Universiteit Utrecht

Master's Thesis

Universiteit Utrecht

Master in Sustainable Development: International Development

Gendered Crops from an Intersectional Perspective: Which Factors Influence Women's Dry-Season Farming Choices?

by Viviana Conti

Thesis Supervisor: Dr. Sebastiaan Soeters
Second Supervisor: Dr. Kei Otsuki

July 27th 2017

At some point, we had to sit down under a tree and reflect on why nothing seemed to have changed. After 4 or 5 years of doing the same things, it got to a point when we had to reflect to on our work as Development facilitators. We concluded that we hadn't brought any change to any life at all, except for our lives, because we had a salary now. So we decided stop treating beneficiaries as if they didn't know anything, didn't have a science or any appreciation of the world and any capacity to do something for themselves. We realized the more we started to interrogate the concept of Indigenous Knowledge, the more we discovered its potency for development. We realised change is never done from ground zero, it is always done from ground one, there is always some foundation of what you want to build.

- CICKOD founder -

Acknowledgments

This work is the formal conclusion of a Research Master in Sustainable Development – International Development at the University of Utrecht. It is the immediate result of a 3-months fieldwork in the Upper West region of Ghana and of five additional months of work behind a screen. Plus, it directly stems from my preceding research work in the Upper East region of Ghana, which allowed me to move my first steps into academic research. However, it is also the indirect outcome of five years of study in development and of the life choices I made to support my interests. Being the result of such a long-term path, there are countless people I would need to thank, so I have to limit these acknowledgments to direct contributors only.

First and foremost, to my supervisor Dr. Sebastiaan Soeters: I renew my gratitude for having been an inspiring guide throughout the last year and a half. The conversations we have had still resonate in my ears in the most unexpected moments. I am also thankful to my second reader, Dr. Kei Otsuki, for her insightful feedback on my research proposal.
I owe the excellent translation work, essential for the success of this research, to Mercy Dakogri of Community Development Alliance Ghana. CDA has been an extremely supportive and resourceful environment during the fieldwork. Therefore, I owe a debt of gratitude to all CDA employees and especially to Mr. Salifu Issu Kanton (MPhil) and to Mr. Bipuah Sulemani (MA). Of course, the core of any fieldwork are research participants, whose views informed this work and to whom I am sincerely grateful. My thanks also go to Ruben Weesie, an insightful mate in research and a stimulating company in leisure.

I received invaluable academic and personal support by Aurora Perego (MA), whose qualities as a friend exceed her outstanding academic skills, and Noelia Iranzo Ribera (MSc), a recent and congenial discovery. None of this would have been possible without the love and patience of my small and caring family in Turin and Pisa, to whom I dedicate my endeavour.

Abbreviations

AF	Adaptation Fund
CIKOD	Centre for Indigenous Knowledge and Organisational Development
DSF	Dry-season farming
EPA	Environmental Protection Agency
FGD	Focus Group Discussion
M&E	Monitoring and Evaluation
MESTI	Ministry of Environment, Science, Technology and Innovation
MoFA	Ministry of Food and Agriculture
UNDP	United Nations Development Programme
UWR	Upper West Region

List of tables and figures

List of tables

List of figures

Abstract

How to effectively target the intended beneficiaries of development interventions, be them connected to climate change, literacy, health or any other related area, is a constant challenge for NGOs and governments. This research gives a contribution in this regard, with a focus on climate-smart agriculture programmes in Sub-Saharan Africa. The case study is dry-season farming programming in the Northern part of Ghana, which is gaining momentum due to its potential as an adaptation practice that fosters local employment. Irrigated agriculture is indeed promoted by Ghanaian and international institutions as it is less exposed to the effects of erratic rainfall patterns increasingly characterising semi-arid areas which, together with droughts, floods, extreme weather events and a shortened rainy season, can cause crop failures and food insecurity.

One of the most commonly targeted groups by dry-season farming interventions are women, who are regarded as an especially vulnerable group to the threats of climate change due to their disadvantaged position in society. Scientific debate has shown that gender is not the only variable to produce differentiated roles and responsibilities that result in different exposures and adaptive capacities within populations, within communities and even within households. In fact, recent scholarship in the field of climate change has highlighted the need of an intersectional approach, drawn from feminist research, to place gender issues into a broader context of cleavages in other individual conditions, like social class, faith, age, disability, ethnicity and others. This research adopts an intersectional framework to the study of farming patterns in the dry-season, with a special attention to crop choices made by farmers. The existing research on gendered crops in West Africa, centred on rainy season varieties, is the blueprint to assess whether such classification holds true for dry-season crops. Moreover, this analysis is also the starting point of recommendations provided to dry-season farming programmers in terms of crops, water sources and fencing choices. These recommendations provide elements to better target the intended beneficiaries of the interventions through adjustments made in intervention programming.

Table of Contents

Introduction

The three Northern regions of Ghana are increasingly impacted by threats of climate change due to erratic rainfall, extreme events and increasing temperatures (Dumenu & Obeng, 2016). The population has a high degree of exposure due to its dependency on rain-fed agriculture: as many as the 80% of Northern Ghanaians are subsistence rainy season farmers (MoFa Ghana, 2016). Traditional subsistence crops, such as maize, sorghum, millet and yam, have an high degree of exposure to climatic changes, with severe effects on the vulnerable local population (Antwi-Agyei, Fraser, Dougill, Stringer, & Simelton, 2012). In fact, farmers are prone to experience decreasing yields and crop failures due to the erratic rainfall patterns that characterise the area (Laube, Schraven, & Awo, 2012). A shorter rainy season, dry spells and extreme events such as floods and droughts also became more frequent, further undermining the agricultural production and the food security of the people living in the area (Laube et al., 2012). In this context, diversification of income and the adoption of agricultural practices that reduce dependency on erratic rainfall are considered the key to adapt to such altered climatic conditions.

Adaptation interventions aim at increasing farmers' resilience through diversification of their livelihoods, innovative farming techniques and services or adoption of improved crop varieties. Among diversification and innovative approaches, dry-season farming is having a momentum and rapidly growing in popularity among farmers, NGOs and the Government as an adaptation strategy. Its popularity is due to a number of reasons: it is an additional activity in the lean season, when subsistence farmers are inactive, is not dependent on erratic rainfall as it employs irrigation, and it is a local income-generating activity that may reduce seasonal out-migration. One of the core slogans of the party which won the Ghanaian elections in December 2016 was notably 'One Village One Dam'. This policy is now part of the Governmental planning and aims to provide each community a dam to farm in the dry-season and for fishing: this is an ambitious attempt to inject dry-season farming into the annual agricultural cycle. Moreover, a new, large scale programme funded by the Adaptation Fund (AF) has been launched in 2016 in the three Northern Regions of Ghana, the "Increasing Resilience to Climate Change in Northern Ghana through the Management of Water Sources and the Diversification of Livelihoods"[1] programme. One of its three components is the promotion of dry-season farming specifically targeting women (Adaptation Fund, 2015).

Awareness is rising among development agencies and policy-makers on the distinct vulnerabilities of women to the adverse impacts of climatic change. Research has repeatedly proved that they often feature lower levels of resilience than men living in the same context (Meyiwa, Maseti, Ngubane, Letsekha, & Rozani, 2014). In the literature, two main explanatory

1 From now on: "Increasing Resilience to Climate Change in Northern Ghana"

factors have been identified; first, women rely on natural resources to carry out their gender-specific activities in household keeping and child-rearing, such as fetching water and firewood (Meyiwa et al., 2014). Secondly, women face additional obstacles in improving their adaptive capacities due to constraining gender roles: they have less access to land, assets, technology, information, and a reduced mobility in comparison with men (Jost et al., 2016). As a result, a number of adaptation interventions specifically target women as a beneficiary group and aim at strengthening their adaptive capacities, often through providing access to resilient livelihoods (Pelling, 2011); this is also the aim of the programme funded by the AF in Northern Ghana.

However, scientific literature raised concerns on challenges related with targeting groups, e.g. women, through one-size-fit-all approaches to development programming, especially with regards to climate-related interventions. With reference to climate services, it has been written that "it is possible to design climate services that, in the context of a specific stressor for a specific group of people, work brilliantly, but when applied to a wider group of users for new purposes, fail dramatically" (Carr & Onzere, 2017, p. 2). The risk of failure in successfully reaching women as a target group of dry-season interventions in Northern Ghana are tangible and have been shown by my previous research work in Northern Ghana (2016) and by Padmanabhan (2007). While there are general constraining factors that can hinder such interventions, e.g. the current disadvantaged position of women and girls in the society and their limited access to assets and knowledge in West Africa (Nielsen & Reenberg, 2010), research have shown that specific attention is required in the case of interventions targeting women and based on the introduction of new dry-season crop varieties. Moreover, scholars have contended that gender is not the only social factor that constrains women's involvement in agricultural and adaptation activities like dry-season farming[2].

The present research is informed by that scholarship; hence, gender will not be analysed in isolation, but rather linked to other explanatory variables such as wealth, ethnicity, marital status and age in an intersectional framework. In fact, intersectionality is the notion that all these variables, and others, contribute to shaping identity as a whole, for both women and men (Carr & Thompson, 2014). In an intersectional framework, one single variable, be it gender, wealth or age, is not considered sufficient to explain the behaviour of all individuals that share a certain characteristic, such as being a woman, poor or old. These groups, women, poor and aged people, are not homogeneous and the constraints individuals face depend on multiple interlacing identities, which should be analysed simultaneously (Carr & Thompson, 2014). In this research, I will analyse the ways in which women practise dry-season farming in the Upper West region of Ghana and how their different wealth, age, ethnicity, and marital status influence their activities.

The ultimate aims of this research work are related to both the academic debate and the work of development-related institutions. Besides contributing to the scholarship in the fields of adaptation and intersectionality, this research provides recommendations on how to target the intended beneficiary group(s) in future interventions fostering dry-season farming activities. Moreover, it will shed a light on how adaptation programming never happens in a vacuum, but

2 See in particular: Carr, 2008; Carr & Thompson, 2014; Kaijser & Kronsell, 2014; Thompson-Hall, Carr, & Pascual, 2016.

rather it is rooted in the existing patterns of inequalities, distribution of power and resources, local knowledge, division of labour, roles and responsibilities. Those, and the characteristics of the target groups, need to be accurately analysed to ensure ideal targeting of the intended beneficiaries.

Given the multiple efforts made in engaging women into dry-season farming, clarification is needed on the conditions that determine whether an intervention will be effective in reaching female farmers. This research aims at shedding light on these conditions by analysing the current state of dry-season farming in the target communities of the AF financed project in the Upper West Region of Ghana. The research, based on a 12-weeks fieldwork and a mixed method investigation, covers the following aspects:

- First of all, a clear picture of the state-of-art of dry-season farming in the area will be obtained, with a specific focus on the features that currently characterise dry-season farming, including techniques and tools employed, time commitment, resources invested, and constraints commonly encountered;
- Secondly, the constraints encountered by farmers will be matched to their determinants in terms of gender, wealth, age, ethnicity, and marital status of the farmers. Attention will be paid on how the relationship between determinants and constraints unfolds among both self-started farmers and those who are engaged in an institutional intervention. The aim of this step of data analysis is to clarify which constraints are determined by the variables above in each phase of the farming cycle;
- Finally, the data gathered through focus group discussions, interviews, a survey, and participant observation will be translated into recommendations for implementing institutions; these recommendations consist of a number of critical variables that can be tailored by institutions to better target their intended beneficiaries.

The guiding question of the research is: How do multiple social variables intersect to create patterns of dry-season farming engagement and modes of production among smallholder farmers in Northern Ghana? As the thesis unfolds, the following contents will be presented: a description of the relevant aspects of the geographical and social context, with particular attention to agricultural activities, adaptation to climate change and gendered division of labour (Chapter 1); a literature review of the academic debate on differentiated vulnerability and gendered crops, followed by the identification of a gap in the literature, the elaboration of a theoretical framework (Chapter 2), and the research aim and design (Chapter 3); a methodological chapter containing the methods and the approach to the participants of the research (Chapter 4); an overview of dry-season farming characteristics in the area and each of the target communities based on the data gathered during the fieldwork (Chapter 5); the identification of a number of factors that constrain and enable engagement in dry-season farming, and a discussion on the variables that influence them (Chapter 6); an analysis of the broader explanatory factors that determine these constraints for certain social groups (Chapter 7); a discussion of the findings and the implications of these for future interventions (Chapter 8) and the conclusions (Chapter 9).

CHAPTER 1

Context and actors

This chapter merges the body of knowledge on social, geographical and economic characteristics of the Upper West region and especially of the Nadowli-Kaleo District. Its purpose is to provide background information on relevant aspects for the research, in particular the climatic threats in the region, the structure of the economy and especially of the agricultural sector, the household division of labour and the local systems of governance and chieftancy.

1.1 The Upper West region of Ghana: social and geographical context

The Upper West is one of the three northern regions of Ghana; the others are the Upper East and the Northern region. Only the 17% of the total Ghanaian population lives in these three regions, but they cover about the 40% of Ghana's surface (GSS, 2010). The northern sector of Ghana has a number of peculiarities in terms of social indicators, economy and climate that make it a distinct and separate unit from the rest of the country. Mean per capita income in the three northern regions is far lower than the national average and most of the poor live there (Pickbourn, 2011). In the Upper West region (UWR), the 84% of the population has been estimated to be living in poverty[3]; this is the highest percentage among the ten regions of Ghana (GLSS, 2008). The Upper East and Northern regions also feature a considerable amount of people living in poverty (respectively 64% and 42% of their population), while the figures for all the other regions range between 22% and 8%. The roots of this uneven distribution of wealth can be traced back to the era of colonial domination of Ghana (Pickbourn, 2011). In fact, the northern sector was not appealing to the British colonisers because of the relative lack of those resources that were abundantly present in the south, such as cocoa, gold and timber (Pickbourn, 2011). This has lead the northern regions to serve as a pool of workforce for the rest of the country and hindered the development of infrastructure, industry and all public services, such as education and healthcare. Sixty years after the Independency (1957), the northern regions still lag behind the rest of the country in all welfare and human development indicators (life expectancy,

[3] The definition of poverty used here and in the rest of the thesis is the one set by the Ghana Statistical Service (GSSb, 2014). The poverty line is determined on the base of nutritional requirements. The value of a sufficient food basket for an adult is calculated (estimated to GHC 792 per year) and multiplied by the number of adults in the household; if the household's total consumption expenditure is lower than that, the household falls below the extreme poverty line.

education, housing conditions, access to clean water), formal employment levels are very low and infrastructure is generally deficient. At the present time, about the 90% of the population in the Upper West live in rural areas and agriculture is the main source of income for the vast majority of households, with only a small percentage of the population employed in non-agricultural sectors (GSS, 2010). Education levels are considerably lower in northern Ghana than in all the other regions; in the UWR, the 54% of the population is illiterate, with the lowest levels of literacy being registered among the rural households and women (GSS, 2010). While the other northern regions register similar levels of illiteracy, they compare poorly with the national average of 26% of illiterate population (GSS, 2010). Only a very small portion of the population in the Upper West, about the 6%, attained secondary education[4] (GSS, 2010).

The Upper West Region is divided into 11 Districts, each of whom has a local Governmental institutions, among which a District Assembly (DA) and a District level extension office of the Ministry of Food and Agriculture (MoFA). The Capital of the region is Wa, situated in the Wa Municipal District; it is the largest urban area of the region. This research is centred on the Nadowli-Kaleo District, north of Wa Municipal. Interestingly, all the Districts of the region, except from Daffiama-Bussie-Issa (DBI), Wa Municipal and Wa East, share a border with Burkina Faso. This has consequences on the trade of goods in the region, especially agricultural products, as Burkina Faso has a culture of dry-season farming and Burkinabé products are exported throughout Ghana. Moreover, especially in bordering Ghanaian communities, the second language spoken by the local literate population might be French instead of English if they attended school in Burkina Faso.

[4] Senior High School or other kind of secondary education.

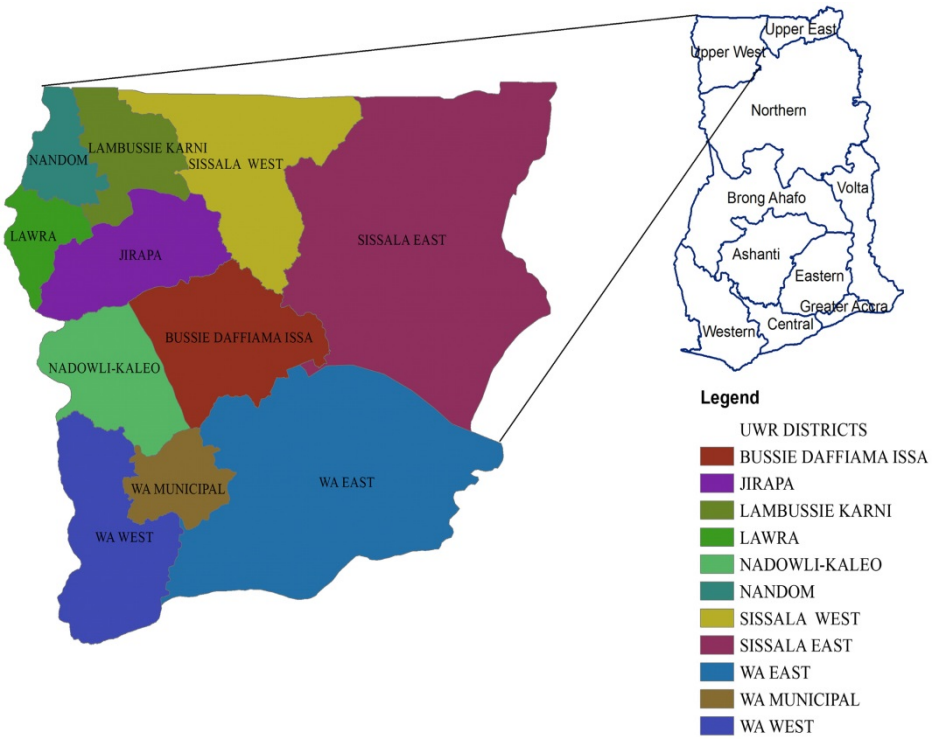

Figure 1. Map of the eleven Districts of the Upper West region. Adapted from Moomen, A. W., & Dewan, A. (2016). Assessing the spatial relationships between mining and land degradation: evidence from Ghana. International Journal of Mining, Reclamation and Environment, 1-14, p.3

As stated above, the livelihood of most of the population in the Upper West depends on agriculture; traditional subsistence agriculture is rain-fed and therefore only takes place in the rainy season. The UWR only has one annual rainy season, unlike the southern regions of Ghana that have a bi-modal rainfall pattern. The UWR falls in the semi-arid savannah belt and between the Sudan and the Guinea Savannah agro-ecological zones; it is a predominantly grassland ecosystem with sparse trees and shrubs (Rademacher-Schulz et al., 2014; Antwi-Agyei et al., 2012). The area is characterised by the alternation of a wet and a dry season and rainfall is concentrated in the months between May and October. The dry season is very hot with average day temperatures consistently ranging from 30° to 37° and is a period of inactivity in the agricultural production (Yiridoe *et al.*, 2006). Therefore, the dry-season is traditionally dedicated to rest, to perform funerals, weddings and festivals[5]. Below is a seasonal calendar showing the planting and harvesting periods of some of the most commonly grown crops in the Guinea savannah agro-ecological zone of Ghana, where the Upper West region lies.

[5] Funerals are important social gatherings and often people spend the whole night out (Monroe *et al.*, 2015). They can also represent a source of income for women who brew more *pitu* (see footnote 7) to sell to the participants and the organisers of the funeral.

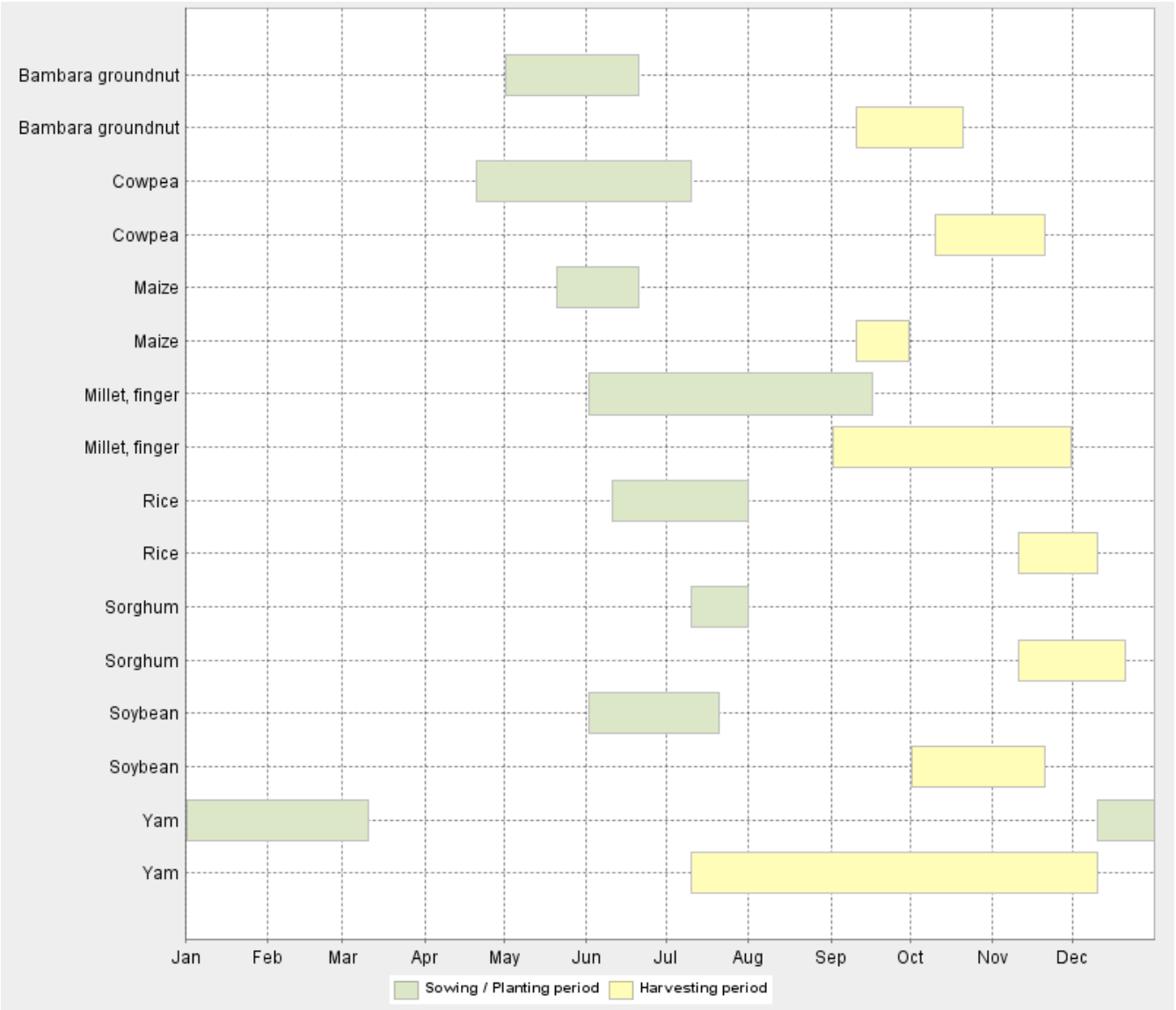

Figure 2. Seasonal calendar of cereals, leguminous and tuber crops in the Guinea savannah agro-ecological zone of Ghana. Adapted from: FAO (2017) Crop calendar. Retrieved at: http://www.fao.org/agriculture/seed/cropcalendar/cropcalendar.do\ [July 2017]

It is evident from the graph above that the period of five months between mid-December and May is largely free from agricultural activities, with the exclusion of the preparation of the land and the planting of the yam. In the dry season, vegetables can be grown with irrigation practices (see Chapter 5 on Dry-season farming in the target communities).

1.2 Farming systems, household labour and gendered division of work

In northern Ghanaian households, there is a division of tasks both on productive and reproductive labour. Productive activities at a household level in rural UWR are mainly farming, animals rearing and petty trading, while reproductive labour activities are related to the day-to-day house-keeping, including fetching water and firewood for cooking, taking care of the children, food processing and cooking, cleaning the compound, washing clothes. All these activities are carried out by the members of the household. Each household is usually composed by a head, a spouse or more, a number of children and often members of the extended family. Society is patrilineal: women have to move to their husband's village when they marry; more than three quarters of households in the UWR are male-headed (GSS, 2010). The average household size in the rural areas of the UWR is 6,7 members (GSS, 2010).

There is a division of tasks in productive roles at a household level. When it comes to farming, there is evidence of a high degree of division of labour within the household: while men are usually responsible for clearing the land, ploughing and weeding, women and children's labour is critical in planting and harvesting (Pickbourn, 2011; Yiridoe *et al.*, 2006). These arrangements derive from the fact that women in the Upper regions are considered "farm hands"[6] and are therefore supposed to contribute to the farming workload, together with their reproductive roles (Apusigah, 2009). Subsistence agriculture is practiced with traditional farming techniques and is characterised by a low level of mechanisation; therefore, it is a labour intensive activity and all the household members should give their contribution. The most commonly grown crops in the rainy season are maize, millet, yam, sorghum, rice, groundnuts and cowpeas. These crops serve both as a household provision until the next harvest and as a source of income when the surplus is sold. Some crops are especially grown to be locally sold, such as groundnuts, rice and soy beans. Even though subsistence crop production is carried out collectively by all the members of the household, men are considered primarily responsible in growing the staples, such as maize, millet and yam, and "This is regarded as the most important contribution to the household's food needs" (Pickbourn, 2011, p. 67); the other men's main responsibility is to provide shelter, usually in the form of a family compound (Pickbourn, 2011). Men play a dominant role in decision-making over household resources and land, as they are regarded to be the owners of the family land. Women, in fact, have no right to inherit the land under customary arrangements and rarely own any (Apusigah, 2009). Women can access family land and are usually allocated small plots for so-called secondary production, which does not include staples but rather vegetables, rice, beans, groundnuts both for household consumption and sale (Apusigah, 2009).

Together with crop production, more than the 60% of the rural population in the Upper West engages in livestock rearing (GSS, 2010). It is mainly on a small scale and serves multiple purposes such as generating income and representing an insurance system for periods of food

[6] In contrast with "non-farm hands" women, who are not required to contribute to the family farming workload; this model is present in the Northern region (Apusigah, 2009).

scarcity (Yiridoe *et al.*, 2006). Most well-off households in the UWR own poultry, goats and, less often, pigs and cows. Men are usually responsible for selling animals at the livestock market; in families that own pigs, women should prepare and give them their feed.
Common activities in the dry-season are firewood fetching and brick production as a household provision for the rainy season; the first one is a typically female activity, the second is practiced by the male members of the household. Hunting is also a popular leisure activity for men and boys and it can be a source of bush meat for household consumption. Off-season (irrigated) farming for sale and household consumption is gaining popularity in the dry-season and is practiced by both men and women with different patterns. Off-farm income-generating activities include charcoal burning, groundnut oil or shea butter processing and *pitu*[7] brewing for sale, most often practiced by women. A common strategy for men, and less frequently for women, is seasonal out-migration. Migration to the southern part of the country is a common and well-established strategy in the dry season, especially among men, as it reduces the stress on household resources and provides some diversification of income. Findings from recent studies also highlighted a new trend of migration in the rainy season as a strategy in time of a crisis (Rademacher-Schulz et al., 2014).

In contrast with farming and other productive activities, reproductive work is constant throughout the year. It is very time-consuming, as the core resources, firewood for cooking and water to drink, wash and bath, need to be fetched, sometimes far from the house. Women are responsible for all the reproductive labour in the household, and many tasks are carried out together with children. Moreover, they are supposed to provide all the ingredients for the meals, apart from the staples, and to pay for the costs involved with milling and grinding maize and other food processing tasks (Pickbourn, 2011). This means that women should constantly provide resources to buy vegetables, cooking fats, salt, spices and, in better-off families, fish or meat for the meals. Many women also rely on leaves and fruits growing in the bush around the village, which can be freely gathered.

1.3 Livelihoods and climatic changes

Dry-season farming, together with spreading of seasonal weather forecast, are among the most popular climate-smart agriculture activities in Ghana. Dry-season farming practices are being encouraged by Government programmes and often supported by local and international NGOs. The Savannah Accelerated Development Authority (SADA), sees them as a great opportunities for Northern Ghanaian farmers to transform their livelihood (IWMI, 2016). In the Upper West Region, the most common irrigated off-season crops grown either for local consumption or for sale are tomatoes, peppers, local leafy vegetables, cabbage, onions, watermelons, okra, eggplant. The need for diversification and dry-season agricultural production is due to a high dependency on rain-fed agriculture to grow the traditional crops. The production of these crops is threatened by erratic rainfall patterns, rising temperatures, and extreme weather

[7] Local alcoholic or non-alcoholic beverage brewed with Guinea corn, consumed throughout the year, but especially in the dry season during funerals.

events. These conditions contribute to the decreasing yields of these crops. The Sudan and Guinea Savannah ecological zones are the regions in which crop failure is the highest and the Upper West Region falls between the Sudan and the Guinea Savannah climatic zones (Antwi-Agyei et al., 2012). These climatic conditions coupled with existing regional social and economic vulnerability and higher poverty levels in comparison with the rest of the country, make the Upper West region highly vulnerable to climate change (Nyantakyi-Frimpong & Bezner-Kerr, 2015). Together with the other northern regions, it has the lowest levels of adaptive capacity and the highest of vulnerability in Ghana (Antwi-Agyei et al., 2012). There is a great dependency on farming activities and very poor opportunities to develop non-farming livelihoods. During the dry-season that lasts seven to eight months, the population of the three northern regions has no complementary means to secure their livelihoods; this results in high levels of seasonal migration to the southern regions of the country and great food insecurity (Dumenu & Obeng, 2016).

Many strategies were spontaneously adopted by farmers in Northern Ghana, all aimed at the diversification of livelihoods. The following excerpt refers to the Upper East region but the same conditions apply to the Upper West region:

> Permanent and seasonal migrations are very important coping strategies, as they help to reduce pressure on available resources and create additional income for consumption or investment. In order to adapt to environmental changes, in many parts of the UER agricultural production is intensified, mainly through the adoption of irrigation practices [for dry-season farming] and the adoption of new crop varieties. (Laube et al., 2012, p.755)

In other words, diversification of livelihoods has taken place to a large extent, both though innovative agricultural techniques, such as irrigation and new crops, and through seeking external income opportunities, such as migration. It must be noted that migration is more often a male strategy (Pickbourn, 2011).

1.4 The Nadowli-Kaleo District

The research sites of this work are five communities located in the Nadowli-Kaleo district, one of the eleven districts of the UWR. The population of the District amounts to 61,561 and it is deemed to be fully rural, as no households were considered urban in the 2010 Census (GSS, 2014). Clearly, most households are engaged in agricultural activities, especially crop production and livestock rearing. The divide between the female and male population in key areas for economic development, such as education and access to technology, is striking. Among the population of 11 years and older, the level of literacy was 60% for males and 44% for females; while the 22% of males of 12 years and older have access to internet and 63% have a mobile phone, the figures for females are much lower. Less than 1% of women have access to internet and 37% own a mobile phone (GSS, 2014). The dominating kind of house is the traditional compound built by mud bricks, where all extended family members have an individual room and the central area is used to cook and for other activities. As mentioned above, women are responsible for most of the house-keeping tasks. In the Nadowli-Kaleo district, more than three

quarters of households use firewood to cook and water from a borehole or a well (GSS, 2014); there resources are fetched daily by women or children and this activity is very time-consuming. The area is very prone to environmental degradation due to a number of factors, including the over-dependency on firewood and charcoal for cooking (GSS, 2014) and the deforestation due to gold mining (Moomen & Dewan, 2016b). Deforestation can also undermine the sector of shea butter production, critical for women's livelihoods (Moomen & Dewan, 2016a). Moreover, the lack of toilet facilities and of liquid and solid waste disposal systems contribute to the pollution of the environment (GSS, 2014).

The two dominant ethnic groups in the Nadowli-Kaleo district are the Sissala and the Daagabe (or Dagara) people; however, the latter is the majority in the five target communities of this research. There is also a minority of Fulani people, estimated to be the 0,5% of the population in the District (GSS, 2014). The main traditional authorities among the Dagare people are the chiefs (paramount, divisional and sub-divisional) and the *tengan dem* or *tendaamba*, the custodial of the earth shrines and of the land; these roles are usually inherited and exclusively performed by men (Kunbuor, 2002). Many ethnic groups in the northern sector, including the Dagare, traditionally have women's leader, but they play a subordinate role (Odame, 2014). On the contrary, the role of the Queen Mother as a powerful traditional leader complementing the chief appears to be common among Akan communities in the south of the country (Odame, 2014). According to some sources, a model of women's leadership has been introduced and empowered in the northern sector by governmental and non-governmental actors (Apusigah, 2009; Odame, 2014). In the northern sector, these female leaders are called *magajias* or *magazia*. They should act as role models for the women of the community and are generally responsible for issues regarding the family and women and children in the community. More recently they participate in negotiations on issues regarding the community, mobilise women for communal labour and coordinate those of them who embark in economic activities, such as brewing *pitu*, making soap, processing shea nuts (Odame, 2014). The magazia are often involved in NGOs' projects for their capacity to mobilise and reach other women; in Nadowli-Kaleo, they have been given trainings on maternal health, malaria prevention, birth control and nutrition (Odame, 2014). The political role played today by some magazia of the area is purely achieved, it often depends on their education and the capacity to influence others instead of being inherited, and varies across the localities in the District (Odame, 2014). The magazia's actual political power is very limited because women are not traditionally involved in the public life of the communities; therefore, they do not play an important role in issues regarding land disputes, conflict resolution and maintaining law and order in their communities. This is due to the fact that their male counterparts do not recognise them as leaders and they are often mistrusted by chiefs and some community members, including other women (Odame, 2014).

1.5 The Adaptation Fund's project, its dry-season farming component and gender aspects

As stated earlier in the introduction of this research, the findings of this work will be used to provide recommendations to implementers of a project funded by the Adaptation Fund (AF) on how to better engage women in dry-season farming practices, one of the three pillars of the project. The AF provided a grant of $8,2mln to the Government of Ghana (GoG) to implement the programme titled "Increasing Resilience to Climate Change in Northern Ghana" (Adaptation Fund, 2015). The executive agency is the Ministry of Environment, Science, Technology and Innovation of Ghana through its Environmental Protection Agency (EPA), while the implementing entity is the United Nations Development Programme (UNDP). Ten district in the three northern regions were identified, namely Lawra, Nadowli and Sissala East in the Upper West Region[8] (Adaptation Fund, 2015). This research will take place in some of the AF target communities.

The programme has three main components: the first and the second deal with water resources, their planning and management at a community level, while the third is about the diversification of livelihoods. The goal of the third component, on which this research is focussed, is to introduce or support activities that are not dependent on rainfall patterns; this activities are dedicated to women. The third component has a budget of $2,25 mln divided into five outputs and should target all the 50 beneficiary communities across three regions. The second output of this component is the promotion of dry-season farming, food processing schemes (shea butter or honey production) and bee keeping practices among existing women's groups.

The project has a specific focus on women and adopts a gender mainstreaming approach based on the acknowledgement that they are disadvantaged in terms of ownership and access to land and resources, decision-making in the household and access to information and knowledge. According to the implementers, the disadvantage is due to cultural norms that impose heavy workloads on women which result in time constraints and limited awareness and participation in development programmes (Adaptation Fund, 2015). The proposal developed for the AF looks to be overall sensitive to gender-related constraints faced by women with regards to participation in projects; for example, meetings and trainings for female farmers are going to be scheduled in ways and times that allow them to participate together with men. The AF policies on gender remark the need to implement learning and knowledge management processes on gender mainstreaming (AF Gender Policies, 2016). However, those social norms and constraints are interestingly not mentioned in the list of possible barriers to achieve the desired results. This list includes, among others, limited institutional capacity in integrating climate change threats into planning, limited human capital and lack of incentives for communities and local organisations to conscientiously manage resources. The M&E framework for the AF project is part of the

[8] Evidence in the field suggest that Lawra District was probably replaced by the neighbouring Nandom District, even though it is not indicated in the project's proposal, and the Nadowli district is officially called Nadowli-Kaleo.

proposal and is based almost solely on quantitative indicators to estimate women's participation (Adaptation Fund Board, 2014). Hence, gender-disaggregated data collection is considered a sufficient indicator of active and effective participation.

CHAPTER 2

Review of the literature and theoretical framework

This chapter features a brief literature review on the themes of differentiated vulnerability to climate change in rural communities and of gendered crops, the identification of a gap in the current scholarship and the consequent contribution that this research aims to give. The second part of the chapter, dedicated to the discussion of intersectionality as a theoretical framework, is strictly linked to the following chapter on the research aim and design.

2.1 Literature review

The literature review in this section covers two main topics both relevant to this research: the background literature that informs interventions addressing women as an especially vulnerable group to the impacts of climate change and the scholarship that raised the issue of gendered crops, which is the point of departure to analyse whether dry-season crops are "gendered" and the implications of this for climate-smart initiatives.

An extensive body of literature exists on the topics of vulnerability to climate change and on the groups that are most hardly hit by its threats, often identified as vulnerable are women and children. This literature has by and large influenced development interventions by international agencies and national governments, including the programme "Increasing Resilience to Climate Change in Northern Ghana" funded by the AF. Extensive literature on gender roles in agrarian societies and its links with women's higher vulnerability to climate change exists (see for example: Denton, 2002; Nyantakyi-Frimpong & Bezner-Kerr, 2015). It proved that "differential vulnerability emanates from patriarchy, cultural norms, and property rights, all of which restrict women's access to household granaries, with implications for their children" (Nyantakyi-Frimpong & Bezner-Kerr, 2015, p. 54). Indeed, micro-level gender dynamics, power structures and social norms shape women's and men's differentiated vulnerability and consequently their resilience to climate change and adaptive capacity (Nyantakyi-Frimpong & Bezner-Kerr). Women are often deemed to be more vulnerable to climate change than men due to their lower social status in the community they live in and their high dependency on natural resources, such as water and firewood, to maintain the family's well-being of which they are responsible (Meyiwa et al., 2014).

These findings inform NGOs whose area of intervention include climate-smart agriculture and community-based adaptation (CBA) initiatives (an example relative to such

interventions is the Adaptation Learning Programme. See: CARE, 2010). Such programmes often target women in rural communities as a group which is homogeneously poor and equally dependent on natural resources. However, there is growing awareness on the limitedness of unidimensional approaches that only take into consideration one isolated variable, in this case gender, to determine the vulnerability of a certain group (Carr, 2008; Carr & Thompson, 2014). This critique, and the rise of the concept of intersectionality as an alternative, will be analysed in the following section, 2.2 on the Theoretical framework.

There is a growing body of literature on gendered crops, especially with reference to Ghana (see: Padmanabhan, 2007; Carr, 2008; Doss, 2002; Lope-Alzina, 2007). This literature will be used as a foundation body of knowledge for this research. The concept of 'gendered crop' is based on the idea that some crops are grown exclusively by men or women, or jointly, depending on the circumstances (Padmanabhan, 2007; Carr, 2008; Doss, 2002; Lope-Alzina, 2007). Research has shown that men and women have different roles in the agricultural production and that these roles result in different socio-economic position (Carr, 2008). This division is especially important in the context of adaptation-related interventions:

> Of particular concern is the fact that, by virtue of often farming different crops or farming the same crops for different reasons, men and women experience different vulnerabilities to such things as climate change and shifts in global markets for the crops under production, shifts that can [...] impact the long-term well-being of affected communities and individuals. (Carr, 2008, p. 901)

Several studies on the gendered division of crops have been conducted in Ghana, including in the three Northern regions, where this research has been carried out. A number of studies acknowledge some sort of gendered crop division; an example is a classification based on the cooking use of the crops, namely women should grow the vegetables which are used to prepare the soup, while men are responsible to provide the cereals for the staple (Padmanabhan, 2007). However, there are some exceptions in the literature. It has been argued that, although there are gender drivers in the farming patterns, it is not possible to draw a clear distinction between female and male crops, as men and women can grow the same vegetables in different circumstances (Doss, 2002). More recently, a new critique emerged on unidimensional analyses that treat gender as an isolated variable, and the only socially relevant one, which divides individuals into two homogeneous groups, men and women. Carr argued that this binary categorisation "Can erase very real and practical differences between those contained within these categories as well as across them" (Carr, 2008, p.901). This line of thinking has generated a number of studies suggesting that intersectionality, the simultaneous study of a set of social characteristics and their overall influences on individuals, provides a more accurate theoretical approach to climate change-related research (Kaijser & Kronsell, 2014) and analyses of rural communities, such as gendered crops research.

2.1.1 Identification of the gap in the literature

This research aims to analyse how multiple variables, namely gender, wealth, ethnicity, marital status and age, contribute to determining the production patterns of dry-season farming and the adjustments of these patterns when the introduction of new varieties occurs. Currently, there is a lack of knowledge in the literature and among development practitioners on how to determine whether a certain dry-season crop will fall into men's or women's portfolio and on which social, environmental, technical factors determine this division. In other words, there is no background literature to assess whether the introduction of new dry-season crops through interventions targeting women will end up diversifying women's livelihoods, or how likely it is to be co-opted by male livelihoods. Moreover, there is a lack of understanding on the role other social variables, such as wealth, ethnicity, marital status and age, in shaping patterns of agricultural production in the dry season across and within groups of women and men. At present, it is not possible to speculate with a reasonable degree of certainty whether a certain crop will be adopted by men or women, well off or poor individuals, young or old farmers, members of female- or male-headed households, members of the dominant or of minority ethnic groups - or by all of them in different circumstances. This research aims at providing the essential background knowledge, now absent, to consciously address the intended beneficiary group(s) through interventions based on the introduction or up-scaling of dry-season farming.

2.1.2 Scientific and societal relevance

From a scientific perspective, this thesis will fill the literature gap on gendered crops in Northern Ghana, with a focus on dry-season farming. It will identify which factors related to gender, wealth, ethnicity, marital status and age determine the engagement in dry-season farming and whether there is a clear gendered division of crops; it will provide a theoretical framework to study this topic in other farming communities in semi-arid sub-Saharan African areas.

From a societal perspective, this research will contribute to provide insights on how to better target the beneficiary group of climate-smart interventions. In adaptation interventions carried out by NGOs in semi-arid areas, there often is a dry-season farming component; this is because agriculture is traditionally rain-fed in these areas and therefore very prone to the effects of climate change. Building on the proven higher vulnerability of disadvantaged groups to climate change, NGOs often target women as beneficiaries of such interventions, but may fail due to lack of knowledge on gendered patterns of agricultural production and of the other social factors that influence it. The findings of this thesis will widen the understanding of these issues and provide a map of factors that determine women's involvement in dry-season farming based on the type of crop, the conditions in which the intervention is carried out and the variety of social and economic conditions lived by women with relation to their wealth, ethnicity, marital status and age. This research ultimately aims at making climate-smart interventions more effective in terms of targeting their chosen beneficiary group(s).

2.2 Theoretical framework

The theoretical approach employed to study the puzzle of dry-season farming interventions and of gendered crops in Northern Ghana is that of intersectionality. This framework has previously been adopted in the literature on gender and adaptation in agrarian contexts by a number of authors (Carr, 2008; Carr & Thompson, 2014). A brief excursus on intersectionality and its emergence in the feminist literature is needed to clarify this concept which is still seldom employed in the literature on climate change. Intersectionality emerged in the feminist scholarship in the late 80s and early 90s as a critique to white feminist scholars and activists that aimed at representing all women ignoring the experiences of black women, oppressed both for their gender and their race. Intersectionality emerged as an analysis that "Contrast[s] the multidimensionality of Black women's experience with the single-axis analysis [white feminism] that distorts these experiences" (Crenshaw, 1989, p.139). Crenshaw, who is considered the pioneer of intersectionality, argues that the discrimination faced by black women was not determined by their gender alone, but by their gender *together with* their racial identity:

> Black women sometimes experience discrimination in ways similar to white women's experiences; sometimes they share very similar experiences with Black men. Yet often they experience double-discrimination - the combined effects of practices which discriminate on the basis of race, and on the basis of sex. (Crenshaw, 1989, p. 149)

The idea put forward by Crenshaw is that multiple identities related to gender, age, ethnicity, religion, sexual orientation, class, disability and others always intersect to create a whole individual. This framework acknowledges that social inequality occurs on a multidimensional basis and that discriminations based on gender, ethnicity, religion and others do not act independently (Crenshaw, 1989). Gender is therefore seen as one possible determinant of social exclusion, but not the paramount or the only one. Intersectionality contrasts the idea that women are to be treated as an homogeneous group; the fact that they share the same gender does not result in the same life experiences, discriminations and needs, even in the same context. In this new line of thinking, gender is placed in relation to other power structures such as class and ethnicity, rather than seen in isolation (Kaijser & Kronsell, 2014). In other words, the centrality, previously granted to gender, shifted to "the interaction between gender, race, and other categories of difference in individual lives, social practices, institutional arrangements, and cultural ideologies and the outcome of these interactions in terms of power" (Davis, 2008 in Kaijser & Kronsell, 2014, p. 418). This interaction of multiple axes of identity -gender, class, ethnicity, age among others- and its social outcomes is the focal point of the concept of intersectionality.

Feminist research in adaptation and agrarian contexts focussed on gender as a main social divide for decades, and intersectionality has been adopted only recently by a few authors (Carr & Thompson, 2014). While it is widely accepted that vulnerabilities to climate change impacts are determined by roles, responsibilities, livelihoods, constraints and capabilities of individuals (Pelling, 2011), gender was deemed to be the main factor that influences an individual's vulnerability and potential adaptive capacity. Gender concerns are now part of the core

development efforts at all levels, including the United Nations (Thompson et al., 2016). While climate change research increasingly considers social dimensions, most of the literature has a unidimensional approach, as it uses a single variable, be it gender or social class, to explain power dynamics (Kaijser & Kronsell, 2014). The intersectionality framework is not widely employed yet compared to conventional approaches that make a narrow analysis through a single variable, e.g. gender, and two categories, men and women, treated as two groups homogeneous within themselves and opposed to each other (Carr & Thompson, 2014). Indeed, recent research has shown that "many of the constraints and opportunities people face in the context of climate variability and change are shaped at the intersection of the responsibilities and expectations attached to a wide range of social differences" (Carr & Thompson, 2014, p.183). It has been argued that gender alone is not a sufficient explanatory factor of vulnerability and resilience: for instance, it is very well possible that in an agrarian context the livelihood of a wealthy woman is more similar to that of a wealthy man than it is to the one of a poor woman, and so her vulnerability to climatic changes (Carr & Thompson, 2014). Moreover, it has been argued that a unidimensional approach to adaptation would lead to maladaptive interventions that risk to increase the vulnerability of the most marginal groups instead of improving their adaptive capacities (Carr & Thompson, 2014). An alternative to these unidimensional approaches is to look at the differences within groups of men and women with regard to their power, knowledge, access to resources and others: conditions that depend on more than mere gender categories.

2.2.1 Suitability and application of the theoretical framework

In this research, an intersectional approach as discussed in the previous paragraph is used to establish which conditions determine the patterns of engagement in dry-season farming in the context of agrarian communities in the Upper West Region of Ghana. Such analysis is informed by the awareness that a binary analysis to gender can lead to maladaptive adaptation and the outcomes of it will contribute to provide recommendations to the implementers of the AF-funded programme in Ghana with regard to its diversification of livelihoods component (see Context and actors Chapter). An intersectional approach to gender is considered appropriate to assess the different livelihoods strategies of the programme's target communities as it has being employed in similar contexts in the literature. In fact, a study on gendered crops with such a framework was conducted in Ghana by Carr (2008) and compared with results analysed with a conventional, binary approach to gender. The author argues that "Compared to a feminist empiricist approach, a feminist post-structural approach to gender [intersectional] will, in most cases, allow us to understand with greater resolution the diversity of vulnerabilities in play in a given community" (Carr, 2008, p. 912). The variables that will be taken into consideration in this research work, in addition to gender, are wealth, ethnicity, marital status and age. The impact of these variables will be discusses with regards as a determinant of constraint in a number of features of dry-season farming grouped into areas. For a throughout discussion on the features of dry-season farming and on Areas of constraints, see Chapters 5 and 6 respectively. The application of the theoretical framework is part of the "Determinants of constraint" component of the research design (see paragraph 3.3).

CHAPTER 3

Research aim and research questions

This chapter outlines the aim and outcomes of the research, the questions it aims to answer and the design of the research. A mind map at the end of the chapter shows how the components of the research design, namely the features of dry-season farming activities and crops, the areas of constraint, the determinants of constraint, the explanatory factors, and the critical variables, are related to each other.

3.1 Research aim

This research aims to contribute to the academic debate on gendered crops and on how to apply an intersectional approach to the study of patterns of adaptation in rural environments. It also aims at translating these findings into recommendations for the "Increasing Resilience to Climate Change in Northern Ghana" programme implementers with regards to addressing women through dry-season farming interventions.

As for the academic outcomes, this thesis aims at mapping the factors that influence the engagement in dry-season farming activities and the "ownership" of the crops based on gender divides and other characteristics such as wealth, ethnicity, marital status and age in an intersectional perspective, and to enrich the body of knowledge on these themes.

With regards to the policy recommendations, this research will provide a list of factors related to dry-season farming and crops that influence the participation of women in the alternative livelihoods component of the AF-funded programme which will be implemented in the three northern regions of Ghana between 2015 and 2019. In fact, it has a strong component of promotion of alternative and resilient livelihoods in the dry-season and a specific commitment to target women as *exclusive* beneficiaries of this diversification through a gender mainstreaming approach to programme implementation and evaluation (Adaptation Fund, 2015). For a detailed outline of the AF, see the Context and actors Chapter.

3.2 Research questions

- Main research question:
    - How do multiple social variables intersect to create patterns of dry-season farming engagement and modes of production among smallholder farmers in Northern Ghana?

- Sub-questions:
    - What are the current farming practices in the dry-season in terms of crops, farming and irrigation systems, farmers' engagement, input procurement, selling methods, and other relevant features?
    - Which factors related to the current dry-season farming practices determine the engagement in dry-season farming in Northern Ghana across social groups? What challenges, barriers and risks constrain farmers' engagement?
    - Are there exclusively men's and/or women's dry-season crops? If not, which other variables can explain crop production patterns?
    - Which local conditions, farming and irrigation practices, resources needed for each crop and other features are critical for dry-season farming-centred interventions and can be used to engage the targeted social group?

3.3 Research design

To answer the above questions, it is necessary to systematise the concepts that they underpin. These concepts are the following:

- **Features of dry-season farming activities and crops**: the characteristics of dry-season farming in terms of activities required (e.g. irrigation, fencing, farming techniques, sale) and of crops (e.g. length of the farming cycle, inputs procurement, cost of inputs);
- **Areas of constraint**: categorisation of the features (see above) based on the constraints some farmers encounter in carrying out the activities required for each feature (e.g. an area of constraint might be mobility, as some farmers with a limited mobility might have lower chances to sell their crops);
- **Determinants of constraint**: social variables, namely gender, wealth, ethnicity, marital status and age, that can act as enabling or constraining factors on the capacity to carry out specific dry-season farming tasks and on the overall engagement;
- **Explanatory factors**: broader societal factors that explain why the determinants of constraint act as such in the context of the target communities creating the constraints identified in the areas above with effects on the dry-season farming features;
- **Critical variables**: the aspects of dry-season farming that are critical in NGOs and Governmental interventions and can be tailored to address the target group(s).

The above concepts are consequential and represent a process of "digging" more and more in-depth into the dry-season farming production patterns. The data gathered on each concept informed the analysis of the following: in fact, the superficial **features of dry-season farming** were investigated first and classified into **areas of constraint**; the understanding of which factors were relevant in creating such constraints lead to the identification of **determinants**; digging deeper into the determinants contributed to identify social **explanatory factors** of why and how certain social variables result into constraints in dry-season farming; finally, the above information was translated into **critical variables** that should inform external interventions and can be used to both loosen the areas of constraint and innovate some features of dry-season farming.

Below is a mind map of these concepts that shows their reciprocal relations.

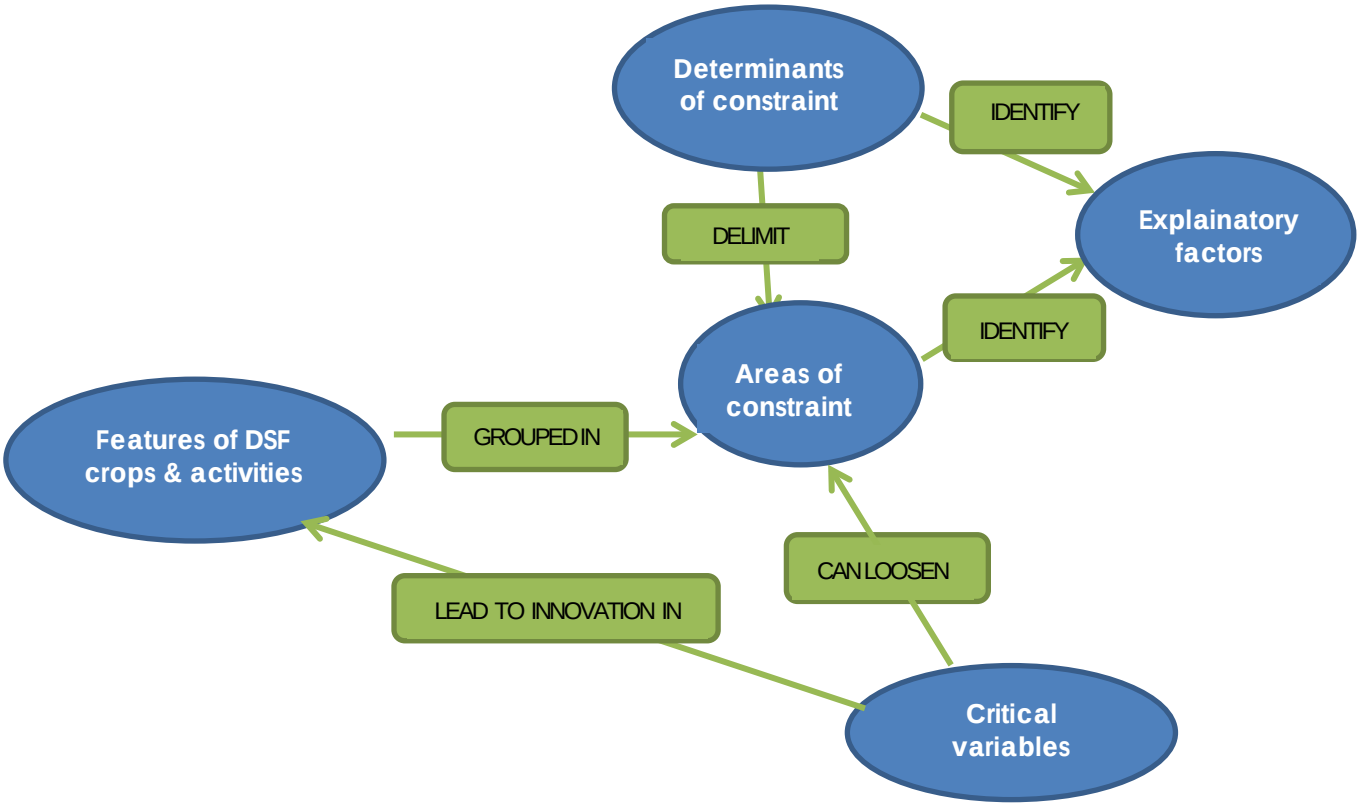

Figure 3. Mind map of the research design. Elaborated by the author.

CHAPTER 4

Methodology

This chapters contains an overview of the mixed methods approach employed for the data collection and analysis and of the principles that guide it.

4.1 Methods

The data collection took place in all the five target communities of the "Increasing Resilience to Climate Change in Northern Ghana" programme in the Nadowli-Kaleo District, located in the Upper West Region; these are Takpo, Jang, Namville, Zupiri and Goli. For the purposes of the programme, these communities were selected by local stakeholders based on a list of criteria, including the communities' current level of engagement in adaptation and income-generating initiatives carried out by NGOs already active in the area, such as CARE International. The research methodology will be mixed: qualitative and quantitative methods are combined and the overall attitude to the research has some elements of a participatory approach. The data gathered during the 12-weeks fieldwork will be integrated when needed with secondary data about the area from Government sources (e.g. National Census) and previous research.

Qualitative data will be collected through focus group discussions, in-depth interviews and participant observation with groups of female and male dry-season farmers in the five AF communities in the Nadowli district. Moreover, at least one in-depth interview will be carried out with the *Magazia* (women's leader) and/or Queen Mother where present in each of the 5 communities. Some elders of the communities and a number of key-informants of the Department of Agriculture and NGOs active in the area with climate-smart projects will be interviewed. Other key-informants are members of the EPA, MoFA and MESTI who are involved in the implementation of the "Increasing Resilience to Climate Change in Northern Ghana" programme, with whom interviews and informal conversations have been carried out to gather data on the implementation stage of the programme. To triangulate the data gathered with the methods described above, a quantitative approach will be adopted too. Participants will be identified in each community and a survey will be administered to a sample of male and female farmers. It will provide data on the background of people involved into dry-season farming (gender, marital status, education), the variety of crops they grow, the surrounding conditions (being part of a group, having started the activities as a result of an NGO intervention, the proximity of the gardens to their house, their means of transport) and the agricultural techniques they employ (use of fertilisers, type of irrigation, type of fencing). The number of farmers surveyed will be 25 per community, so the total number of surveys administered will be 125.

The sampling technique for the focus groups will be based on existing farmers groups as in each community there is at least one group of farmers sharing a common plot. As for the interviews with the farmers and the survey (see below), the sampling technique will be relying on available farmers coupled with a stratification of the sample to decrease the bias of this technique. An equal number of female and male farmers will be sampled across the five communities; moreover, farmers from all water points -dams, dugouts and rivers- in each community will be selected. The number of off-season farmers in each community is small, so the sampling will include the majority of them. However, it must be noted that the sampling neither aims to be representative of the whole dry-season farming community nor to be statistically perfectly randomised. This is because there is no data available on the number of dry-season farmers in the area and the research timeframe does not allow the researcher to obtain such data.

To summarise, the following data collection activities have been carried out:

- 1 focus group discussions per community, 5 in total, with men and women separately;
- In-depth interviews with the *Magazia* and/or Queen Mother of each of the five communities, 5 in total;
- In depth interviews with farmers, one male and one female farmer per community, 10 in total;
- 8 in-depth interviews with key-informants (elders of the community, officers of Department of Agriculture and of locally active NGOs);
- 125 surveys across the 5 communities;
- Participant observation.

The qualitative data collection will have some elements of participatory research as it allows me to better develop the research aim and questions. In the literature, participatory research is distinguished not much by its methods, but rather as a practice "that argues in favour of the possibility, the significance, and the usefulness of involving research partners in the knowledge-production process" (Bergold & Thomas, 2012, p.192). The primary aim of a participatory research process is to give a voice to members of marginalised communities, or provide them means to make their voices heard, and this collaboration is possible only when based on trust (Bergold & Thomas, 2012). Important features of a participatory approach are the democratic conditions of the research site, that can have a great impact on participation; the creation of a "safe space" where participants feel that they can freely express their critical opinion and do not fear the consequences of that; and the awareness that research must be conducted *with* the affected people, not *about* them. This participatory and qualitative approach to research will allow the researcher to unveil the reasons behind the choices made by farmers in the context of dry-season agriculture and is coherent with a intersectional approach to the matter. Indeed, it has been argued that:

> Traditional, (typically) quantitative approaches to gender analysis may not be sufficient for elucidating the norms and roles that underlie gender dynamics in specific sociocultural contexts, or identifying entry points for transforming

> gender norms and thereby enabling a community's adaptation to climate change (Nelson & Stathers, 2009). They may, in fact, be promoting the predominant framing in much of the climate change discourse of women as a homogeneously vulnerable yet nature-protecting group (Arora-Jonsson, 2011). (Jost et al., 2016, p. 134)

In fact, this would be an oversimplification that impedes a full understanding of gender dynamics with relation to climate change (Jost et al., 2016).

4.2 Limitations and ethical concerns

There are a number of limitations of this research, having to do with the small area researched, the language barriers, the researcher bias and the involvement of research assistants. Due to time and resources constraints, only one District among the three of the AF will be researched, therefore the generalisation of the findings might be limited. To overcome the language barriers, as most respondents do not speak English, one local translators was hired and trained. As most respondents will be women, the translator is also female in order to ensure an open conversation and the creation of a "safe space". For the same reason, focus group discussions with farmers have been carried out in female-only and male-only groups. Local research assistants were trained to administer part of the questionnaires. Part of the questionnaires were administered in the absence of the researcher, therefore the quality of the questionnaires autonomously administered by assistants is beyond the researcher's control. The topics that have been discussed are not especially sensitive, as expected; therefore, there is no expected or likely harm that the research could make to respondents. Moreover, Fulani pastoralists were not included in the sample, although ethnicity is taken into consideration in the analysis. This is because, although they are members of the targeted communities, their exclusion from dry-season farming activities would have skewed the analysis towards considering ethnicity a major determinant of constraint while in fact it only involves a single minority in comparison to other, more relevant, determinants of constraint.

CHAPTER 5

Dry-season farming in the target communities

This chapter addresses the current state of dry-season farming in the target communities by discussing the common features observed in all of them and the local peculiarities of each. Based on this information, the critical features of dry-season farming activities and crops have been identified and successively classified into areas of constraint. The areas of constraint represent the categories of actions and activities in which some social groups might be hindered in their engagement in dry-season faming. Such areas of constraint will be employed to investigate the differentiated involvement in dry-season farming of individuals based on an intersectional analysis.

5.1 The target communities and their common characteristics in dry-season farming patterns

As a preliminary consideration, it should be noted that, similarly to what happens in the whole northern sector of Ghana, in the UWR the dry season is commonly intended as a time of rest after the work carried out in the farming season, concentrated. Hence, off-season farming is not embedded in the traditional farmers' lifestyle and yearly work routine. There are some typical dry season activities, which do not include farming: provision of firewood for the rainy season, production of building bricks, hunting, attending funerals and other celebrations (see Chapter 1 on Context for more information).

An intrinsic characteristic of dry-season farming is that, not being rain-fed, it needs an alternative source of water. Most often, farmers use water from boreholes, wells, dugouts, dams or rivers to irrigate their gardens and in each community there might be several sources of water. Boreholes, dugouts and dams are all sources of groundwater, as opposed to rivers. The main differences between the dugouts and dams lie in their size, structure, and responsible institutions for construction and maintenance. Dugouts are smaller than dams and often used for small-scale farming, while dams are also suitable for activities such as livestock watering, fish production and mechanised irrigation for large scale agricultural production. The structure differs considerable because dugouts, unlike dams, do not have canals or intake structures; moreover, they are usually dug by communities and local governments, whilst dams are often financed and built by donors and NGOs (Namara et al., 2011).

Figure 4. A dugout employed for dry-season irrigation. Picture taken by the author.

Figure 5. A dam employed for dry-season irrigation. Picture taken by the author.

Figure 6. Black Volta river employed for dry-season irrigation. Picture taken by the author.

In a small number of cases, farmers use borehole water to irrigate their plots, while boreholes are most commonly used for drinking and domestic activities such as washing, cooking, bathing. Some farmers irrigate their plots manually, with buckets, basins or watering cans; others have water pumps, especially when dams and rivers are the sources of water. As water pumps are expensive items, they are usually not owned by individuals but rather provided by NGOs or the Government and used in groups. However, even when pumps are donated, their use requires the use of fuel to power a generator; the cost of the fuel is borne by the farmers.

A common feature of plots used for off-season farming is that they are often located in the outskirts of the communities. This is especially the case for the plots irrigated by dams and rivers, which tend to be outside of the densely populated areas of the communities. In the research sites, famers usually spend 15 to 30 minutes to reach them, but it can sometimes take up to one hour. Most farmers reach their plots on foot, while some have a bicycle or, in very few cases, a motorbike. The ownership of a bicycle or of a motorbike not only influences the travelling time, but also the capacity of transporting the crops from the gardens to the selling point (e.g. local market).

Another common feature is the presence of livestock freely grazing in the communities, especially goats and sometimes cattle. All livestock is free to roam in the dry season, unlike in the rainy season when animals usually enclosed. Therefore, all dry-season crops need to be fenced to protect them from the animals. Traditional fencing methods include sticks, canes, brushwood and the so-called live fencing; while the first types need to be replaced every year as they degrade quickly, the live fencing is a type of bush that takes around 2 years to fully grow and provides a thick defensive layer to the gardens which lasts for years.

Figure 7. In the background, brushwood as a fencing method. Picture taken by the author.

Figure 8. In the foreground, sticks fence under construction. Picture taken by the author.

Another option is the wire fencing, which can only be bought in the bigger towns; it provides the most effective protection to the gardens, but it is usually unaffordable to farmers. Therefore, most of the times it is donated by an NGO or the Government. An additional challenge is that while goats, sheep and animals of similar size are easily discouraged by any type of fencing, bigger ruminants, such as cows, can easily destroy weak fences. Stick, cane and

brushwood fences are especially prone to be stepped on by cattle. This is especially likely to happen in plots located near the dams, as this is where the herds drink. It is a common practice among dry-season farmers to spend a large part of their day in the gardens in order to be able to chase animals away, in case they come close to the fence.

In all target communities, dry-season farming is perceived as a highly time-consuming activity. This aspect is linked to some of its characteristics discussed above. These include the necessity to water the crops daily, the distance that farmers need to travel to reach their plots and the time spent in the gardens to protect the crops from animals. These are time-consuming tasks that should be added to the active work needed for the other usual farming tasks, such as preparing the land, sowing, weeding, harvesting.

Dry season crops grown in all the communities are a number of local leafy vegetables including pumpkin leaves, beans leaves, cassava leaves and others, okra, tomatoes, cabbage, peppers, onions, salad, sugarcane, maize. Across the sample population, the most common are local leaves, okra and tomatoes; each of them is grown by more than 70% of the farmers surveyed[9]. These crops have different characteristics in terms of maturing times, cultivation techniques, availability and cost of the seeds in the local market, use of fertilisers and pesticides, saleability in the local market. It should be noted that all the researched communities are at least 15km far from the closest bigger town (either Nadowli or Wa), but often 30km or more[10]. This has repercussions on the ease of supply of the inputs for the farming, as especially certain seeds and chemicals (fertilisers and pesticides) are only sold in bigger towns. It also influences the availability of a market for some of the vegetables grown in the dry season. In fact, most people living in the target communities consider vegetables commonly grown as dry-season crops, such as carrots, salad and cabbage, as exotic products that are not embedded in the local diet. Therefore, the only way to sell them would be to reach the closer town, which can take a long time without a private means of transport, such as a motorbike.

In brief, dry-season farming in all the target communities has the following common features:

- It is not embedded in the traditional yearly farming routine;
- The crops are irrigated through dams, dugouts, rivers and occasionally, boreholes;
- The plots are usually located in the outskirts of the communities;
- The crops are threatened by the presence of livestock and therefore all plots are fenced in a variety of ways;
- It is very time-consuming, as crops need to be watered every day and protected from animals, if the fencing is not sufficient;
- It can require inputs that can only be bought in the nearest towns and some of its products are more likely to be sold there.

[9] Each farmer often grows more than one crop variety, so the respondents were given the chance to give more than one answer to the question on which crops they grow.
[10] All distances were measured with a GPS device and confirmed with those indicated by Google Maps.

These characteristics have a differentiated impact on the active participation of social groups in dry-season farming, depending on a number of factors, including gender, ethnicity, wealth, age and marital status. For example, gendered roles in household keeping greatly limit the amount of time women can commit to dry-season farming; in contrast with men, they have to spend a lot of time in fetching water and fuel, cooking, washing, taking care of the kids and related activities.

A special note needs to be made on the presence of Fulani people, their herds, the consequences on dry-season farming and the gender issues linked to their presence. The area of the research has a historical presence of Fulani herders, a population of pastors who are partly nomadic, partly semi-nomadic and partly settled. According to the Census, the 0.5% of population of the Upper West Region is constituted by Fulani pastors, although it is hard to have a reliable estimation. In the area, there are numerous Fulani settlements, constituted by a compound located at the outskirts of the communities where a small family group lives. Simply put, they are not considered members of the community and are often not well received by the local population. Their main activity is to rear the cattle they own and/or the one of the some local families who hire them to do so. In all of the communities, there have been accidents of crops destroyed by animals, including Fulani's cattle. Therefore, all the dry-season farmers whoso plots are fenced with sticks or brushwood are aware of the risk, and some of them, depending on the severity of the situation, spend most of their day at their plots, or take turns, in order to be able to chase animals away. However, this in only possible to male farmers: women would not be able to abandon their household keeping chores for a whole day. Therefore, the presence of freely roaming small ruminants, such as goats, and especially cattle, including those reared by Fulani, represents an obstacle for those female farmers who want to engage in dry-season farming. Their options would be to either join a group formed by an NGO or the local Government where the wire fencing is provided, or to take the risk of leaving their crops unattended. Moreover, some male and female farmers mentioned cases of local women in some neighbouring communities being harassed or raped by Fulani men on their way to the plots or to the water points. Therefore, some female and male farmers in the research sites see it as a further hindrance for women who carry out dry-season farming activities. Hence, although the presence of Fulani herds could be a threat to the crops of both female and male farmers, women are definitely more prone to directly experience its downsides.

5.2 Specific characteristics of the 5 target communities

The five target communities are located in the Nadowli-Kaleo District; below is a map of the District where all communities are visible.

Figure 9. The Nadowli-Kaleo district with the five target communities (highlighted in red). Elaboration of the author

5.2.1 Takpo

Takpo is close to Namville and about 27km far form Wa, less than half on an unpaved road. It is connected to Wa on market days, every six days, and is located in a relatively densely populated area with scattered medium/sized communities. There is a dam and a number of dugouts which have been used for dry-season farming, but at the time of the data collection the most of the farmers stopped due to the presence of large herds which crashed the stick fences made by the farmers and spoiled the crops. A peculiarity of Takpo is the Chief, an aged man who had a university education in Canada and is fluent in both English and French. He is the reference point of all the NGOs working in Takpo and is considered a very resourceful person.

5.2.2 Goli

Goli is about 10km far from Nadowli, the main town of the District, and relatively well connected to it, while it is 35km far from the regional capital Wa. It has a well-established group of dry-season farmers who farm next to the dam, located outside the community. An international NGO set up a system of drip irrigation, fuelled by a water pump, on a large wire-fenced plot next to the dam. A group of women and men, where women are two thirds of the total number of participants, has been set up by the NGO and currently engages in the farming. The peculiarity of Goli is the presence of a retired agriculture teacher who, given his experience and dedication, acts as a point of reference for the whole group, coordinates the work and advices the group members. He has been farming a variety of vegetables and fruits next to the dam for more than a decade and spends most of his day there, to farm his crops. The group established by the NGO had a number of challenges in the two years of the project, therefore a number of farmers abandoned the group. At the time of the research, the NGO had concluded the project, but the group is still carrying out the activities thanks to the coordinating effort of the retired teacher.

5.2.3 Namville

Namville is about 33km far from Wa and equally far form Nadowli, the other biggest town of the area, with half of the road unpaved. It is reachable with public transport on market days (every six days) and there are other medium-sized communities in the area. It has a dam located outside of the community where farmers groups grow their dry-season crops both in wire-fenced plots thanks to the intervention of an NGO and independently in stick-fenced areas. There is a model garden funded through the District Assembly; the Ministry of Food and Agriculture provided wire fencing and water pumps. In the model garden, an equal number of women and men work, as requested by the donors.

5.2.4 Zupiri

Zupiri is the remotest and smallest community among the researched ones. It is about 35km far from Wa and about two thirds of the road is unpaved. It is the only community which does not have a market, while all the others have one every six days. These makes it very hard for farmers to sell their products locally and to buy any input for the dry-season farming. The community is located just a couple of kilometres far from the Black Volta river, which is the border between Ghana and Burkina Faso. Because of this, inhabitants of Zupiri intermarry with members of the bordering communities Burkina Faso and a few attended school there. It is common to cross the river on board of a pirogue to reach the closest Burkinabé market or attend social and family events, such as funerals. These close contacts are facilitated by the fact that the neighbouring Burkinabé communities belong to the same ethnic group and speak the same language. Dry-season farming takes place exclusively along the Black Volta and Zupiri is the only researched community whose source of water for dry-season farming is a river. Along the river, the farming is mainly carried out by men, but some women attended a dry-season farming training in Namville.

5.2.5 Jang

Jang is positioned on the main paved road that runs between the regional capital, Wa, and other main towns of the area. It is only 15km far from Wa, which makes it well connected through daily public and private transport to bigger markets, seeds and fertilisers selling points, local Government and NGOs offices in town. Among the researched communities, it is the one with the easiest access to the town. The culture of dry-season farming is rooted in Jang. It was initially practiced only next to some dugouts close to the centre of the village and later some farmers created new plots next to the dam that was built at a later time. At the time of the research, there were farmers on both sites. However, the dam was almost dry due to the misuse of it: it is a recurring story in the interviews conducted in the community that some fishers opened the canal of the dam in order to drain it and easily catch the fish. Therefore, only a handful of farmers remained trying to irrigate their crops with the little water that was left, while others went back to the dugouts. There is also a number of farmers, all of whom are women, who use the backyard of their houses to grow dry-season crops.

5.3 Modes of dry-season farming in the target communities

Three main modes of dry-season production were identified across the target communities: self-started, initiated by external institutions and backyard farming. Each mode of production has peculiarities in terms of women-men ratio, location of the water sources and of the plots, crops grown, reason for farming, and irrigation and fencing methods. Below is a map of one target community, Takpo, and the location of the water points (dam, dugouts, boreholes); the plots are obviously located as close as possible to the respective water source. The location of the water points with regards to the main inhabited community follows similar patterns in all the target communities.

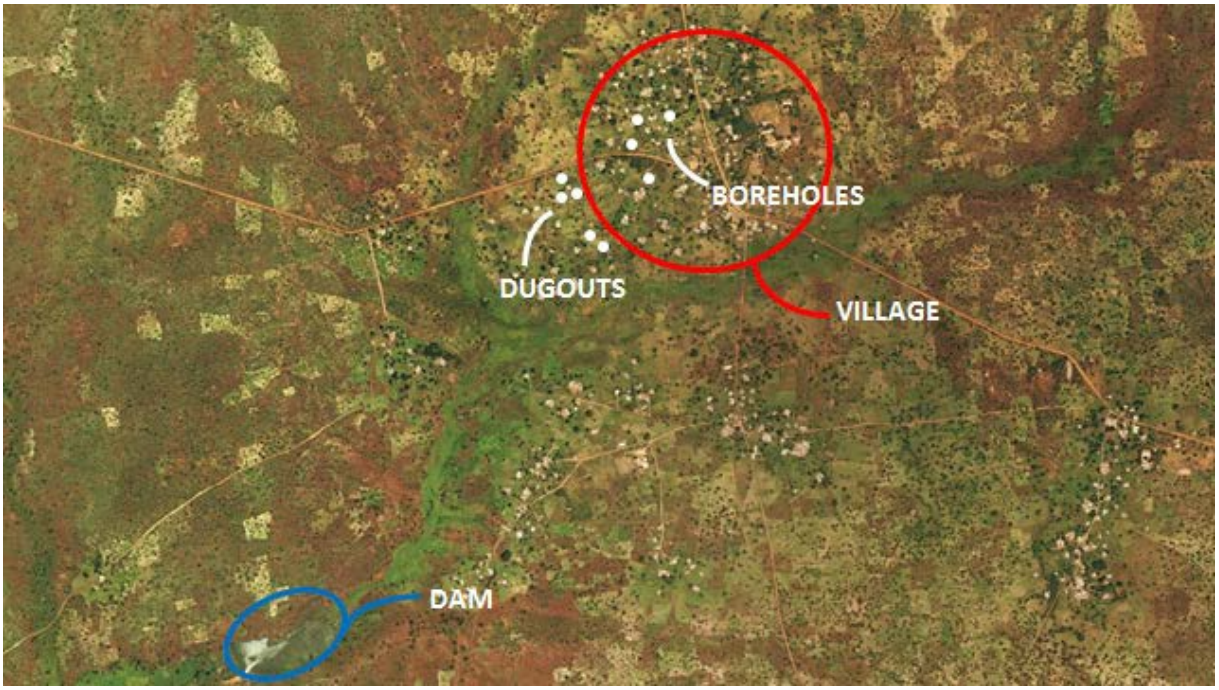

Figure 10. Common position of water sources (boreholes, dugouts and dam) with respect to the main inhabited area. Adapted from NASA SADAC and edited by the author. Retrieved at: http://sedac.ciesin.columbia.edu/mapping/hazards/# [July 2017]

5.3.1 Self-started farmers

Self-started dry-season farmers fetch water to irrigate their plots either from the dam, or the river[11] or dugouts. Being self-starters, these farmers have to procure all the agricultural inputs they might need (e.g. seeds, fertilisers, pesticides) and build their own fence, usually with sticks they gather in the bush. Inputs procurement may require a certain degree of mobility, as not all seeds are available locally and almost no chemicals are. Moreover, the tasks of manually digging the dugouts and fencing the plots require an intensive physical effort. This is a traditionally male activity[12], and the ratio between female and male self-started farmers favours men, for multiple reasons. Firstly, building the stick fence and dig the dugouts require great physical strength and women often claim that they have to ask to their husband or children for help. Secondly, it is highly time-consuming as farmers tend to spend most of their day at the farms, to protect them from roaming animals which could easily destroy their sticks fences. The main purpose of this farming is to sell the harvest, although part can be used for household consumption.

5.3.2 Institutional interventions

As maintained earlier, an increasing number of farmers is involved in dry-season farming interventions initiated by NGOs or the Government. In these cases, the source of water is always

[11] A river, the Black Volta, is only present in one target community, namely Zupiri (see section 5.2.4).

[12] See paragraph 7.3 for a discussion of this point.

the dam of the village. Often, these institutions require an equal number of male and female farmers, a majority of female farmers or even only female farmers. Therefore, women involved in dry-season farming are more and more often approaching it through institutional interventions. Less strength and time is required, as wire fence is provided by these institutions and the plots do not require any surveillance, because the wire fence is more robust than the sticks one and roaming ruminants cannot push it down easily. Inputs like seeds, fertilisers and water pumps, are usually provided by the sponsoring institutions for a few years, making it easy for those with little capital to start. As the seeds are provided by the funding institutions, the choice of the crops partly depends on them. Therefore, the variety of vegetables grown in these contexts is high and farmers are often encouraged to try new ones, considered exotic by the locals, such as carrots or salad. Institutional interventions are the only contexts in the target communities in which irrigation is sometimes carried out through water pumps; in these cases, farmers have to contribute to the costs involved with the use for the pump, namely fuel. In the farming groups of the target communities, those who cannot contribute to these costs do not have the right to make use of the pump. As shown in the picture above, most dams are located outside the communities, often 30 minutes of walk far or more, and therefore getting there and back daily can be time-consuming. Again, the production is intended for sale, although part of is consumed within the household.

5.3.3 Backyard farmers

Finally, there are backyard farmers. They are only women and have their plots around their compound houses, where rainy-season agriculture is normally carried out. They are also self-starters, so farmers must procure the inputs and build a fence. However, as the plots are small due to space constraints, only a small range of local vegetables is grown, for which the inputs are available locally. Moreover, being the plots small, the fencing activity is not too demanding in terms of physical effort and time commitment. This mode of dry-season farming production is integrated in the daily housekeeping routine. In fact, female farmers fetch water from the borehole as a part of their household chores and use part of it to water the crops. In addition, because of the location of the plots, women can farm while being around their house and keeping on carrying out their routine chores like cooking or cleaning. Another advantage given by the location of these plots is that roaming ruminants do not have an easy access to them, despite the weak sticks fences, as dwellers of the community are always in the premises and can prevent them from entering. The harvest is commonly for household consumption, and only the surplus is sold at the local market.

5.4 Gendered division of dry-season crops

Most commonly grown crops in the target communities are a number of green leaves, such as pumpkin, beans, cassava and other local varieties. These are popular as they are employed, fresh or dry, to prepare a traditional soup that accompanies the staple, composing a typical Northern Ghanaian meal. In the graph below, all these varieties were grouped under the

category "green leaves"; all farmers in the sample were found to grow at least two different varieties of these. Similar considerations are valid for the okra in terms of popularity in the local diet. Both green leaves and okra are grown throughout the year both in the rainy and dry season and can be dried to preserve them. Therefore, these crops are typically complementary to rainy season subsistence crops, such as millet, maize, sorghum and yams. Tomato is almost as popular as okra in the sample population, but, as opposite to all green leaves and okra, it is predominantly considered as a cash crop. One of the reasons for this is that tomato is a perishable crop and no preservation method is employed in the research area. Therefore, as the harvest can be abundant, it needs to be sold as quickly as possible and only part of it is used for household consumption. Similar considerations are applicable to peppers, which are chosen by about a fourth of the sample farmers population. Cabbage and watermelon are considered exotic varieties and have been recently introduced by external interventions. While cabbage is gaining popularity and entering in the local diet, the same cannot be said about watermelon, which, like sugarcane, is only preferred by one farmer. This pattern can be due to the high cost of inputs for watermelon farming, the high failure risk involved and the technical skills required to grow it. As for onions, they are very present in the local diet. However, onion growers are very specialised and localised in certain areas (not in the researched one) as the farming cycle of onions is lengthy (FAO database) and requires specific skills, such as transplanting. These characteristics explain why, despite its popularity in the diet, onion is not commonly grown by the sample population.

The graph below presents the percentages of women and men growing each of the crops mentioned above.

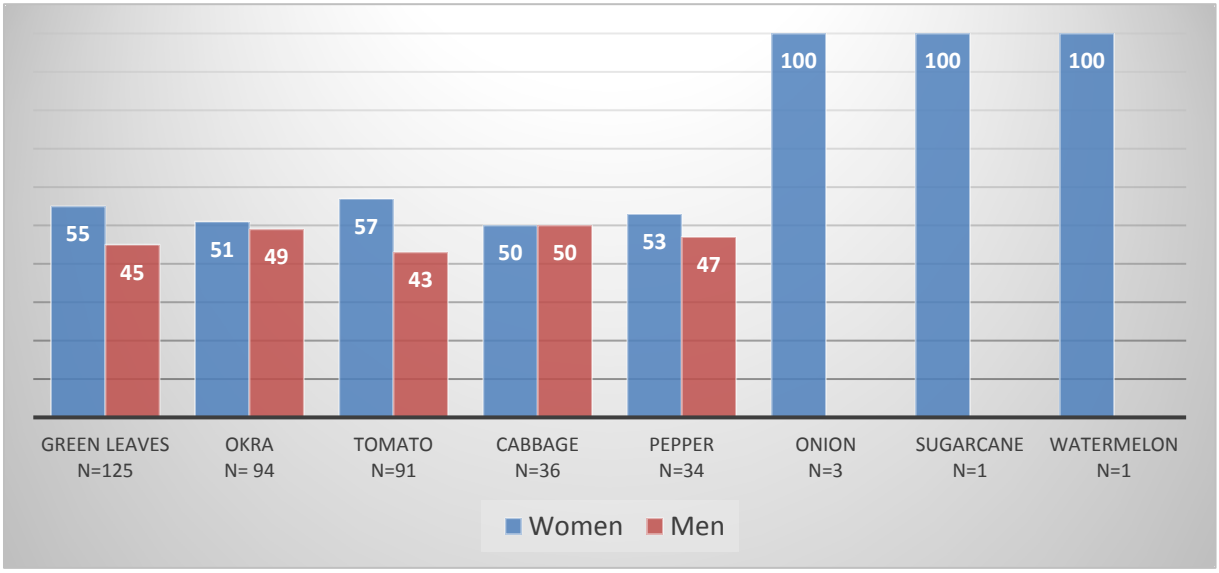

Figure 11. Percentage of women and men growing each dry-season crop. Data gathered and analysed by the author.

It is immediately evident that only the last three crops of the graph, onion, sugarcane, and watermelon, present a clearly gendered pattern, as they are exclusively grown by male farmers. However, the sample population growing them amounts to only 5 farmers, so it is not possible to draw conclusions based on such scares data. On the other hand, the most popular varieties have an almost even distribution among male and female farmers in the sample, with green leaves and tomato showcasing the largest divide. These data are not sufficient to identify a gendered pattern of crops grown by the sample population of dry-season farmers.

5.5 Identification of the areas of constraint and of the critical features of dry-season farming activities and crops

Based on an analysis of the common and community-specific characteristics of dry-season farming activities and crops in the target communities, it is possible to identify a number of critical features of cry-season farming. These are related either to the farming activities or to the crops. In the following chapters, these critical features will be analysed in order to unveil how they influence farmers' choices in terms of dry-season farming based on their own individual traits, such as gender or wealth. After identifying a number of critical features, such as the time needed to reach the farming areas or the cost of inputs, they were grouped under broader categories, the areas of constraints. The table below summarises the seven areas of constraint and of the dry-season farming features for each area.

	Areas of constraint		Features of dry-season farming
i.	**Technology**	1	Application of fertilisers and pesticides
		2	Activation of the water pump
ii.	**Mobility**	3	Selling the crop
		4	Buying inputs
iii.	**Capital**	5	Cost of inputs
		6	Cost of using the water pump
iv.	**Time available**	7	Proximity of the plot
		8	Capacity to innovate
		9	Need to guard the plot because of the presence of roaming animals
v.	**Strength**	10	Fencing
vi.	**Risk and delayed profit**	11	Duration of the agricultural cycle
		12	Likelihood of failure
vii.	**Access to land**	13	Limited availability of land close to the water sources
		14	Need to join an existing farming group to access wire-fenced plots

Table 1. Areas of constraint and features of dry-season farming. Elaborated by the author.

These features of dry-season farming activities and crops cover all the activities of the farming cycle, from accessing the land and making it suitable for dry-season farming through access to irrigation and fencing to the selling or consumption of the harvest. Moreover, they are comprehensive of all the aspects related to access to technology and capital, availability of time and mobility constraints.

CHAPTER 6

The areas of constraint and their determinants

This chapter features an analysis of the quantitative and qualitative data related to each of the features of dry-season farming activities and crops, grouped in the 7 areas of constraint. The aim of the chapter is to show the links existing between the constraints faced by farmers and the determinates of these, identified as gender, class, ethnicity, marital status, and age.

6.1 Area of constraint 1: Technology

This area of constraint is related to the ability of using the available technologies in dry-season farming activities. Although farming activities are not mechanised and by and large carried out in a labour-intensive fashion, there are some tools used by some farmers to improve the quality and quantity of their harvest. Among the limited technologies available to northern Ghanaian subsistence farmers are substances meant to enhance the crops, like fertilisers and pesticides, and machines that facilitate the watering of the crops, such as mechanised systems of water fetching and irrigation. While there are a number of relevant aspects related to the use of these technologies, such as the procurement and the costs, this area of constraint only refers to the actual use of available technologies[13]. In the case of synthetic fertilisers and pesticides, commonly referred to as "chemicals" or "sprays", the ability of using them consists in the application of the fluids on the soil and/or the plants; as for water pumps, being able to use them one means knowing the procedure to operate it and being able to carrying it out autonomously.

Based on the data collection and analysis, a few trends exist in the use of synthetic fertilisers and chemicals. The survey results show that less than half of the dry-season farmers make use of synthetic fertilisers and pesticides (46% of the sample) and that women are more likely to use them than men (56% of women compared to 35% of men). However, interviews with farmers and experts and focus groups discussions revealed that women do not apply the "chemicals" themselves, but the men in the groups do it for them. According to the retired agricultural teacher in the community of Goli, this is due to the fact that

[13] Other areas of constraints are concerned with the procurement (Area 2, Mobility) and the costs (Area 3, Capital) of inputs and technologies.

> […] women are tender, they don't use dangerous things. They don't want to and the men don't allow them to do it. Normally, men by nature are stronger than women. We [men] normally do the mountains [needed to grow yams], and we have the backpack to spray. We wear clothes, close the mouth and nose, you protect your body. After spraying we wash our hands with soap.

Women farmers confirm that they avoid applying synthetic fertilisers and pesticides as they are scared of the effects they might have on their bodies, especially those who are breastfeeding or taking care of young children. Hence, the data analysis suggests that the constraints in the ability to apply fertilisers is explained by one determinant of constraint, namely gender. A popular alternative that does not present the same (perceived) dangers of synthetic fertilisers and pesticides is manure, which is widely used applied by both female and male farmers.

As for the use of water pumps, similar constraints and determinants thereof exist. In fact,

> Women cannot operate the water pump. Even though we trained women to spark the pump, all the women, most of them, when they get close to the water they are scared. Because of that, every group has a man.

Constraints related to the use of water pumps seem to be dependent on gender only. Therefore, in the area of constraint Technology, one determinant seems to explain the patterns of use of the "chemicals" and of the water pumps, namely gender. The five target communities are homogenous in this respect.

6.2 Area of constraint 2: Mobility

This second area of constraint refers to the mobility opportunity that farmers have when selling their crops and procuring the farming inputs they need. Being able to reach a local market where the crops can be sold is essential for gaining a profit form dry-season farming activities. Likewise, it is essential to be able to travel to bigger towns, as some farming inputs can be purchased only there. Four out of five target communities, except for Zupiri, host a market every six days, where some vegetable varieties can be easily sold. Despite the moderate distance between communities, farmers would need a private or a public mean of transport to reach them. Most popular private means of transport are bicycles, while only well-off farmers own a motorbike. On market days, all communities are connected to neighbouring villages by motorised tricycles which are especially popular among women farmers, as this service allows them to carry a few buckets of their crops to neighbouring communities. However, they would need a private mean of transport to reach the towns and their bigger markets or to stop along the way to find customers, and this limits their marketing opportunities. The survey reveals that more women than men sell their crops in the same community where they live, but the opposite is true for the selling in neighbouring communities. In fact, while the 77% of women rely on the local market, only the 41% of men does so; on the contrary, the 73% of men travel to neighbouring communities to sell their crops, compared to the 27% of women. Only a very small percentage of farmers travel to the markets in bigger towns. This data show a gendered pattern of mobility that

is coherent with the means of transport used to reach the dry-season farming plots, as men are much more likely to own a bicycle or a motorbike then women, who walk on the 98% of the cases. The mobility opportunities greatly influence farmer's farming choices: women farmers in Jang, which is the closest community to Wa, only 15km far, explained that

> Within the area, the beans leaves and pumpkin leaves have a very good market. But the others, like cabbage, carrots, lettuce, people don't know them here, so men carry them to Wa tied at the back of the bicycle and sell to anyone who is interested. So if we *[women]* don't have a mean to go to Wa, we cannot really sell. About the sugar cane, people know it here, so men send it to a neighbouring market and people will buy. Men would cut them and carry them at the back of their bicycle, meaning to go to Wa. But on the way, people would call you to buy the sugarcane, to you won't reach Wa and everything would be sold.

In fact, whether a crop is suitable for being sold locally or not depends on how common it is in the local diet. Crops such as cabbage, carrots, lettuce are not popular among the local population and they can only be sold in bigger markets, such as Wa or Nadowli. Zupiri faces additional challenges in this respect, as it is the remotest community and does not have its own market. Women farmers in Zupiri remarked that

> There used to be a huge market here and members of neighbouring communities used to come here and buy. But now […] there is no more market. In every community, the business is dead. There is no market to sell your vegetables and buy other ingredients, so this is an obstacle.

Constraints in terms of mobility are critical when it comes to both selling the crops and procuring the inputs. In fact, while some seeds are supplied in local markets, others are only sold in specialised shops in towns together with fertilisers, pesticides, backpacks to spray them and similar items. Therefore, the variety of crops that farmers can grow and the tools they can employ are closely related to their mobility opportunities. Determinants of constraint in Mobility are of course also related to the wealth of the farmers, as the poorest cannot own a bicycle (or a motorbike), and to gender, as discussed above.

6.3 Area of constraint 3: Capital

Capital as an area of constraint clearly refers to the economic resources that farmers invest in order to carry out dry-season farming activities; the investments are mainly related to the inputs, such as seeds, tools, fertilisers and pesticides, and to the use of water pumps, if available. It is worth remarking that not all farmers equally invest in these items; rather, the investment depends on the farming practices and crops that farmers employ. It is possible to keep the costs very low by buying economical seeds varieties, i.e. all the local leaves, by avoiding hiring labour and expensive "chemicals", and by carrying out all activities without the aid of machines such as water pumps. On the contrary, those who can invest a greater amount of resources would be able

to buy a wider variety of seeds, hire labour for the heaviest tasks such as weeding and watering, make use of fertilisers and pesticides to enhance their harvest and pay for the fuel needed to power water pumps[14]. Therefore, the lack of capital is a qualitative and quantitative constraint: it influences the types of crops that farmers can grow and the size of the land they can farm. Ultimately, the higher the capital available, the higher the profits can be: crops that require expensive inputs (seeds and "chemicals") are sold at a much higher price at the market and obviously machines and hired labour allow farmers to work on bigger plots and obtain larger harvests. The views of farmers reflect this variety of farming patterns and the cost of inputs and services is a recurrent complaint. Poorer farmers cannot afford to grow certain crops or do not have access to water pumps as they are not able to pay for the fuel. Therefore, while a straightforward determinant of constraint in this area certainly is wealth, a less obvious one is gender. In fact, the data gathered with the survey show that a higher percentage of women make use of fertilisers and/or pesticides, which would suggest that women are more likely to be able to buy them. However, a closer examination of data shows that this is not accurate. The sample population can be divided in two main groups: those who farm at close to a dam and those who farm thanks to dugouts. Out of the farmers in the first group, many have received support from international donors or the Government, entities which often provide fertilisers and/or pesticides; this is especially true for women, as they are strongly encouraged to be part of those groups. Coherently, looking at this group of farmers, women who use fertilisers and/or pesticides outnumber men (59% versus 39%). The second group is composed by those who farm around a dugout and none of them received any form of external support, therefore the purchase of fertilisers and/or pesticides is entirely on them. In this group, contrary to what happens in the dam group, men who employ "chemicals" largely prevail on women (83% of men and 43% of women). Data gathered through interviews and focus groups is consistent with this interpretation. A group of farmers in Namville, who only received support in terms of technical training and provision of a wire fencing, explained that "women do not get the [watermelon] seeds because they are too expensive. The men have animals which they can sell and buy the seeds, but the women don't".

From the interviews, it appears that in mixed farming groups established by NGOs or the Government where a water pump is available, it is mostly men who can use it, because the women of the group cannot contribute to buy the fuel to power it. Hence, the main determinants of constraint in this area are, once again, gender and wealth.

6.4 Area of constraint 4: Time available

The features of dry-season farming which make up this area are the time needed to reach the farming location, the capacity to innovate and the need to guard the plots from roaming animals. Constraints related to the amount of available time lie in a number of facts and have

[14] As for the costs involved with buying a water pump, they are usually covered by international donors, the Government or NGOs and the pump is used by a group of farmers. None of the farmers in the target communities privately owns a water pump.

impacts on multiple features of dry-season farming; first of all, those who have less time available for the farming activities are hindered in the choice of the farming location, as they wouldn't be able to reach a far place; furthermore, they would have a lower innovative capacity, as innovation within farming often comes from spending time in the fields experimenting new techniques; finally, they would also commit less time to guard their farms from roaming animals and, consequently, have greater chances to have their crops spoilt. The first impact of time constraints, the limited choice of farming locations, is especially relevant if a dam is the source of water, as these are often built in the outskirts of the communities. Despite that, the Government and the NGOs consider dams the preferable site for dry-season farming and all the related interventions in the area adopted dams as water sources. Therefore, joining a farming group established by these entities implies being able to daily reach a remote farming site and the lack of time can determine a lower chance to join such a group. This is especially relevant to women as they often are the main target population of dry-season farming interventions promoted by NGOs and the Government in these sites. Below are satellite images of two of the research sites, Takpo and Namville. The red circle highlights the main inhabited area of the community, where the market takes place and people gather for public meetings, while the blue circle defines the dam area. On foot, it would take about half an hour on average to reach the farming sites from the main inhabited area.

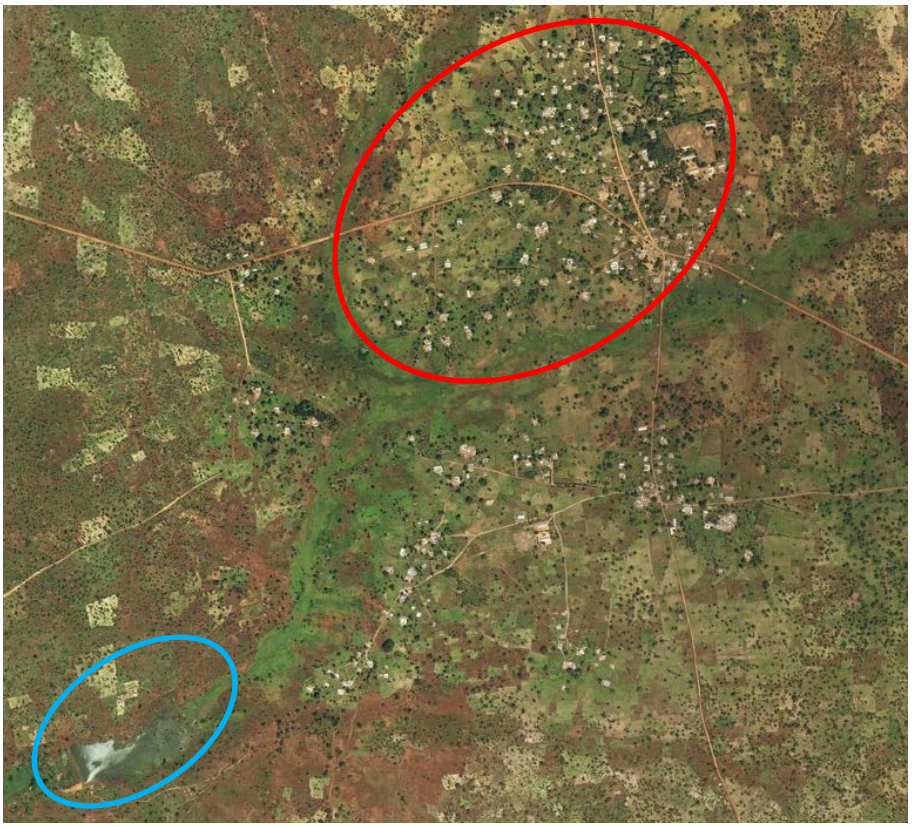

Figure 12. Position of dam (blue circle) with respect to the main inhabited area (red circle) in Takpo. Adapted from NASA SADAC and edited by the author. Retrieved at: http://sedac.ciesin.columbia.edu/mapping/hazards/# [July 2017]

Figure 13. Position of dam (blue circle) with respect to the main inhabited area (red circle) in Namville. Adapted from NASA SADAC and edited by the author. Retrieved at: http://sedac.ciesin.columbia.edu/mapping/hazards/# [July 2017]

The second impact of time constraints determines farmers ability to innovate. In fact, being dry-season farming a relatively recent practice in the area, some farmers introduce small amounts of new varieties to test them, or try new ways to sow, water and combine their crops. This can lead to improved yields and, ultimately, more abundant harvests and higher profits. Having a limited amount of available time determines constraints in this respect and leads to a lower innovative capacity. This has been confirmed in multiple interviews and focus groups with female and male farmers, who consistently stated that household chores keep women away from the farms and this affects their farming performance. This quote is from a woman in Takpo, but is extendable to all the target communities:

> Even more challenging [than physical fatigue] is the time, because we have to balance household chores and work in the farms. We try and do both by getting up very early, cleaning the surroundings, bathing the children and cooking before we can leave for the farm. In terms of results, the men do better than the women: our crops still yield, but not as much. This is because the men have much time for the farming. They just get up and go to work in the farm, and when the women arrive there, they have done a lot of work in the farm already. Women have to rush and go back home again, so we spend less time in the farm and our crops have lower yields.

On the other hand, a prominent discourse among men, consistent with the observations made during the data collection, is that they often spend the whole day at the farm and try new varieties of seeds or new sowing and watering techniques. When visiting the farming locations after 10 in the morning, it was very hard to find women, who are usually there between 7AM and 9AM. On the contrary, it was easy to find male farmers throughout the day.

Finally, roaming animals and Fulani cattle represent a risk for dry-season crops for all farmers whose plot is not enclosed within a wire fence. For those whose fence is made out of wood, out of which 40% are women, the more time is spent at the gardens, the lower the chance is that the crops get destroyed. Almost one third (31%) of the farmers in the sample population lost their crops because of roaming animals; they feel discouraged and considered stopping the farming activities. Therefore, spending the whole day at the farming site in order to protect it is a common routine in Takpo, where this quote was recorded, as well as in most target communities:

> We water the crops twice, morning and evening. We take turns and help each other with the watering […]. If we do not have any other business to do at home, we stay there and watch over the crops. There is always someone around the farms, especially to chase the cattle away.

However, this is a recurring story only among male farmers, while women often rush home after doing the necessary work. In fact, the same group of male farmers in Takpo also added that "The women stay for some time and then come back home, they do not spend the whole day there". In addition to the ordinary household keeping chores, women have additional highly time-consuming tasks in the dry season, as explained by a woman farmer in Goli:

> The women are very busy in this season. We have to gather firewood for the rainy season, because in that season we are very busy with the farming and we want to make sure they have enough aside.

There were recurring complaints and challenges mentioned by all the farmers across interviews and focus group discussions, but issues regarding limited time available were only raised by women. Considering the above, it is coherent to conclude that gender is the main determinant of constraint with regards to time available.

6.5 Area of constraint 5: Strength

References to the different "strength" of men and women were consistently made during interviews and focus group discussions. It soon became clear that the word was intended in multiple ways and that different levels of "strength" are determined by more variables than only gender. The three different meanings given to this word are: economic power, assertiveness and decision-making power, and physical robustness. The first meaning of strength was analysed under the area of constraint 3, Capital, and its determinants were both gender and wealth; strength as assertiveness and decision-making power refer to the social role of women in collective decisions; finally, physical strength is what this paragraph is concerned with. The feature of dry-season farming that seemed to be mostly constrained by the strength of the

farmers is the capacity to fence a plot. As stated before, a robust fence is a necessary condition for dry-season farming activities and, unless a wire fence is provided by an NGO or the Government, farmers themselves usually build one with sticks or brushwood. This is regarded as one of the most labour-intensive and exhausting activities that farmers have to perform. An account consistently heard throughout the interviews and focus group discussion was similar to the one of this woman in Takpo:

> The women face more challenges than the men, because men and women do not have the same strength. For example, men can go, cut the stick and finish the fencing, while women would get tired after collecting the sticks and cannot finish in one day.

The same explanation was used to explain why farming at a dam with the support of an NGO or the Government is more suitable for women than independently farming at a dugout:

> Women don't have enough strength to dig the dugouts and fence the place with sticks collected from the bush. That's why we were not involved in the farming at the dugouts. Instead, at the dam, we were provided wire fencing and we joined.

The survey confirmed these statements; out of the farmers who have a stick or brushwood fence, the women were less likely than the men to having built that fence themselves. In fact, while all men stated that they made their own wood fence, only 76% of the women said so, and many added that they were helped by someone else, usually their husband or kids. It is also common to hire labour for some tasks including fencing of the plots, but of course this implies a higher economic investment.

While gender was consistently identified as a determinant of constraint limitedly to the fence building activity, age is a factor that determines the overall engagement in dry-season farming. In fact, being able to carry out dry-season farming activities, which is regarded as "very hard work", obviously depends on the robustness of farmers, which declines with age. Another common account in all the target communities is that, after a certain age, farmers have to stop doing dry-season farming as they find it too hard, but still work in the family farm during the rainy season by helping with light tasks. Therefore, while age is a determinant of constraint that extensively hinders farmers participation in dry-season farming, gender does so when it comes to a specific task, namely fencing the plots[15]. Interestingly, the intersection between age- and gender-related constraints was also highlighted by a field officer of an NGO engaged in promoting dry-season farming among the most vulnerable groups of the communities, including widows:

> In our [farming] groups, one of the criteria in the selection [of participants] is poverty: some of the women are very poor and cannot afford food, some are widows, are weak and old, but they still need money. With these women it is a

[15] This is not to say that women have the same physical strength than men; instead, the meaning of this section is that women do not see their lower strength as a general constraint, but rather as one limited to a specific activity.

problem, it is hard to work with them, because they are old and dry-season farming is hard work.

6.6 Area of constraint 6: Risk and delayed profit

The features of dry-season farming that compose this area of constraint, likelihood of failure and duration of the agricultural cycle, are strongly influenced by the characteristics of each crop. In fact, the level of difficulty of farming a certain crop determines the risk of failure involved with growing it, while the length of the agricultural cycle, different per crop, determines the delay in obtaining a profit, which only happens after the harvest. Farming a crop with a higher level of difficulty means accepting the failure risk involved with it. Moreover, farmers are aware that more expensive inputs are needed at an initial stage for more difficult crops (seeds, fertilisers and pesticides, special tools) that might not pay off in case of failure. On the other hand, crops with a lower level of difficulty usually require less expensive inputs and, being simpler, have a lower chance to fail. Therefore, while all crops are subjected to failure under certain conditions (nonviable seeds, extreme weather events, unexpected climatic conditions), the loss would be more costly and more likely in the case of more challenging crops. Interviews and focus group discussions contributed to shed a light on which crops are considered the most risky, expensive and challenging, and on which have a lengthy or a quick growing cycle. Moreover, farmers also clarified what constraints influence their farming choices in terms of crops with a high degree of difficulty and with a lengthy growing cycle. The crops that are considered "easier" to grow are all the local leaves, tomatoes and okra, while cabbage, onion and watermelon are regarded as "tedious", as they require more efforts in terms of irrigation, application of "chemicals", nursing and transplanting. The fact that the local leaves are considered the simplest to farm might also depend on the fact that there is a wide variety of local leaves, such as pumpkin, beans and bitter leaves which are broadly farmed (also in the rainy season) and consumed in the Upper West region of Ghana. Therefore, people are very familiar with their farming; similar considerations apply to okra and tomatoes, very common varieties in the region. The crops with a shorter agricultural cycle are by and large all local and their agricultural cycle lasts 4 weeks on average. The second fastest growing dry-season crop variety is okra, with a cycle of 7 to 8 weeks[16], while tomatoes have an agricultural cycle of about 10 weeks. The varieties with the longest cycle among those farmed in the target communities are peppers, watermelons and onions with farming cycles of 17 to 20 weeks or more. An officer from an NGO engaged in promoting dry-season farming in the Upper west region, gave an overview of the crops and remarked that gender is one of the main determinants in farmers crops choices:

[16] Farming cycle duration of vegetables was retrieved from the FAO (FAO, 2017) crop calendar. As data are not available for the semi-arid regions of Ghana where the Upper west region is located, the information on bordering regions of Burkina Faso were employed instead. These regions, namely the West and central zone, have more similar climatic conditions than the transitional, rain-forest or coastal savannah zones of Ghana. Although the accuracy might not be perfect, data are meant to show the wide range of farming cycle durations and give an indication of the differences between crops.

> They [farmers in the Upper West] have interest in dry-season farming, but some issues are preventing them from working. There is a gender division in dry-season crops: as for pumpkin and beans leaves, women can do them, but take cabbage, for example. Women are not familiar with these, so they think they cannot do it. As for cabbage, pepper, cauliflower, women think it is very hard, while pumpkin and beans leaves take little time to be ready [for harvest] and can be quickly sold at the market and planted again, they do not need any specialities for them. But the crops that need to be sprayed [application of fertilisers and/or pesticides] and taken care of, women think it is very tedious. Women do not like doing those crops, but they prefer the simple ones, that just need to be watered. Men do cabbage, garden eggs, onions and watermelons; women cannot grow them, but men do it in the area, because they require fertilisers and sprays. If you don't spray it, they will spoil. They [women] would need to hire someone to go and do it for them.

These information was confirmed by interviews and focus groups with farmers; women only engaged in growing more challenging crops such as cabbage or carrots only if an NGO or the Government provided them the seeds and other inputs for free, as the risk of failure would not influence their available capital, but only the time they committed to the crops. Besides gender, also the wealth of a farmer has a great influence on his or her farming choices for at least two reasons: poor farmers cannot take a high failure risk and need to gain some money quickly, for which crops with a shorter cycle are more suitable. Well-off farmers, instead, can afford to accept the risk involved with challenging varieties and will continue their activities despite the losses. An NGO offices whose father is a well-off dry-season farmer explained:

> He has a pumping machine to pump the water from the river. His crops didn't yield much, for example the watermelon spoiled and did not grow enough, so it was not possible to sell them. We had to eat them in the family. Looking at the cost involved with the farming, they are high: fuel for the motorbike and the pump, which he bought in Wa and brought it to Jirappa [his hometown], fertilisers etc. Still, no matter what you tell him, he will keep on doing that.

Hence, features of dry-season farming such as the risk involved with the production and the delayed profit due to the agricultural cycle, which largely vary among crops, determine farming choices and constrain those of some social groups. Specifically, the determinants of constraint for this area are gender and wealth.

6.7 Area of constraint 7: Access to land

The features of constraint that compose this area are limited availability of land close to the water sources and the need to join an existing farming group to access wire-fenced plots. Access to portions of land suitable for dry-season farming, namely close to water sources, is an essential ned for dry-season farmers. The way local farmers access land is determined by

customary laws. Simplifying, land is owned by men and inherited in a patrilineal fashion; farmers can ask other landowners to access their land and farm it, if it is not used; women can access it with the permission of one male member of their family. These arrangements are essential in the case of dry-season farming, as the amount of land close to water sources (dams, dugouts, rivers) is limited – but underused in most cases. This system works among farmers and provides an overall balanced access to available land suitable for dry-season farming in the researched communities. Another important variable is the access to wire-fenced plots, as this type of fencing provides a secure protection from roaming animals, as opposed to sticks fences. Access to wire-fenced plots is limited to institutional interventions, as self-started and backyard farmers do not have enough resources to procure them. Therefore, the number of farmers who can benefit from wire fences is low and linked to the implemented interventions in each community.

Those considerations are not valid for one ethnic minority settled in the outskirts of all the target communities, namely the Fulani pastoralists. In fact, they are not considered indigenous and do not own land, but rather they are hosted by someone. The farming population has a conflictual relationship with them and there are no trust bonds, therefore Fulani men and women do not have any possibility to access arable land close to water sources. Relationships between farmers and pastoralists are tense because of disputes on cattle owned by Fulani pastoralists and/or by farmers and catered by settled Fulani, as they are often thought to be responsible for spoiled crops. A common problem I stat farmers cannot obtain a compensation for the damage:

> Another problem they face is the fencing of the gardens, because There is cattle eating the vegetables, catered by the Fulani. If you didn't see the animals destroying the crops, who can you report to? But if you see them, you can report to the owners. It also happens in the night.

Moreover, even when access to land is granted by an institutional intervention together with a wire fence, Fulani pastoralists do not participate. This is due to both negligence from NGOs and the Government, which do not include them in dry-season farming interventions, and to mistrust of the farmers. A widespread idea among farmers is that "Fulani don´t like to work hard, so they wouldn´t join dry-season farming groups". Due to the relative abundance of land close to water sources in comparison to the small number of dry-season farmers, there are not any issues of land scarcity on the research sites; however, one group faces land access constraints, namely the Fulani settled pastoralists. Therefore, ethnicity is the only determinant of constrain when it comes to land access for dry-season farming in the research sites.

6.8 Areas of constraints: summary table

This table summarises the way structural features of dry-season farming activities and crops interlace with gender, wealth, ethnicity, marital status and age of the farming population. The features are grouped under the seven areas of constraint discussed previously in this chapter, providing a summary of it. A few words are needed on Marital status as a determinant of constraint. Marital status is a determinant of constraint only for women, as female widows sum up the constraints determined by their gender, often the ones related to lack of wealth, as they do

not have a husband who supports them economically, and sometimes the ones determined by age, as they are usually old. Therefore, when reading the table, it should always be taken into consideration that most of the constraints listed under the columns Gender, Wealth and Age might also be valid in the Marital status column.

AREAS OF CONSTRAINT	FEATURES OF DSF	DETERMINANTS OF CONSTRAINT				
		Gender	Wealth	Age	Ethnicity	Marital status
i. Technology	1. Application of fertilisers and pesticides	Women do not feel comfortable with applying "chemicals"	-	-	-	-
	2. Activation of the water pump	Women find it hard to ignite it and fear the water	-	-	-	-
ii. Mobility	3. Selling the crops	Women are less mobile than men because of their household chores and limited access to resources	Poor people are less mobile than others because of their limited access to resources (own means of transport or money to pay for public transport)	-	-	Widowed women sum up the constraints of the Gender and Wealth categories
	4. Buying inputs	Same as above	Same as above	-	-	Same as above
iii. Capital	5. Cost of inputs	Women are less likely to buy expensive inputs such as certain seeds and all chemicals	Level of wealth is a constraint in terms of the ability of buying farming inputs			
	6. Cost of using the water pump	Women are likely not to have the resources to pay for the water pump fee	Poor people are likely not to have the resources to pay for the water pump fee	-	-	-
iv. Time available	7. Proximity of the plot	Women are responsible of household chores and child rearing, therefore the time employed to reach the plots can determine their engagement	-	-	-	-
	8. Capacity to innovate	Due to the limited time committed to dry-season farming, women often have a lower innovation capacity	-	-	-	-
	9. Need to guard the plot because of the presence of Fulani	Due to the limited time committed to dry-season farming, women often do not have time to guard their plots. This can result in a higher risk of having their crops destroyed by roaming animals	-	-	-	-

AREAS OF CONSTRAINT	FEATURES OF DSF	DETERMINANTS OF CONSTRAINT				
		Gender	**Wealth**	**Age**	**Ethnicity**	**Marital status**
v. Strength	10. Fencing	Women often ask their husbands or children to help them build their fence, if they are self-starters, as this activity requires great strength	-	Age, and the likely lack of strength, is a paramount constraint in participation in dry-season farming activities	-	-
vi. Risk and delayed profit	11. Duration of the farming cycle	Women tend to praise crops with a shorter farming cycle, in order to have immediate earnings	Poor people tend to praise crops with a shorter farming cycle, in order to have immediate earnings	-	-	-
	12. Crop varieties with higher or lower failure likelihood	Women tend to be risk-averse, as they are responsible for everyday and immediate needs of the family, especially buying ingredients for the meals	Poor people tend to be risk-averse, as they have limited resources. Well-off farmers can accept the risk involved with crops that present a moderate degree of failure likelihood	-	-	-
vii. Access to land	13. Limited availability of land close to the water source	-	-	-	The minority of Fulani people cannot access land neither as self-starters, as their families do not own any, nor through external interventions, as they are not targeted	-
	14. Need to join an existing farming group to access wire-fenced plots	-	-	-	The minority of Fulani people cannot join existing farming groups as they would be opposed by farmers of all the other ethnic groups	-

Table 2. Summary table of the way structural features of dry-season farming activities and crops interlace with gender, wealth, ethnicity, marital status and age of the farming population in each area of constraint. Elaborated by the author.

CHAPTER 7

The explanatory factors of constraint

This chapter concerns the factors that explain why the determinants of constraint act as such in the context of dry-season farming in the target communities, and how these are linked to the seven areas of constraint. The explanatory factors discussed in the chapter influence the life of the communities as a whole, not only the practice of dry-season farming; therefore, this chapter opens a more general discussion on issues of tradition and innovation.

7.1 Socio-economic roles in the household

One of the main broader factors that explain why gender is a determinant of constraint in the involvement in dry-season farming within the target communities are the socio-economic roles in the household. More precisely, the division of economic responsibilities within households, such as the procurement of resources, and the division of labour can explain a large part of the constraints experienced by women in the areas of Mobility, Capital, Time available, and Risk and delayed profit. The next two sections examine the intra-household allocation of economic responsibilities and division of labour, respectively. It will be shown how those patterns have consequences on dry-season farming practices.

7.1.1 Intra-household allocation of economic responsibilities

The allocation of responsibilities relating the economy of the household follows specific rules in the research area; those were identified in the interviews and FGDs carried out across the communities. Such allocation affects the capital available to women and men and their adversity to risk in the dry-season farming activities; the areas of constraint involved are therefore Capital and Risk and delayed profit. It appears that the male head of the household, in a context where most households are male-headed, is responsible for providing a shelter and staple foods to the whole family, besides contributing to jointly expenses such as school fees and healthcare costs. On the other hand, women are supposed to cover all the costs related to transforming the staples into meals, including grinding cereals, buying spices and salt, providing a side dish, and those related to the housekeeping, such as soap and small kitchen utensils. The first category of responsibilities, those attributed to men, mainly depends on the resources and on the labour of the whole family: staple foods are autonomously farmed by the household in the land owned by the family and the shelter is a family compound whose everyday maintenance is on women.

Moreover, expenses such as school fees and healthcare do not require daily earnings, but rather medium-term savings, that can be gained through investments. The second category of expenses, on the contrary, requires day-to-day expenditures. Women, especially the poor ones, know that they need a source of income which allows them to constantly have small amounts of money available on a daily basis. Activities preferred to women are therefore those with a low level of investment, a low risk and quick returns: "there is no woman in a village who sits doing nothing, they do small things to have an income. But the women's mentality is that they want something that doesn't have costs but can provide some profit". Locally practiced activities by most women are selling some own-prepared foods in the community, brewing local alcoholic drinks, and charcoal burning. These have a low risk, can be initiated with a small investment and guarantee a daily income. When shifting the discussion to dry-season farming, similar preferences apply among women: they would rather farm local green leaves that can be harvested every two weeks and are riskless and cheap instead of investing more resources and accepting a higher risk:

> With dry-season farming, I would spend most of my time and energy and what I would get is equivalent as if I engaged myself in doing another business, such as selling cakes [cozi] at the market. But if I farmed the cabbage, for example, I would have to pay for the seeds, fertilisers, and work on it to water it every day. I would risk spending resources on something that hasn't yielded yet. Imagine if you suffer a lot and then you don't get anything.

It is evident that this constant and immediate need of resources dictated by the household division of economic responsibilities greatly impacts women's behaviour in dry-season farming, both in their choice of crops (lower risk, lower investment and lower profits) and in their overall engagement. In fact, some might choose not to engage at all or stop after encountering a challenge, such as a failed harvest. Men, however, enjoy a situation in which, not needing resources for everyday needs, they can invest a certain amount of money in crops with a longer growing cycle and accepting the delayed profit (and sometimes risk) involved with them. As a local NGO officer explained with emphasis:

> The reason is that women and men are two different people. The way a man will think is not the way a woman will think. A man does not need money to solve problems immediately. He can wait one, two, three months before getting the money, but he will always go home and eat. The woman will always prepare something for him to eat. Also, the men do two kind of things, dry-season farming or rearing animals, at the same time. So if they need money and the crops haven't yielded yet, they can always sell a goat or a fowl, or a pig. But a woman is not like that. As a woman, you do the cooking, you fetch the water, you wash the clothes and the bowls. An all these things, you need money. That is why they need immediate income. A woman can stay dry a whole month, but a woman cannot.

In conclusion, involvement in self-started or externally-initiated dry-season farming activities will depend on these household arrangements. The patterns of engagement, the crops chosen, the farming systems preferred by female and male farmers are shaped by these locally-created household economic responsibilities. This explains why, for example, backyard farmers

(who are all women) only farm local green leaves; or why the few farmers who engaged in onion, watermelon and sugarcane farming (see paragraph 5.4) are all men.

7.1.2 Intra-household division of labour

The intra-household division of labour in the research sites follows strict gendered rules. Similarly to the allocation of the household economic responsibilities discussed above, the division of labour has consequences on the pattern of engagement of female and male dry-season farmers. In this case, it mainly impacts farmer's Mobility and Time available. As extensively discussed in Chapter 1, women are responsible for all issues regarding the housekeeping and childrearing; those include time-consuming tasks such as fetching water and firewood, cooking, cleaning, washing the clothes, caring for the children. That is perceived as a challenge by most women interviewed, who commonly described their daily routine and challenges as follows:

> We could fill this whole room with the challenges we have! There are challenges in conciliating the household chores and the farming. We get up and pray at 4AM, then we fetch water, cook for the children, and bath them so that they are ready to go to school. We are ready to go to the farm at 6 or 7AM. The men do not help with these activities.

These tasks are to be carried out again in the evening, therefore female farmers need to be at home in time for preparing the evening meal and finish any remaining chore. It is clear that these arrangements erode the time available for farming that women have. Factors such as the distance of the plots to their house is therefore crucial, especially when farming crops that need to be watered twice a day. One visible effect of this is the creation of backyard gardens only by initiative of female farmers. This clearly indicates a strong need of having a farming location close to their house, which male farmers did not perceive and did not sought. In conclusion, the allocation of household labour entirely in women's activities portfolio can explain why female farmers have challenges in terms of time allocated to farming and of mobility that men are less likely to experience.

7.2 Relevant wealth differences within the communities

The second broader explanatory factor that can shed a light on why certain conditions act as a constraint for local dry-season farmers is represented by the relevant wealth cleavages within the target communities. In fact, wealth differences among the farming population result in the amount of resources farmers can invest on dry-season farming (Capital) and on the Risk and delayed profit they are ready to accept. The NGO CARE International carried out a participatory Wealth Ranking exercise on a number of communities in the area[17], some of whom are the target of this research. It appears that community members have clear criteria to identify who can be

[17] They are Chaang, Duong, Kanyini, Zambogu, Namville, and Takpo. They are all located in the Nadowli-Kaleo district and the last 2 are among the research sites of this work.

considered very poor, poor, middle class or rich in their environment. Clear signs of belonging to the minority of rich people are not borrowing money, being able to feed one's family all year round, owning a private means of transport and cattle, and cultivating a large farm with expensive inputs, such as a tractor (CARE, 2015a). Moreover, rich people have to be present in any meeting where decisions are made (CARE, 2015b). On the other hand, the poor can only afford basic education, might not be able to be properly fed in the lean season, do not own any mean of transport of animal, and can only manually farm a small piece of land.

These divides are often not visible at first sight, and neither are their consequences on the varied ways in which dry-season farming interventions are approached by members of the community. However, they are essential to explain why having a greater capital can influence farmer's engagement not only in self-started contexts but also in institutionally-initiated dry-season farming interventions. In fact, similarly to what has been discussed earlier in section 7.1.1, the amount of capital available directly shapes the choice of crops and the amount of risk farmers are open to accept. In conclusion, existing wealth inequalities in the communities are a valid explanatory factor of the differences in wealth and especially of patterns of investment and risk acceptance in dry-season farming.

7.3 Role of dry-season farming in the society and in the economy

A third category of factors that must be acknowledged is the role that dry-season farming has in the economy of target communities and how this is impacted by external interventions. A first, much needed clarification is that the five target communities are not homogenous in this sense. Therefore, they will respond differently to the same intervention due to the their specific identities. For example, backyard farming is practiced in Jang, Takpo and Namville, but not in Goli and Zupiri. According to the dwellers of these communities, this is due the number of interventions aimed at promoting farming in the dry-season. In both cases, they were not often reached by MoFA extension officers and other institutional initiatives to promote it, therefore, only a limited proportion of the population is aware of the possible advantages of it and women, the potential backyard farmers, do not have the know-how to start or never even considered it a feasible idea. As an addition, contingent conditions of the communities play a major role in explaining this: in the case of Zupiri, there is only one borehole in the whole community, which makes it hardly possible for women to have enough water for household chores and is therefore not suitable for irrigation.

A second relevant factor is the fact that dry-season farming is not engrained in the traditional way of life in the whole area. As discussed in Chapter 1, the dry-season is a period of rest between rainy season agricultural cycles. A local key-informant, NGO officer and expert in indigenous knowledge of the area, explained:

> Gardening *per se*, deliberately growing crops in the dry season, was not part of the traditional life of our people. But as food crises started to emerge, these were options that people started to explore. Because of the severity of these crises, people were pushed to put adaptation mechanisms in place and farming in the dry season was one of them. Then NGOs and Government scaled this

> up. So there is a history of that, but not predominantly a women's affair. It was an area that was more for men and they had the responsibility. This is because moving to the riverside is dangerous, because for the distance. Those areas are usually uncultivated, there is the bush, only men had the courage to walk that distance and establish a farm on the Black Volta.

Not only dry-season farming is not part of the traditional habits of the local population and is a recent addition to the habits of farmers, but it was initiated by men. Nowadays, despite the numerous interventions of NGOs in the area, traditional authorities see promoting it as a hard task. This is evident as dry-season farming interventions in the area have failed and resulted in unsustainable investments for the donors. The traditional Chief of Takpo provided a number of reasons why local farmers should be interested in adding a farming cycle to their habits but remarks that at the same time interventions promoting this often fail:

> When the dam [in Takpo] was built, they [the donors] put the idea that if someone farms in the rainy season and farms in the dry season, as an addition, from October to April, obviously his total income would be higher. If you only farm in one season, you cannot beat them. So these people [the donors] were advising us: why don't you go to the dam area? But again, you need to produce to a certain level, so that you can make enough to pay for your cost of production and make it worthwhile to stay in there. When you are sinking and drowning [because of poverty], you have to get any help you can have. But look at Sankana[18]. The dam was dug in the 70s. Everybody agrees that we have not used it adequately. People have difficulties in changing their habits, we are rainy season farmers. If you come and dig a dam for irrigation, you have to teach them. You have guide people, so that others see that it is profitable, because it is not our way of life. When you are in difficulties, you have to adopt these new things. But the dam has been there since the 70s and no one used it.

In conclusion, the existing farming and economic arrangements in the communities can be highly diverse depending on the history of the single communities, the interventions that took place and their conditions (such as the number of water points available). Moreover, the general absence of dry-season farming in the traditional agricultural habits of the

[18] Neighbouring community close to Takpo.

CHAPTER 8

Discussion and policy recommendations: the critical variables of dry-season farming interventions

In this chapter, the issues regarding the features of dry-season farming activities and crops, the areas and the determinants of constraint, and their explanatory factors will be wrapped up to identify the critical variables of dry-season farming that are relevant to the planning of related interventions. It will be shown how making changes in each of the critical variables will affect the level of constrain experienced by farmers and how each of them has a direct impact on multiple features of dry-season farming. This is relevant to the work of NGOs and other institutions as they often provide farming inputs to the farmers, choose the water source for irrigation and the fencing methods.

8.1 Type of crops

The characteristics of each crop are of great importance in determining the engagement of farmers in dry-season activities according to their gender, wealth and marital status characteristics. Three main characteristics define which farmers will choose that crop:

1. whether it is locally saleable;
2. whether it is exotic (requiring expensive inputs and having a higher failure risk) or local;
3. whether it has a long or a short maturing cycle.

There are a number of elements that make crops accessible, or not, to certain segments of the local population. An important element is the possibility to sell the harvest at the local market, which people can reach on foot, instead of travelling to the nearest town to sell it. In fact, some crops, like watermelons, cabbage, carrots, salad are not popular in small communities as they are not part of the traditional diet, but are appreciated by town dwellers. This brings about constraints in terms of mobility, as certain categories of people, such as women and the less wealthy, have limited or no access to private means of transport, like bicycles. Therefore, by choosing crops that are part of the communities' diet and can be sold locally, it is possible to target those who have constraints in the area of Mobility.

The second element that makes crops accessible to a wider range of farmers is whether the crop is exotic, namely recently introduced in the area, or indigenous, namely local. These aspects determine the technology needed to grow each crop in terms of fertilisers, the cost of the inputs, and the risk involved with it, as local crops have a lower degree of failure as farmers master the farming techniques. Those 3 aspects are crucial in determining constraints in the areas of Technology[19], Capital and Risk and delayed profit. Farming local crops can loosen constraints in those areas, while exotic crops will reinforce them and make farming less accessible to some groups, especially women and the less wealthy.

The third element related to the type of crop is the length of its maturing cycle. As discussed in paragraph 7.1.1, some categories of people, namely women and the poor, need to have small amounts of money available to solve every day's problems. Therefore, a crop with a lengthy farming cycle is not suited to their needs.

These observations are relevant to the work of NGOs and other institutions as they often introduce new varieties and provide seeds and fertilisers for a few years. It is important to notice that even when inputs are provided, not all constraints are loosen: for example, farmers are still impaired by their mobility level when they need to travel to the nearest town to sell non-indigenous crops. Therefore, if the target population of the intervention has Mobility, Technology, Capital, and Risk and delayed profit constraints, the crop choice can be used to tailor the intervention on the target group. In the local context of the Nadowli-Kaleo district, the crops that are more easily saleable locally and the indigenous ones are all green leaves, okra, peppers and tomatoes; the ones with a shorter faming cycle are all green leaves and the one with the longest cycle are the onions.

8.2 Type of water source

The proximity to the inhabited areas and/or to the households is of great importance and can be used to tailor interventions in order to involve those who have time constraints. As discussed earlier, dams are often located outside the main inhabited areas at an average of 30 minutes walking. This greatly impairs the engagement of categories which do not have much time available for farming activities, i.e. women. This can be easily changed by using a different water source to loosen the constraints related to the Time available area. For example, the use of existing boreholes in the community might be encouraged for small-scale farming and the wells can be dug for medium-sized plots within the communities. This would also avoid the use of water pumps, which might loosen the constraints in the Technology area mainly encountered by women. NGOs and other institutions might consider promoting dry-season farming through irrigation from a more diverse range of water sources, in order to better target those who do not own a private mans of transport, do not have enough time available or are reluctant in operating a water pump.

[19] Technology constraints refer to the fact that most women do not feel comfortable in applying fertilisers and other chemicals on their crops. See Chapter 6 for a discussion of each area of constraint.

8.3 Type of fencing

The type of fencing is the third feature of dry-season farming that can be tailored by NGOs and other institutions to better target their intended beneficiaries. In fact, if the fence is robust enough, it can allow farmers to leave the plots at any time as it would be sufficient to protect the crops. Instead, a weak fence, or a damaged one, require daily surveillance that farmers with little time available could not guarantee. Moreover, wire fences are subjected to usury due to humidity in the rainy season. Farmers report that wire fences need to be replaced after three or four years of use. When this happens, and the intervention is over, they have to do it themselves and those who are not strong enough might have to abandon the plots. Other might have to replace it with a weaker fence made of sticks that could be destroyed by roaming animals and it forces farmers to guard the plots every day. To avoid this, it is possible to use a local kind of bush, commonly referred to as live fencing, that forms a thick layer of evergreen vegetation that roaming animals cannot trespass. This type of fencing can be combined with the wire fence, as it takes about two years to fully grow and it can replace the wire when it is damaged.

To conclude, NGOs and other institutions are able to loosen the constraints in the areas of Time available and Strength by carefully choosing the most appropriate type of fencing and, at the same time, make their interventions more sustainable over time through the use of live fencing.

8.4 M&E framework

In order to timely react to unwanted outcomes and adjust the project in case of unexpected results in terms of targeting beneficiaries, such as new crop varieties being appropriated by male farmers, a sound M&E scheme is required. Indeed, conventional M&E practices that simply rely on quantitative and gender-disaggregated indicators to account for women's participation might not be suitable to determine whether and how they are actively involved (Thompson-Hall et al., 2016) and to keep track of dynamic processes taking place in the communities. Therefore, a participatory M&E scheme based on the determinants and areas of constraint and on the local explanatory factors is essential to determine whether the intended beneficiaries are effectively reached and to make any adjustment to improve the targeting.

CHAPTER 9

Conclusions

In this research work the underlying causes of current arrangements in dry-season farming in Northern Ghana were investigated. The data collection and analysis unfolded to reach an in-depth understanding of the phenomenon of dry-season farming in the research sites through the guiding question: how do multiple social variables intersect to create patterns of dry-season farming engagement and modes of production among smallholder farmers in Northern Ghana?.

The answer to this main question is shaped in a multi-layers form. The first, and more superficial, layer is a study of dry-season farming engagement and modes of production; these were identified in three main categories: self-starters, institutional interventions and backyard farmers. Those modes of production have differentiated patterns of engagement dependent on farmers' gender (e.g. backyard farmers are exclusively women), wealth (e.g. well-off farmers have an easier access to bigger markets), age (e.g. young age is a benefit), ethnicity (e.g. settled pastoralists do not have access to dry-season farming), and marital status (e.g. female widows are hardly reachable by interventions). The second layer unfolds a theoretical and empirical explanation of why and how those variables (i.e. gender, wealth, age, ethnicity, and marital status) act as determinants of constraint in dry-season farming engagement patterns. In this part of the analysis, links are established between those variables and the features of dry-season farming they interact with; by this interaction, constraints in a number of areas arise, namely Technology, Mobility, Capital, Time available, Strength, Risk and delayed profit, and Access to land. Broader social explanatory factors, such as intra-household division of labour and wealth cleavages within the communities, are needed to place those constraints in the social and environmental context of the region. The third and final layer of this work is the identification of critical variables in dry-season farming interventions that can be tailored and adjusted in order to better target the intended beneficiary group(s) of a given interventions. Recommendations on how to do it have been formulated and include the type of crops that are chosen by NGOs or other institutions, the water sources employed, and the type of fencing built. These critical variables, if properly adjusted to the characteristics of the target group, bring innovation to the features of dry-season farming and minimise the risk of failing to reach the intended beneficiaries.

This work gives a contribution to the body of research focussed on how differentiated roles and responsibilities result into different exposures and vulnerability levels, and on how development interventions can address their beneficiaries taking those into consideration. The identification of critical variables in dry-season farming is one step towards better targeting of a beneficiary group, e.g. women, as a heterogeneous set of people whose constraints are not only

determined by the belonging to the same gender group, but also to their diverse wealth, age, ethnicity and marital status characteristics.

The final conclusions can be summarised in 3 points:

1. Dry-season crops cannot be classified as gendered crops into a 'male' or 'female' dichotomy as it has been previously attempted in the literature for rainy-season crops, except for one or two which were found to be grown by a few men only. Instead, the majority of dry-season crops are grown by women and men in similar percentages, but show cleavages between social groups, depending on other variables, such as the wealth of the farmers. My contribution to the debate on gendered crops is the use of an intersectional approach based on five variables, instead of a bi-dimensional one, to classify dry-season crops. This allows for a much clearer classification.

2. The use of multiple variables, or determinants of constraint as they have been named in this research, is necessary do dig into the complexity of dry-season farming engagement and modes of production. If a single variable was used (such as gender), it wouldn't have been possible to tell why, for example, some men grow more expensive crops and some don't or why female widows are harder to target than non-widowed women. Most importantly, it enabled me to shed a light on the diversity of engagement within the category of women, which is often thought to be homogeneous. Therefore, I conclude that an intersectional approach to the analysis of vulnerabilities and adaptive capacity is highly needed and suitable.

3. Given the crucial nature of such an intersectional approach, institutions that plan dry-season farming interventions need to be aware of the constraints, their determinants and explanatory factors through an analysis based on multiple variables. In fact, there are pre-existing farming and division of labour patterns, inequalities, roles and responsibilities that can determine the success, or failure, of their interventions, and are often not visible at first glance. Instead, an intersectional analysis is an essential step in tailoring the critical variables to the intended beneficiary group. In addition, this needs to be done at a community-scale, as communities show local peculiarities. A community-based tailoring of interventions rooted in an intersectional analysis and with adjustments to the critical variables identified in this research can lead to more effective efforts and better targeting of intended beneficiary groups.

This work sets a first steps towards the use of an intersectional framework in the context of dry-season farming and is placed in an emerging body of literature that advocates for its use in climate change and adaptation research. Further research is needed to improve both the depth and breadth of this work. Detailed agronomical studies, for example, could improve our understanding of irrigated agriculture techniques in semi-arid climates and provide inputs for innovation in terms of crop varieties, fertilisers, watering and others. Moreover, the breath of intersectional research in dry-season farming could be heightened by further studies focussing on which variables need to be included in the analysis in different contexts and on the criteria to identify them.

References

Adaptation Fund (2015), Request for project/programme funding from Adaptation Fund. Retrieved at: https://www.adaptation-fund.org/wp-content/uploads/2015/09/RESUBMISSION_Ghana-AF_proposal_-29-January-2015.pdf [July 2017]

Antwi-Agyei, P., Fraser, E. D., Dougill, A. J., Stringer, L. C., & Simelton, E. (2012). Mapping the vulnerability of crop production to drought in Ghana using rainfall, yield and socio-economic data. Applied Geography, 32(2), 324-334.

Apusigah, A. A. (2009). The gendered politics of farm household production and the shaping of women's livelihoods in Northern Ghana. Feminist Africa, 12(12), 51-67.

Bergold, J., & Thomas, S. (2012). Participatory research methods: A methodological approach in motion. Historical Social Research/Historische Sozialforschung, 191-222.

CARE (2010), Climate Change Brief: Adaptation, Gender and Women´s empowerment. Retrieved at: http://www.care.org/sites/default/files/documents/CC-2010-CARE_Gender_Brief.pdf [July 2017]

CARE (2015a). Namville Wealth Ranking (Internal document)

CARE (2015b). Takpo Wealth Ranking (Internal document)

Carr, E. R. (2008). Men's crops and women's crops: The importance of gender to the understanding of agricultural and development outcomes in Ghana's Central Region. World Development, 36(5), 900-915.

Carr, E. R., & Onzere, S. N. (2017). Really effective (for 15% of the men): Lessons in understanding and addressing user needs in climate services from Mali. *Climate Risk Management*.

Carr, E. R., & Thompson, M. C. (2014). Gender and climate change adaptation in agrarian settings: Current thinking, new directions, and research frontiers. *Geography Compass, 8*(3), 182-197.

Conti, V. (2016). Community-Based Microfinance for Adaptation, Panacea for inclusion at the household level, or source of gender conflict? Internship report, unpublished, University of Utrecht

Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. U. Chi. Legal F., 139.

Denton, F. (2002). Climate change vulnerability, impacts, and adaptation: Why does gender matter?. *Gender & Development*, 10(2), 10-20.

Doss, C. R. (2002). Men's crops? Women's crops? The gender patterns of cropping in Ghana. *World Development*, 30(11), 1987-2000.

Dumenu, W. K., & Obeng, E. A. (2016). Climate change and rural communities in Ghana: Social vulnerability, impacts, adaptations and policy implications. *Environmental Science & Policy*, 55, 208-217.

FAO (2017) Crop calendar. Retrieved at: http://www.fao.org/agriculture/seed/cropcalendar/cropcalendar.do\ [July 2017]

Ghana Living Standard Survey. 2008. Report of the fifth round (GLSS 5). Ghana Statistical Service. Retrieved from http://www.statsghana.gov.gh/ [July 2017]

GSS – Ghana Statistical Service (2010), Population and Housing Census, National Analytical Report. Retrieved at: http://www.statsghana.gov.gh/docfiles/2010phc/National_Analytical_Report.pdf [July 2017]

GSSa (2014), District Analytical Report – Nadowli-Kaleo District. Retrieved at: http://www.statsghana.gov.gh/docfiles/2010_District_Report/Upper%20West/NADOWLI.pdf [July 2017]

GSSb (2014), Ghana Living Standards Survey Round 6 (GLSS6) – Poverty Profile in Ghana (2005-2013). Retrieved at: http://www.statsghana.gov.gh/docfiles/glss6/GLSS6_Poverty%20Profile%20in%20Ghana.pdf [July 2017]

IWMI, International Water Management Institute (24th March, 2016), Dry-season farming, A great opportunity to transform the economy of northern Ghana. Retrieved at: http://www.iwmi.cgiar.org/2016/03/dry-season-farming/ [July 2017]

Jost, C., Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R., Aggarwal, P., Bhatta, G., Chaudhury, M., Tapio-Bistrom, M.L. & Nelson, S., (2016). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. *Climate and Development*, 8(2), pp.133-144.

Kaijser, A. & Kronsell, A. (2014) Climate change through the lens of intersectionality, *Environmental Politics*, 23:3, 417-433.

Kunbuor, B. (2002). Customary Law of the Dagara of Northern Ghana: Indigenous Rules or a Social Construction. *Journal of Dagaare Studies*, 2, 01-21.

Laube, W., Schraven, B., & Awo, M. (2012). Smallholder adaptation to climate change: dynamics and limits in Northern Ghana. *Climatic change*, 111(3-4), 753-774.

Lope-Alzina, D. G. (2007). Gendered production spaces and crop varietal selection: Case study in Yucatán, Mexico. *Singapore Journal of Tropical Geography*, 28(1), 21-38.

Meyiwa, T., Maseti, T., Ngubane, S., Letsekha, T., & Rozani, C. (2014). Women in selected rural municipalities: Resilience and agency against vulnerabilities to climate change. *Agenda*, 28(3), 102-114.

Monroe, A., Asamoah, O., Lam, Y., Koenker, H., Psychas, P., Lynch, M., Ricotta, E., Hornston, S., Berman, A. and Harvey, S.A., (2015). Outdoor-sleeping and other night-time activities in northern Ghana: implications for residual transmission and malaria prevention. *Malaria journal*, 14(1), 35.

Moomen, A. W., & Dewan, A. (2016a). Analysis of spatial interactions between the Shea industry and mining sector activities in the emerging north-west gold province of Ghana. *Resources Policy*, 48, 104-111.

Moomen, A. W., & Dewan, A. (2016b). Assessing the spatial relationships between mining and land degradation: evidence from Ghana. *International Journal of Mining, Reclamation and Environment*, 1-14.

Namara, R. E., Horowitz, L., Nyamadi, B., & Barry, B. (2011). Irrigation Development in Ghana: Past experiences, emerging opportunities, and future directions. Ghana Strategy Support Program (GSSP) Working Paper, (0026).

NASA SADAC Retrieved at:
http://sedac.ciesin.columbia.edu/mapping/hazards/# [July 2017]

Nielsen, J. Ø., & Reenberg, A. (2010). Cultural barriers to climate change adaptation: A case study from Northern Burkina Faso. *Global Environmental Change*, 20(1), 142-152.

Nyantakyi-Frimpong, H., & Bezner-Kerr, R. (2015). The relative importance of climate change in the context of multiple stressors in semi-arid Ghana. *Global Environmental Change*, 32, 40-56.

Odame, F. S. (2014). Ghanaian Traditional Women Leaders and Sustainable Development: the Case of Nadowli District of Ghana. *European Scientific Journal*, 10(14).

Padmanabhan, M. A. (2007). The making and unmaking of gendered crops in Northern Ghana. *Singapore Journal of Tropical Geography*, 28(1), 57-70.

Pelling, M. (2011). Adaptation to climate change: from resilience to transformation. Routledge.

Pickbourn, L. J. (2011), Migration, remittances and intra-household allocation in Northern Ghana: Does gender matter?, PhD Thesis, University of Massachusetts.

Rademacher-Schulz, C., Schraven, B., & Mahama, E. S. (2014). Time matters: shifting seasonal migration in Northern Ghana in response to rainfall variability and food insecurity. *Climate and Development*, 6(1), 46-52.

Yiridoe, E. K., Langyintuo, A. S., & Dogbe, W. (2006). Economics of the impact of alternative rice cropping systems on subsistence farming: Whole-farm analysis in northern Ghana. *Agricultural Systems*, 91(1), 102-121.

Appendix 1 List of interviews, FGDs and questionnaires

FOCUS GROUP DISCUSSIONS
Goli with women
Zupiri with men
Takpo with women
Namville with women
Jang with men
IN-DEPTH INTERVIEWS
Magazia and/or Queen Mother in Goli
Magazia and/or Queen Mother in Zupiri
Magazia and/or Queen Mother in Takpo
Magazia and/or Queen Mother in Namville
Magazia and/or Queen Mother in Jang
a male and a female farmer in Goli
a male and a female farmer in Zupiri
a male and a female farmer in Takpo
a male and a female farmer in Namville
a male and a female farmer in Jang
KEY-INFORMANTS INTERVIEWS
Chief of Takpo
agricultural expert in Goli
EPA officer in charge of the implementation of the AF funded programme
national MESTI officer in charge of the implementation of the AF funded programme
two regional MoFA officers in charge of extension agricultural services for the research sites
Director of the local NGO CIKOD (Centre for Indigenous Knowledge and Organisational Development), implementer of dry-season farming projects in the Upper West region
officer of local NGO, implementer of dry-season farming projects in the Upper West region
officer of the international NGO CARE, implementer of dry-season farming projects in the Upper West region
2 members of the local NGO CDA Ghana (Community Development Alliance)
SURVEYS
125 questionnaires administered among female and male dry-season farmers across the 5 target communities with male and female current and past dry-season farmers

Appendix 2 Survey

Questionnaire Dry Season Farming

1. Sex F / M

2. Are you a widow? YES / NO

3. What is your level of education? **Underline:** None / Primary school / JHS / SHS / Tertiary

4. How long have you been doing dry-season at the current location? ……

5. If you have farmed on another location, for how long did you do that?.....

6. How long does it take you to reach the garden? **Underline**: Up to 15 min / Up to 30 min / Up to 1 hour

7. How do you travel to the dry-season gardens? **Underline:** On foot / Bicycle / Motorbike / Motorking

8. Do you use any fertiliser, pesticide or any kind of chemical? YES / NO

9. What is your source of water for dry-season farming?
Underline: Dam / Dugout / Borehole / Other:…….

10. How do you mainly water your crops? **Underline:** With pumps / With buckets /
Other:.....

11. Which vegetables do you grow? **Tick one or more:**

☐ Pumpkin leaves	☐ Beans leaves	☐ Salad
☐ Other local leaves	☐ Tomatoes	☐ Peppers
☐ Cabbage	☐ Carrots	☐ Watermelon
☐ Onions	☐ Sugarcane	☐ Other:…….....

12. How do you sell your vegetables? **Underline:** Market in my community / Market in neighbouring community / Market in town (Wa, Nadowli, Kaleo) / Other:…….

13. How much time do you spend in the garden? **Underline:** I don't go every day / I go there every day in the morning / I go there twice a day / I spend most of the day there

14. Where do you get the seeds for your crops from? **Underline:** An NGO provides them / At the local market / In a bigger town (Nadowli, Wa) / Local Government / Other:……....

15. Is/was your dry season farming plot fenced? YES / NO

If YES what material was the fence made of? **Underline:** iron/wood/fence plants

If NO, is/was the farm guarded at night YES / NO

16. If YES, Who made the fence for your garden? **Underline:** Myself / An NGO or Government / My husband or wife / Hired workers / Other: …….…….

17. Did your crops ever get destroyed by Fulani roaming animals? YES / NO