and available dairy products. These dietary changes could have led to a decline in a historically essential and very accessible protein source. Furthermore, commodification of dairy or selling of livestock, as informants also mentioned, could explain the limited dairy consumption in my 60-day food log. Both Lestrangle (1977) and de St Croix (1972) described in detail Pulaar meals containing large quantities of dairy and sometimes dishes consisting only of dairy products. Without cattle as a source of protein, people might have turned to consuming more bush meat, but there are now restrictions placed on hunting (as mentioned by informants above), further limiting access to other, local protein sources. Limited access to a reliable, free or cheap protein source could have real health consequences, which are touched on later.

Scales of power such as political shifts (Guinean dictatorship) and social shifts (switching from migratory to sedentary livelihood) might have resulted in impacts on the local environment. Although these shifts might have occurred within the last two generations for people in the study site, the landscape has undergone changes from growing populations of sedentary peoples such as farming, forest stewardship, hunting, urbanization, and road construction as mentioned in the results above. This brings the conversation to the construction and availability of a few modern healthcare structures in the region and widespread consumption of imported foods. Given these changes to the region and the current diets, what might be happening to health in Kedougou?

6.1.2 Health Implications

It would be difficult if not impossible to identify the linear cause of changing health in the Kedougou region. As explained above, even the loss of cattle and subsequent sedentary lifestyle of people in the region might just be one factor that influenced changes in diet. Furthermore, it would be impossible to dissect the diet of every individual in the region to discover what might contributing to declining health. However, what can be examined are some of the power scales that have influenced and are influenced by the physical environment and how this might be connected to health. As mentioned previously, peer-reviewed literature has extensively examined geographies of disease and political ecology of epidemiology (Krieger 2001; Omran 1971). The connection between geographic and communicable diseases can be traced

through recorded cases, but the geographies of health and nutrition are a bit blurrier (Jackson & Neely 2015). There is evidence, however, that stunting is strongly associated with chronic malnutrition, which begins when a pregnant woman is malnourished and anemic (UNICEF 2013). Examining the health of an individual or a small social group contains complex factors that are still difficult to understand, such as the role of epigenetics across generations, which is explained later (Mahajan et al. 2004).

Using the loss of cattle from influential political and social power relations as the main example, the people of the Kedougou region could be at higher risk for anemia and chronic malnutrition from a lack of protein. Though there is limited data on the Kedougou region, according to the World Health Organization (2011), 79% of children under the age of five are anemic, 57% of non-pregnant women are anemic, and 65% of pregnant women are anemic in Senegal. An estimated 80% of children 6-59 months-old and 54% of women ages 15-49 are anemic in the Kedougou region (ANSD & ICF International 2012). Though epigenetics is a new field, there is strong evidence that malnourished mothers are at a high risk for producing children who have genetic predispositions to storing excess nutrients as adults, leading to obesity and other chronic illnesses (Mahajan et al. 2004). According to Mahajan et al. (2004), anemic, pregnant women are at risk for birthing children who will later develop a variety of chronic illnesses, such as higher risk of hypertension, heart disease, and diabetes. Unfortunately, due to cultural norms, women in the Kedougou region are the

least likely out of all the regions in Senegal to give birth with trained medical personnel present (ANSD & ICF International 2012). This could mean that if women are experiencing nutritional deficiencies or chronic illnesses themselves while pregnant, then they it is unlikely that would be diagnosed by a medical professional as well. The cultural norm of giving birth at home, medical costs of giving birth in a medical facility, and a husband's permission may further impede on a woman's opportunity to access health information. If undiagnosed, then women might also be unaware of the risk they might pass on to their children and the possible health complications they face themselves during pregnancy and while giving birth. These risks will be tied into the added health risks posed by consumption of popular, nutritionally-poor imported foods later.

Aside from cultural norms, other complications await women in rural areas who seek medical attention during pregnancy or when giving birth. Even if women sought medical help, they may not fully understand the diagnosis or be limited in terms of treating an illness, especially if it is a chronic illness associated with diet. Furthermore, women, who are less educated than men in Senegal, might be less familiar with French terminology for illnesses that doctors used to diagnose them. People in the study region frequently applied medications incorrectly or overdosed on malaria treatments because of miscommunications between the local doctor, who could not speak Pulaar, and patients who only spoke Pulaar. Furthermore, the top four causes of death in Senegal are still communicable diseases: lower respiratory infections (16.1%), malaria (8%),

diarrhea (6.1%), and preterm birth complications (4.5%) (WHO 2012); nutrient deficiencies, especially those associated with something as difficult to change as diet, may be the least of rural women's concerns.

Although most informants felt that there were more or different illnesses today, very few people specifically identified the NCDs. Instead, informants said there were 'more,' 'new' or 'different' illnesses that had not affected people in the past. However, diseases caused by high blood pressure or high blood glucose have also crept in among the top eight causes of death in the country: stroke (4.4%), ischemic heart disease (3.3%), and diabetes mellitus (3.1%) (WHO 2012). Some informants described swelling of the body or limbs as a symptom of 'new' illnesses affecting people today, which is a symptom of both high blood pressure and high blood sugar.

In 2008, an estimated 9.3% of men and 10.6% of women over the age of 25 had raised blood glucose, while 37.9% of men and 34.4% of women over the age of 25 had raised blood pressure in Senegal (WHO 2014). It comes as less of a shock that informants blamed the appearance of 'new' diseases on bouillon seasoning and sugar, particularly in a region of the country where bodies are already weakened from poor nutrition and communicable diseases, which still make up 57% of the total deaths in Senegal (WHO 2014). It is well-known that the nutritional deficiencies weaken bodies and are detrimental to the body's ability to fight other illnesses (Himmel-green, Romer-Daza, & Noble 2012). With the dual-burden of people facing overconsumption of nutrient-poor foods and deficiency of nutrient-rich foods, people likely will become

more susceptible to both chronic NCDs and common, communicable diseases (Doak et al. 2005). Despite these rising numbers in the last ten years, Senegal's Ministry of Health currently has no plan for monitoring or creating a plan to reduce the burden of budding NCDs (WHO 2014).

It is possible that the dual-burden is occurring in the study site. As described above, the dual-burden can exist in the same household in which there is one overweight individual and one underweight individual and is typically a mother and child. Several informants stated that their children were shorter and 'not growing.' Although national trends for stunting in children under five years old is the lowest it has been since 1990, stunting increased from 15.5% in 2012 to 19.4% in 2014 (WHO 2014). On average, children under five in rural areas are more stunted than urban and national children under five years old (ANSD & ICF 2012). Kedougou is faced with even higher rates of stunting with 39% of children under five years old moderately or severely stunted and an additional 21% of children under five years old are underweight for their age (ANSD & ICF 2012). Longitudinal anthropometric data for Kedougou is a challenge; until 2008, the region was part of the northern Tambacounda region so it's difficult to determine whether or not children are actually shorter. It is also possible that children are stunted in the region and is very likely associated with chronic malnutrition, as touched on above (UNICEF 2013). If this is the case, then the lack of iron from protein in diets during the past two generations, could have contributed to the chronic malnutrition and anemia among women and children.

Given women and children's higher risks for malnutrition and development of NCDs, there might be an unequal burden placed on them with changing diets. Gender roles pose an additional threat to women and children's health and access to nutrition and subsequent health. Women access most of their money and all their permissions through their husbands, and children access nutrition through their mothers who are responsible for cooking for them. Women and children therefore, are doubly burdened with unequal access to proper healthcare, education, medical treatment, and nutrition.

Kedougou is facing different health concerns than national averages, and most people in the region still participate in subsistence agriculture while living in forest communities, this could indicate that the level of access to health and nutrition resources is different as well. Though this study cannot speak for every region of Senegal, the results presented above open the conversation that the entire country of Senegal is in phase four of the nutrition transition. This is also an important lesson for examining the nutrition transition in other regions of the world: different levels of access, which influence political, economic and social power dynamics play roles in which phase of the transition different regions might be in. People living in rural areas still maintain high levels of physical activity and continue to eat some '*cosani*' dishes, even if imported products are added to them. Informants confessed that people 'should stop' eating new, imported foods, but as one informant stated, the result would only be to 'live a little longer,' and not enjoy 'delicious' foods. Regardless of the phase of the nutrition transition, Kedougou still lags behind other areas of Senegal in accessible

nutrition education and people in the region continue to suffer from undernutrition. Further complications could exist in the future if people continue to maintain high levels of physical activity *and* develop NCDs from poor nutrition when they are *already* susceptible to communicable diseases.

6.2 Food Sovereignty & Globalization

Globalization of food systems is becoming more common, reaching remote corners of the world. Despite the lack of cattle that Pulaar people are experiencing in the study site and the complaints about not consuming meat or dairy, Senegal is still consuming a large quantity of livestock products from global markets. The annual growth rate for dairy decreased from 1.5% (1980-1990) to 1% (1990-2000) and milk yields decreased from 350 kg/year in 1980 to 287 kg/year in 2002 (FAO 2005). However, milk consumption is about twice that of milk production in Senegal and although exportation of milk increased from 1980-2002 (68 to 11,011 metric tons), milk importation jumped from 87,083 metric tons to 127,904 metric tons during the same years to meet demand (FAO 2005). These numbers put Senegal in a negative net trade of milk as well as all its other livestock products, except for hides and skins (FAO 2005). Although these numbers are not specifically for the Kedougou region, there is significant international trading and globalization of dairy products occurring between Senegal and global markets. Senegal is consuming more dairy than it is producing, which is a dangerous position during a global crisis and makes markets more vulnerable to shocks and disturbances (Olayiwola, Soyibo, & Atinmo 2004). The lack

of dairy, as well as other nutritional foods, creates a reliance on inexpensive, calorie-dense, but nutritionally-poor foods such as white rice (Himmelgreen, Romero-Daza, & Noble 2012). Dairy may be an important aspect of Pulaar identity, but in a globalized world, it is becoming a bottled commodity, rather than a cultural expectation in rural, Pulaar villages. Globalization of food systems does not just push food systems into places of economic instability and vulnerability, but also creates substitutions for healthy, local foods that already exist. Female informants complained about not having enough money for all of the things that they now needed to buy, which included imported foods. Instead of spending time making ‘*ojji*’ and shea butter, they now sold bush fruits, garden vegetables or large quantities of ‘*cosani*’ foods to buy the new foods preferred by their families. Bullion seasoning substituted ‘*ojji*’ and vegetable oil substituted shea butter. Abandoning traditional foods for cheaper, faster foods to expedite cooking is not unique to Kedougou, nor to Senegal and has been observed in other parts of the world, particularly where shifting gender roles have taken place (Mahadevan, Blair & Raines 2014). In the Sierra’s of Ecuador, for example, Weismantel (1989) found that bread was a more desirable substitution than a traditional barley (*Hordeum vulgare* L.) gruel. Bread started out being a sweet gift in rural places, but as children’s preferences changed, arguments arose over the cost and the loss of a traditional food (Weismantel 1989). The homogenizing of diets in a globalized world has carried serious health and environmental consequences with it, as discussed in previous sections (Tilman & Clark 2014).

Although the term ‘food security’ was mentioned throughout this study, with specific meaning in the context of Kedougou, the more appropriate term is ‘food sovereignty,’ with some caveats. As mentioned in the literature review, food sovereignty acknowledges the role that “social control of the food systems” (Patel 2009, p. 665) plays, including control over nutritional resources (Declaration of Nyeleni 2007). Contextually, however, just like food security, all aspects of food sovereignty may not apply. Food security may not mention the social control at play with diets, but in the context of this study, rural people still maintain relative access to culturally appropriate food. There are still shea trees and women still know how to produce ‘*ojji*’ in rural areas, but the introduction of new foods and modern medicines have created desires for imported foods. Female informants and other individuals in the study site reported that even if they made ‘*cosani*’ foods, their family members refused to eat them because new foods were more ‘delicious.’

Maintaining some level of food sovereignty is made challenging when accessible, new foods become the cultural norm and also are fast, easy, convenient, and taste delicious.

Women and children are more at risk for chronic illnesses, as discussed in previous sections, but because of gender roles, their access to nutritional resources is limited. This is also true for land ownership and land management because access is granted through male counterparts. Because women are charged with the responsibility of collecting and processing ‘*cosani*’ foods, they are also most at-risk for losing their

access to forest resources. With changing preferences and homogenization of diets, access to the forest and forest use might be subjected to change.

Globalization of food systems and homogenization of diets explains some of the dietary change occurring in the Kedougou region, as it does in other areas of the world. Due to varying scales of political, social and economic influences, a phenomenon like the nutrition transition deserves further inspection through a political ecology lens. There is a history of peer-reviewed literature regarding geographic susceptibility to disease and epidemiology (Krieger 2001; Omran 1971); however, the surface of political ecology and health has barely been scratched. Not all individuals have equal access to information nor nutrition necessary to maintain healthy bodies (Jackson and Neely 2015; King 2010; Yates-Doerr 2015), causing some individuals to be disproportionately burdened with disease. Future health policies should take these access inadequacies into consideration when examining regions of the world where there are extreme differences in elements such as physical environment, social organization, and socioeconomic status.

6.4 Gold Mining

While the questions about upholding food sovereignty remain, and cultivating knowledge about nutritional, local foods among young generations lingers, the Kedougou region is experiencing some direct, regional changes that are influencing dietary changes in the region: gold mining. Gold mining presents a novel aspect of the Kedougou region in the context of Senegal because it is the only region where the

industry is located. The development changes that have occurred in the region because of the gold mining industry therefore are unique to Kedougou. The presence of international gold mining companies, however, serves as a direct connection to external forces, both economic and political, that are shaping the social atmosphere and physical environment of the region.

As mentioned above, commercial gold mines are adding new infrastructure to support mining activities as well as attracting people from other areas of West Africa who want to work in the mines. In an effort to grow Senegal's economy, President Macky Sall revised the 2003 mining code in 2016, allowing mining companies to own 100% of its shares, which attracted more foreign investors (Dorin & Welsh 2017; Fall 2015). Although artisanal gold mining has been in the area for some time and has taken its toll on the stability of the physical landscape, commercial gold mining is exploiting the physical landscape to new limits with the revised 2016 mining code (Dorin & Welsh 2017; Fall 2016). Commercial gold mining was designed to bring 'social funds, development, and jobs,' but has so far failed to address these needs and instead, has merely exacerbated the extreme differences between rich and poor in the region (USAID 2009).

Recent political changes made by the president to expand gold mining influenced economic and social scales on a regional scale. Mining has the potential to alter the environment through varying economic, social and political agendas. Blaikie (1985) pointed out that in lower SES countries, it is external powers and agencies

making land use decisions. In the case of gold mining in Kedougou, decisions about local land and resources in Kedougou are being made on national and international political scales without any direction from the people who will be or are most affected (Blaikie 1985). Given that Kedougou is already a struggling region with little political strength due to its distance from the capital, the rurality of its people, and differences in ethnic groups and languages, its residents may suffer from lack of access to political power dynamics in the gold mining industry.

USAID (2009) cautioned that Kedougou's remote location adds to its vulnerability to exploitation, instability, and potential for violent conflict because it is on the periphery of Senegal's national politics. By attracting foreign investors and building an economy based on resource exploitation, there is potential for expediting future land and resource conflicts between large businesses and rural populations (USAID 2009). Kedougou's position as a formerly colonized country in Africa is all too familiar if history is re-examined: individuals put in power, post-independence continued abusing power and exerted control while the people must access resources *through* that control, in the name of economic growth (Peluso & Robot 2003; Wolf 1972). Economic gains achieved from gold mining will also majorly be dependent on global prices, which puts the region in an unstable position if there are future political fluctuations (Pelto & Pelto 1983).

Development in the region and exposure to globalized new foods is unlikely to slow down given the mining code; however, caution should be given for the lack of

other services like health and nutritional services that are not yet accessible to all individuals in the region. Men and women are affected differently with the mining industry as well, as mentioned above; women's autonomy, education, and urbanization might be a double-edged sword because it might alter gender roles and cause social reorganization. Social reorganization in which men are leaving villages and women are burdened with more responsibilities could continue to push women away from '*cosani*' practices and into commerce, particularly if they still cannot participate in decision-making or own land. If men's roles shift away from agriculture, and they sell off land and livestock, then women are further limited in their access to trees, the bush, and creating gardens (Schreckenber 2004). This is a possible outcome with increasing rates of urbanization as well. There is an argument that the alternating, seasonal livelihoods of gold mining and agriculture do not impede one another's productivity (Persaud, Telmer, Costa, & Moore 2017), but it cannot be sustained if water and soil in the region are degraded beyond repair from mining activities.

6.3 Political Ecology of Health

Understanding the different scales of political ecology in a place can help determine the geography of health and nutritional status, which will undoubtedly be unique to each environment. In the Kedougou region, globalization of food systems and the external forces that have power within those systems (transnational corporations, political agendas and economic shifts) are at play more than informants directly stated. What is interesting in this assessment of access to forest resources that

could lead to nutritional resources, is that a globalized food system has the power to introduce as well as *restrict* individuals' access to foods, affecting their overall health. There might be higher food diversity in some places, but it may not mean that all individuals can afford the new foods and it begs the questions: how does food sovereignty play into diet and what are individuals trading or sacrificing to access imported foods? Food sovereignty plays into women's roles as the prime collectors of nutritional foods. Food sovereignty might become limited as women are encouraged to supply their families with the most popular, delicious, and culturally accepted foods. The barrage of advertisements encourage women to change their behaviors and growing local preferences for imported foods easily substitutes '*cosani*.' The sacrifice comes in the form of health consequences; this is particularly true when examining the unnecessary health burdens placed on women and children all over West Africa examined above. Informants may have a wealth of knowledge about the benefits of '*cosani*' foods, but this may not be true for their imported substitutes.

Informants believed that having 'enough food' (eating imported foods during food insecure times) and the use of modern medicines were not the best methods for achieving health in Kedougou. They most often felt that new foods were making people sick and that modern medicines did not completely get rid of illnesses; however, people continued eating new foods. People in the study region may not have had any control in the status of their food security, which is determined, in part, by the

government's power dynamics, decision-making, and ability to manage or distribute resources for communities (Peluso & Ribot 2003).

Women and children especially are targeted by transnational companies that persuasively advertise inadequate nutritional resources (Olayiwola, Soyibo, & Atinmo 2004). Advertisements for '*Jumbo*,' for example, pop up all over the market, on clothes, shopping bags, television, and radio commercials. Seeing advertisements depicting women cooking with either '*Jumbo*' or vegetable oil was almost inescapable. Some of the most popular brands of these foods were either made by Nestle or Chinese corporations that aimed to set up factories in the countries where demand was highest (e.g. '*Maggi*' brand bullion seasoning made by Nestle and '*Jumbo*' bullion seasoning made by Alibaba.com). Although bullion seasoning is substituting the '*cosani*' food '*ojji*,' there is no comparison for health value. '*Ojji*' contains high sources of protein, fat, fiber, and carbohydrates (Nyadanu et al. 2017), which cannot be substituted in a manufactured '*Jumbo*' cube. Even though most informants believed that they were straying from the healthy lifestyle that their parents and grandparents once led, they are at a complicated juncture – either they change their diets to avoid the imported foods that have become popular and well-integrated into national dishes, or they continue down a path of consuming micro-nutrient poor foods that will potentially deteriorate health (Pelto & Pelto 1983).

Improved food security in the Kedougou region also might not be as stable as informants perceived it to be. Senegal's relationship with imported dairy as described

above, is an example of this potentially unstable element of food security. Although informants reported not eating as much dairy, Senegal is still importing a growing quantity of it from global markets. Government agencies, non-government agencies, and other external forces determine the availability and accessibility of resources for people across the country and within the region. Access to the new foods, medicines, and technology are the result of the spreading effects of globalization. Foods that people now consume regularly such as imported white rice, green tea, vegetable oil, and white sugar, have a more serious impact on food security during shifts in global market prices (Mwaniki 2006; Olayiwola, Soyibo, & Atinmo 2004). Global prices that often change due to political shifts such as fuel prices required for transportation have a more widespread impact in a globalized world (Pelto & Pelto 1983). Consumers in some urban environments are dependent on imported foods, but they have less control over accessibility of those resources if they are processed, manufactured, or produced in another country (Blaikie 1985; Peluso 1996). Consumers are also subjected to global politics, which can threaten importation of foods or other goods such as foreign medical aid and supplies (Olayiwola, Soyibo, & Atinmo 2004).

7 Conclusion

It cannot be assumed that a country is in the same phase of the nutrition transition in all regions simultaneously. This study explored the nutrition transition and some of the scales of power influencing relative phases of the transition in Kedougou, Senegal. This study is not without its limitations, most of which were touched on

previously, in the methods section. A limitation for future research is that it would be difficult to repeat this study. Informants' responses to questions are subject to change over time and they may give different answers to another interviewer or researcher. However, thick description should increase the generalizability of the findings presented, which could be applied to other settings, contexts, or populations (Lincoln & Guba 1985).

Kedougou still faces chronic malnutrition and many communicable diseases so it may not be in the same phase as the rest of the country or the other regions. Residents of the Kedougou region continue to maintain active, physically-intensive agricultural livelihoods for most of the year. Informants may have expressed that they had 'more food' now than they had been in the past, expressing an improvement in being more food secure, but they said it was at the expense of losing '*cosani*' foods and medicines. The availability and accessibility of new, modern foods and medicine replaced '*cosnai*' in the region. The convenient, imported foods that substituted '*cosani*' generated fear and concern among older generations that there will be a loss of knowledge and loss of health among younger generations. Despite the fact the informants still regularly incorporated some '*cosani*' foods and medicines, they felt that there had been a noticeable decline in consumption.

Though there is a clear definition and five phases of the nutrition transition, that are presumed inevitable, this study has shown that the phases may be determined by political, economic and social power dynamics. Digging further, this study has also

demonstrated that when examining the nutrition transition or nutritional changes in a country, not all regions within a country can be lumped into one phase. The driving forces of dietary changes and the nutrition transition may be more fruitfully observed across political (e.g. colonization), , social (e.g. shifting gender roles) and economic (e.g. expanding gold mining industry) scales. None of these driving forces could have been observed directly from individuals' lack of physical activity or moving from low socioeconomic status to high socioeconomic status (Popkin's 2002) in the Kedougou region. Although this study is limited specifically to the Kedougou region when discussing the nutrition transition in Senegal, it expands the unique connection between political ecology and health. Regional disparities may continue with the growth of the gold mining industry. Disparities between genders, ethnic groups, rurality, age, food security and proximity to gold mines may shape the strength of the nutrition transition across regions of Senegal. In a broader context of political ecology and globalization, however, there is a silver lining: women are gaining access to participation in commerce in urban areas, allowing them to obtain some agency, independence and entry into new social circles where knowledge is exchanged.

This case study focused primarily on informants' perceptions of change and triangulated them with peer-reviewed literature, but longitudinal anthropometric and forest use data in the Kedougou region would be valuable additions to research, especially as the region continues to be shaped by urbanization and the gold mining industry. Long-term anthropometric data could serve as a tool to see trends of

children's health in the region. Forest data about canopy changes, species composition and land composition would additionally be useful for comparing changes in forest use in the region with ecological impacts. Though this case study represents a specific context and it has its limitations as noted previously, it serves as a unique connection between political ecology and health, highlighting the importance of food sovereignty for future conversations about resource management in transitioning forest communities. The qualitative nature of the research was critical to understanding the main elements influencing diet and therefore health, both directly, in more nuanced ways and on external scales of power relations. This study marks just one example of a political ecology of health, largely using the phenomenon of the nutrition transition to guide the discussion. More examples that demonstrate the power relations seen through the political ecology of health and nutrition lens in other contexts would be crucial to furthering some of the main findings from this study.

8 BIBLIOGRAPHY

- Abrahams, Z., Mchiza, Z., & Steyn, N. P. (2011). Diet and mortality in Sub-Saharan Africa: Stages in the nutrition transition. *BMC Public Health*, 11(801), 1-12.
- Azarya, V. (1993). Sedentarization and Ethnic Identity among the Fulbe: A Comparative View. In P. K. Eguchi & V. Azarya (Eds.), *Unity and Diversity of a People: The Search for Fulbe Identity* (pp. 35-60). Osaka, Japan: Senri Ethnological Studies.
- Azarya, V., Eguchi, P. K., & VerEecke, C. (1993). Introduction. In P. K. Eguchi & V. Azarya (Eds.), *Unity and Diversity of a People: The Search for Fulbe Identity* (pp. 1-9). Osaka, Japan: Senri Ethnological Studies.
- Ba, C. O., Diagna, B., Dièye P. N., Hathie, I., & Niang, M. (2009). *Changements Structurels des Economies Rurales dans la Mondialisation: Programme Rural Struc-Phase II*. Washington, DC: World Bank.
- Basset, T. J. (1994). Cartography and Empire Building in Nineteenth-Century West Africa. *American Geographical Society*, 84(3), 316-335.
- Bernard, H.R. (2011). *Research Methods in Anthropology: Qualitative and Quantitative Approaches 5th Edition*. Lanham, MD: Rowman & Littlefield Publications, Inc.
- Boffa, J. -M. (1999). Agroforestry parklands in sub-Saharan Africa. *FAO Conservation Guide* 34. FAO, Rome. Retrieved from <http://www.fao.org/docrep/005/x3940e/x3940e00.htm> Web 5 March 2017.
- Bosu, W. K. (2015). An overview of the nutrition transition in West Africa: implications for non-communicable diseases. *Proceedings of the nutrition society*, 74, 466-477.
- Birner, R. & Resnick, D. (2010). The Political Economy of Policies for Smallholder Agriculture. *World Development*, 38(10), 1442-1452.
- Brewis, A. A. (2011). *Obesity: Cultural and Biocultural Perspectives*. New Jersey: Rutgers University Press.
- Buchmann, C. Prehler, S., Harl, A. Vogl, C. R. (2010). The Importance of Baobab (*Adansonia digita* L.) in Rural West African Subsistence - Suggestion of a Cautionary Approach to International Market Export of Baobab Fruits. *Ecology of Food and Nutrition*, 49, 145-172.
-

- Caballero, B. and Popkin, B. M. (2002). Introduction. In Eds. B. Caballero & B. M. Popkin, *The Nutrition Transition: Diet and Disease in the Developing World* (pp. 1-5). San Diego, CA: Academic Press.
- Camara, M. S. (2005). *His Master's Voice: Mass Communication and Single-party Politics in Guinea under Sékou Touré*. Trenton, NJ: Africa World Press, Inc.
- Creswell, J. 2007. *Qualitative inquiry and research design*, 2nd ed., Thousand Oaks, CA: Sage.
- Declaration of Nyeleni. (2007). Declaration of the Forum of Food Sovereignty, Nyeleni. Selingue, Mali. Retrieved from <https://nyeleni.org/spip.php?article290> Web 10 November 2017.
- De St Croix, F. W. (1972). *The Fulani of Northern Nigeria*. Lagos, Nigeria: Gregg International Publishers Limited.
- Delprato, M., Akeampong, K., & Dunne, M. (2017). Intergenerational effects of Early Marriage in Sub-Saharan Africa. *World Development*, 91, 173-192.
- Delprato, M., Akyeampong, K., Sabates, R., Hernandez-Fernandez, J. (2015). On the impact of early marriage on schooling outcomes in Sub-Saharan African and South West Asia. *International Journal of Educational Development*, 44, 42-55.
- Detraz, N. (2017). *Gender and the Environment*. Malden, MA: Polity Press.
- Doak, C. M., Adair, L. S., Bentley, M., Monteiro, C., & Pokin, B. M. (2005). The dual burden household and the nutrition paradox. *International Journal of Obesity*, 29, 129-136.
- Dorin, A. & Welsh, L. (2017). *Senegal: A Brief Overview of Mining in Senegal*. Frankfurt, Germany: Mondaq: The Mayer Brown Practices (Last Updated 22 June 2017). Retrieved from <http://www.mondaq.com/x/604334/Mining/A+Brief+Overview+Of+Mining+In+Senegal> Web 31 August 2017.
- Dupas, P. & Robinson, J. (2011). Why Don't the Poor Save More? Evidence from health savings experiment. *American Economic Review*, 103(4), 1138-1171.
- Eguchi, P. K. (1993). Fulbe-ness in Fulbe Oral Literature of Cameroon. In P. K. Eguchi & V. Azarya (Eds.), *Unity and Diversity of a People: The Search for Fulbe Identity* (pp. 181-200). Osaka, Japan: Senri Ethnological Studies.
-

Fall, A. (2015). Towards a New Mining Code for Senegal. *American Bar Association*. Dakar, Senegal: GENI & KEBE, SCP de A'vocats. Retrieved from https://www.americanbar.org/content/dam/aba/events/international_law/2015/06/Africa%20Forum/Mining2.authcheckdam.pdf Web 30 August 2017.

Fairhead, F. and Leach, M. (1998). *Reframing Deforestation: Global analyses and local realities: studies in West Africa*. New York, NY: Routledge.

Felker-Kantor, E. & Wood, C. (2012). Female-headed Households and Food Insecurity in Brazil. *Food Security*, 4(4), 607-617.

Fioratta, S. (2017). Islam and Politics in Guinea. *Oxford Islamic Studies Online*. Retrieved from <http://www.oxfordislamicstudies.com/article/opr/t343/e0072> Web 4 March 2017.

Food and Agriculture Organization of the United Nations (FAO). (2005). *Livestock Sector Brief: Senegal - Livestock Information, Sector Analysis, and Policy Branch*. Rome, Italy: FAO corporate document repository. Retrieved from http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lbsb_SEN.pdf Web 9 September 2017.

Food and Agriculture Organization of the United Nations (FAO). (2002). *Chapter 2: Food Security Concepts and Measurements*. Rome, Italy: FAO corporate document repository. Retrieved from <http://www.fao.org/docrep/005/y4671e/y4671e06.htm> Web 29 September 2017.

Fratkin, E. (1997). Pastoralism: Government and Development Issues. *Annual Review of Anthropology*, 26(1), 235-261.

Gerson, J. (2017). The Dirty Secrets of Gold Mining in Senegal. *National Geographic*. Retrieved <https://voices.nationalgeographic.org/2017/07/19/the-dirty-secrets-of-gold-mining-in-senegal/> Web 30 August 2017.

Glew, R. S. & Vanderjagt, D. (2006). Coping strategies and nutritional health in rural Niger: recommendations for consumption of wild foods in the Sahel. *International Journal of Food Sciences and Nutrition*, 57(5-6), 314-324.

Glaser, B. & Strauss, A. (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Chicago: Aldine.

Hadley, C. and Crooks, D. L. (2012). Coping and the Biosocial Consequences of Food Insecurity in the 21st Century. *Yearbook of Physical Anthropology*, 55, 72-94.

Harnischfeger, J. (2006). Islamisation and Ethnic Conversion in Nigeria. *Anthropos*, 101(1), (37-53).

Himmel-Green, D.A., Romero-Daza, N. & Noble, A.C. (2012). Chapter 17: Anthropological Perspectives on the Global Food Crisis. In D.L. Dufour, A. H. Goodman, and G. H. Pelto (Eds.), *Nutritional Anthropology: Biocultural Perspectives on Food & Nutrition* (2nd ed., pp. 120-127). New York, NY: Oxford University Press.

Honfo, F. G., Akissoe, N., Linnemann, A. R., Soumanou, M., & Van Boekel, M. A. J. S. (2014). Nutritional Composition of Shea Products and Chemical Properties of Shea Butter: A Review. *Critical Reviews in Food Science and Nutrition*, 54(5), 673-686.

Jackson, P. & Neely, A. H. (2015). Triangulating Health: Toward a practice of political ecology of health. *Progress in Human Geography*, 39(1), 47-64.

Jones, A. D., Shrinivas, A., & Bezner-Kerr, R. (2014). Farm Production Diversity is Associated with Greater Household Dietary Diversity in Malawi: Findings from Nationally Representative Data. *Food Policy*, 46, 1-12.

Kennedy, G, Nantel, G., & Shetty, P. (2004). Globalization of food systems in developing countries: a synthesis of country case studies. In *Globalization of food systems in developing countries: impact on food security and nutrition*. Rome, Italy: Food and Agriculture Organization of the United Nations, 83, (pp. 1-26).

King, B. (2010). Political Ecologies of Health. *Progress in Human Geography*, 34(1), 38-55.

Kiptot, E. & Franzel, S. Gender and Agroforestry in Africa. *Agroforest Syst*, 84, 35-58.

Krieger, N. (2001). Theories for epidemiology in the 21st century: an ecosocial perspective. *International Journal of Epidemiology*, 30(4), 668-677.

Kvale, S., & Brinkmann, S. (2009). *InterViews: Learning the craft of qualitative research* (2nd Ed.). Thousand Oaks, CA: SAGE Publications, Inc.

L'Agence Nationale de la Statistique (ANSD) and ICF International. (2012). *2010-11 Senegal Demographic and Health and Multiple Indicators Survey: Key Findings*. Calverton, Maryland, USA: ANSD and ICF International.

L'Agence Nationale de la statistique et de la demographie (ANSD). (2013). Situation économique et sociale regionale. *Ministre de l'économie, des finances et du plan, République du Senegal*, 1-13.

Lestrangle, M-Th. de. (1977). Alimentation et anthropologie: donees concernant les Bassari, boin et Peul de la region de Kedougou (Senegal Oriental). *Bulletins et Memoires de la Societe d'anthropologie Paris*, 4(8), 371-381.
Doi: 10. 3406/bmsap.1977.1890.

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications.

Mahajan, S. D., Signh, S., Shah, P., Gupta, N., & Kochupillai, N. (2004). Effect of maternal malnutrition and anemia on the endocrine regulation of fetal growth. *Endocrine Research*, 30(2), 189-203.

Mayer, J. D. (1996). The political ecology of disease as one new focus for medical geography. *Progress in Human Geography*, 20(4), 441-456.

Mayer, J. D. (2000). Geography ecology and emerging infectious diseases. *Social Science and Medicine*, 50(7-8), 937-952.

Mahadevan, M., Blair, D., & Raines, E. R. (2014). Changing Food Habits in a South Indian Hindu Brahmin Community: A Case of Transitioning Gender Roles and Family Dynamics. *Ecology of Food and Nutrition*, 53(6), 596-617.

Morton, J. (2010). Why Should Governmentality Matter for the Study of Pastoral Development? *Nomadic Peoples*, 14(1), 6-30.

Mwaniki, A. (2006). Achieving food security in Africa: Challenges and issues. *UN Office of the Special Advisor on Africa (OSAA)*.
<http://www.un.org/africa/osaa/reports/Achieving%20Food%20Security%20in%20Africa-Challenges%20and%20Issues.Pdf> Web 10 May 2017.

Naik, R. & Kaneda, T. (2015). *Noncommunicable diseases in Africa: youth are key to curbing the epidemic and achieving sustainable development*. Washington, D.C.: Population Reference Bureau: Policy Brief. Retrieved from
<http://www.prb.org/pdf15/ncds-africa-policybrief.pdf> Web 10 September 2017.

National African Language Resource Center (NALRC). (2017). *Pulaar*. Madison, WI: University of Wisconsin. Retrieved from
<http://www.nalrc.indiana.edu/brochures/pulaar.pdf> Web 1 October 2017.

Ndione, M. (2008). 'Contraintes d'une Croissance Inégalement Répartie'. *Magazine du Bureau Régional de la Banque Mondiale à Dakar*, 10, 22-23.

Ngianga-Bakwin, K. & Stranges, S. (2014). Geographic Variation of Overweight and Obesity among Women in Nigeria: A Case for Nutritional Transition in Sub-Saharan Africa. *PLoS ONE*, 9(6): e101103. doi:10.1371/journal.pone.0101103.

Niane, B., Guedron, S., Mortiz, R., Cosio, C., Ngom, P., Deverajan, N., Pfeifer, H., & Pote, J. (2015). Human exposure to mercury in artisanal small-scale gold mining areas of Kedougou region, Senegal, as a function of occupational function and fish consumption. *Environmental Science and Pollution Research*, 22(9), 7101-7111.

Nyadanu, D., Adu Amoah, R., Obeng, B., Kwarteng A. O., Akromah, R., Aboagye, L. M., & Adu-Dapaah, H. (2017). Ethnobotany and analysis of food components of African locust bean (*Parkia biglobosa* (Jacq.) Benth.) in the transitional zone of Ghana: implications for domestication, conservation and breeding of improved varieties. *Genetic Resources and Crop Evolution*, 64(6), 1231-1240.

Obeng-Odoom, F. (2015). Understanding Land Grabs in Africa: Insights from Marxist and Georgist Political Economics. *Black Polit Econ*, 42, 337-354.

Ogawa, R. (1993). Ethnic Identity and Social Interaction: A Reflection on Fulbe Identity. In P. K. Eguchi & V. Azarya (Eds.), *Unity and Diversity of a People: The Search for Fulbe Identity* (pp. 119-137). Osaka, Japan: Senri Ethnological Studies.

Olayiwola, K., Soyibo, A., & Atinmo, T. (2004). Impact of globalization on food consumption, health and nutrition in Nigeria. In *Globalization of food systems in developing countries: impact on food security and nutrition*. Rome, Italy: Food and Agriculture Organization of the United Nations, 83, (pp. 99-118).

Olaniyi, R. O. (2015). Bororo Fulani Pastoralists and Yoruba Farmers' Conflicts in the Upper Ogun River, Oyo State Nigeria, 1986-2004. *Journal of Asian and African Studies*, 50(2), 239-252.

Omran, A. R. (1971). The epidemiologic transition. A theory of the epidemiology of population change. *The Milbank Memorial Fund Q*, 49(4), 509-538.

Omwami, E. M. (2011). Relative-change theory: examining the impact of patriarchy, paternalism, and poverty on the education of women in Kenya. *Gender and Education*, 23(1), 15-28.

Patel, R. (2009). Grassroots Voices: Food Sovereignty. *The Journal of Peasant Studies*, 36(3), 663-706.

Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N. D. & Hoagwood, K. H. (2016). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Adm Policy Ment Health*, 42(5), 533-544.

doi: 10.1007/s10488-013-0528-y

Peluso, L. N. & Ribot, J. C. (2003). A Theory of Access. *Rural Sociology*, 68(2), 153-181.

Peluso, L. N. (1996). Fruit Trees and Family Trees in an Anthropogenic Forest: Ethics of Access, Property Zones, and Environmental Change in Indonesia. *Comparative Studies in Society and History*, 38(3), 510-548.

Pelto, G. H., Dufour, D. L., & Goodman, A. H. (2012). Chapter 1: The Biocultural Perspective in Nutritional Anthropology. In D.L. Dufour, A. H. Goodman, and G. H. Pelto (Eds.), *Nutritional Anthropology: Biocultural Perspectives on Food & Nutrition*, (2nd ed., pp. 1-6). New York, NY: Oxford University Press.

Pelto, G. H. & Pelto, P. J. (1983). Diet and delocalization: dietary changes since 1750. *Journal of Interdisciplinary History*, 14(2), 507-528.

Persaud, A.W., Telmer, K.H., Costa, M., and Moore, M.L. (2017). Artisanal and Small-Scale Gold Mining in Senegal: Livelihoods, Customary Authority, and Formalization. *Society & Natural Resources*, 30(8), 980-993.

Blaikie, P. (1985). *The Political Economy of Soil Erosion in Developing Countries*. New York, NY: Routledge, Taylor & Francis Group.

Popkin, B. (2002). An overview on the nutrition transition and its health implications: The Bellagio meeting. *Public Health Nutr.* 5(1A), 93-103.

Poulsen, G. (1982). The non-wood products of African forests. *Unarylva*, 34(137), 15-21.

Rafei, L. (2014). Africa's urban population growth: trends and projections. *The Data Blog*. The World Bank, Retrieved from <https://blogs.worldbank.org/opendata/africa-s-urban-population-growth-trends-and-projections> Web 19 September 2017.

Remans, R., Wood, S. A., Saha, N., Anderman, T. L., & DeFries, R. S. (2014). Measuring Nutritional Diversity of National Food Supplies. *Global Food Security*, (3), 174-182.

Resnick, D. (2013). Working Paper No. 2013/015: Personalistic policy-making in a vibrant democracy: Senegal's fragmented response to the 2007/08 food price crisis. United Nations University (UNU), World Institute for Development Economics Research (WIDER), 1-28. ISBN 978-92-9230-592-5.

Richmond, C., Elliott, S. J., Matthews, & Elliott, B. (2005). The political ecology of health: perceptions of environment, economy, health and well-being among 'Namigs First Nation. *Health & Place*, 11, 349-365.

Rocheleau, D., & Edmunds, D. (1997). Women, Men and Trees: Gender, Power and Property in Forest and Agrarian Landscapes. *World Development*, 25(8), 1351-71.

Schreckenberg, K. (2004). The contribution of shea butter (*Vitellaria paradoxa* C.F. Gaertner) to local livelihoods in Benin. In T. Sunderland & O. Ndoye (Eds.) *Forest products, livelihoods, and conservation-case studies of non-timber forest products systems: Volume 2 Africa*. Indonesia: CIFOR, (pp. 91-113).

Shimada, Y. (1993). Jihad as Dialectical Movement and Formation of Islamic Identity among the Fulbe. In P. K. Eguchi & V. Azarya (Eds.), *Unity and Diversity of a People: The Search for Fulbe Identity* (pp. 87-118). Osaka, Japan: Senri Ethnological Studies.

Simpson, A. (2004). *Language and National Identity in Africa*. New York, NY: Oxford University Press.

Sneyd, L. Q. (2013). Wild Food, Prices, Diets and Development: Sustainability and Food Security in Urban Cameroon. *Sustainability*, 5, 4728-4759.

Thone, F. (1935). Nature Rambling: We Fight for Grass. *The Science Newsletter*, 27(717), 14.

Tilman, D. & Clark, M. (2014). Global diets link environmental sustainability and human health. *Nature*, 515, (518-522).

Trotter II, R. T. (2012). Qualitative research sample design and sample size: Resolving and unresolved issues and inferential imperatives. *Preventative Medicine* 55(2012), 398-400.

United Nations Children's Fund (UNICEF). (2013). *Improving Child Nutrition: the achievable imperative for global progress*. New York, NY: Division of Communication, UNICEF.

United Nations Educational, Scientific, and Cultural Organization (UNESCO). (2012). UNESCO Global Partnership for Girls' and Women's Education - One Year On. UNESCO, Retrieved from http://www.unesco.org/eri/cp/factsheets_ed/SN_EDFactSheet.pdf Web 13 September 2017.

- USAID. (2009). Senegal Sub-Regional Conflict Assessment. *Management Systems International, Co.* Retrieved from https://www.usaid.gov/sites/default/files/documents/1866/Senegal%20Sub-Regional%20Conflict%20Assessment_Final%2012-30-09.pdf Web 23 August 2017.
- Weismantel, M. J. (1989). Chapter 21: The Children Cry for Bread: Hegemony and the Transformation of Consumption. In D.L. Dufour, A. H. Goodman, and G. H. Peltó (Eds.), *Nutritional Anthropology: Biocultural Perspectives on Food & Nutrition* (2nd ed., pp. 172-179). New York, NY: Oxford University Press.
- Wickens, G. E. (1991). Management issues for development of non-timber forest products. *Unasylva*, 165(42), 3-8.
- Wolf, E. (1972). Ownership and Political Ecology. *Anthropology Quarterly*, 45(3), 201-205.
- World Bank. (2015). Country Profile Data: Senegal. Retrieved from <http://data.worldbank.org/country/senegal> Web 25 June 2017.
- World Bank. (2016). Basic Profile of Child Marriage in Senegal. *Knowledge Brief: Health Nutrition and Population Global Practice*. The World Bank: ICRW. Retrieved from <http://documents.worldbank.org/curated/en/401141467995901691/pdf/106419-BRI-ADD-SERIES-PUBLIC-HNP-Brief-Senegal-Profile-CM.pdf> Web 10 September 2017.
- World Bank. (2013). *The Global Burden of Disease: Main Findings for Sub-Saharan Africa*. News: The World Bank. Retrieved from <http://www.worldbank.org/en/news/feature/2013/09/09/global-burden-of-disease-findings-for-sub-saharan-africa> Web 10 February 2017.
- World Health Organization (WHO). (2017). *Media Centre: Noncommunicable Diseases*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs355/en/> Web 21 June 2017.
- World Health Organization (WHO). (2012). *Nutrition Landscape Information System, Senegal*. Retrieved from <http://apps.who.int/nutrition/landscape/report.aspx?iso=sen> Web 7 March 2017.
- World Health Organization (WHO). (2004). Part 4: Burden of Disease: DALYs. *Global Burden of Disease Report*. Retrieved from http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_part4.pdf Web 10 February 2017.
- VerEecke, C. (1993). Sub-National Fulbe Identity in Nigeria? Responses to Political Change in Post-Independence Times. In P. K. Eguchi & V. Azarya (Eds.), *Unity and*
-

Diversity of a People: The Search for Fulbe Identity (pp. 139-161). Osaka, Japan: Senri Ethnological Studies.

Yates-Doerr, E. (2015). *The Weight of Obesity: Hunger and global health in postwar Guatemala*. Oakland, CA: University California Press.

Yin, R. K. (1984). Case Study Research Design and Methods. *Applied Social Research Methods Series*, 5, 1-53.

Zakari, S., Ying, L., & Song, Bh. (2014). Factors Influencing Food Security in West Africa: The Case of Southern Niger. *Sustainability*, 6(3), 1191-1202.
