

**ENVIRONMENTAL, HEALTH AND SAFETY IMPLICATIONS OF TOBACCO
PRODUCTION IN MALAKISI DIVISION, BUNGOMA COUNTY, KENYA**

BY

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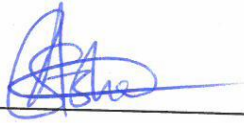
C50/63682/2011

**A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENT FOR THE DEGREE OF MASTERS OF ARTS IN
ENVIRONMENTAL PLANNING AND MANAGEMENT**

JUNE, 2016

DECLARATION

This project report is my original work and it has never been submitted for examination in any other University



Date 16/06/2016

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(C50/63682/2011)

This project report has been submitted with our approval as the university supervisors

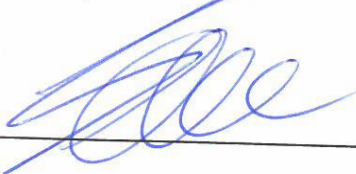


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DEDICATION

For my late parents, Jane Nabalayo and Ibrahim Sitati, whose memories have always inspired me
to stretch beyond the limits.

ACKNOWLEDGEMENT

The finalization of this paper is one of the major milestones I have accomplished and I would like to thank all those who have been a part of this journey. Most importantly, a profound thank you to Dr. Maggie Opondo, my supervisor, for her guidance, unwavering patience, constructive criticism and for the moral support throughout my project work. Thank you to Dr. Samuel Owuor for accepting to be my second supervisor and offering guidance, and to Prof. Jacob Kibwage for guiding me on the study topic.

I am thankful to all the lecturers within the Department of Geography and Environmental Studies, for their dedication and commitment. I am grateful for all the knowledge gained. Thanks to all my classmates for the motivation and team work.

I am indebted to my enumerators, Linet and Fred, who willingly offered assistance in data collection and community mobilization. This research would not have been possible if it were not for their relentless efforts. You are very much appreciated.

My colleagues: Dr. Zinta Zommers for being very understanding with my schedule amidst work-related deadlines, and for her continued support and guidance; Dr. Richard Munang for reading my work and providing feedback; and James Osundwa for assisting with the study area map.

Lastly, I am very grateful to my beloved family for the inspiration and always believing in me. My brothers Simon and Isaac, and my sisters Mariam, Esther and Lilian, for the genuine love, and support. Thank you for being a constant reminder that the past does not define the future. I appreciate and love you all!

TABLE OF CONTENTS

DECLARATION	Error! Bookmark not defined.
DEDICATION	iii
ACKNOWLEDGEMENT	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF ACRONYMS	x
ABSTRACT.....	xi
1.0 BACKGROUND TO THE STUDY	1
1.1 Introduction.....	1
1.2 Statement of the research problem.....	4
1.3 Research questions.....	5
1.4 Objectives of the study.....	6
1.5 Justification of the study	7
1.6 Scope and limitations of the study	8
1.7 Operational definition of terms.....	10
2.0 LITERATURE REVIEW	11
2.1 Tobacco production and deforestation.....	11
2.2 Impact of tobacco production on soil quality	15
2.3 Impact of tobacco production on health and safety	16
2.4 Conceptual framework.....	21
3.0 METHODOLOGY	24
3.1 Study area.....	24
3.1.1 Economic activities and employment	24
3.1.2 Climate.....	26
3.1.3 Soil and Topography.....	26
3.2 Study design.....	26
3.3 Data collection	29

3.4 Data analysis, interpretation and presentation	30
3.5 Ethical considerations	31
4.0 RESULTS AND DISCUSSION	32
4.1 Respondents' demographic characteristics	32
4.2 Background of agricultural practices	34
4.3 Tobacco farming	36
4.3.1 General information on tobacco farming	36
4.3.2 Tobacco farming and land system	43
4.4 Environmental impacts of tobacco farming.....	45
4.4.1 Impact on forests and aquatic life	45
4.4.2 Impact on water resources.....	53
4.4.3 Waste management	55
4.5 Tobacco production impact on health.....	56
4.6 Tobacco companies' role in sustainability.....	62
4.6.1 Effectiveness of environmental conservation efforts.....	62
4.6.2 Energy-efficiency technology	63
4.6.3 Tobacco companies' rules and regulations	64
5.0 SUMMARY, CONCLUSION AND RECOMMENDATION	68
5.1 Summary of key findings.....	68
5.2 Conclusion	70
5.3 Recommendations.....	71
5.4 Areas for further research	73
REFERENCES	74
APPENDIX 1: QUESTIONNAIRE FOR TOBACCO FARMERS	86
APPENDIX 2: QUESTIONNAIRE FOR NON-TOBACCO FARMERS	92
APPENDIX 3: FOCUS GROUP DISCUSSION GUIDE.....	95

LIST OF TABLES

Table 3.1	Sampled Sub-locations.....	28
Table 3.2	Age variation of FGD participants.....	29
Table 4.1	Gender and education level.....	32
Table 4.2	Age of respondents	33
Table 4.3	Indigenous trees in Malakisi	35
Table 4.4	Household uses of tobacco.....	37
Table 4.5	Reasons for tobacco production.....	39
Table 4.6	Source of farm inputs.....	39
Table 4.7	Reasons for not growing tobacco.....	40
Table 4.8	Problems faced in tobacco production	41
Table 4.9	Type of farmer and level of soil fertility.....	42
Table 4.10	Type of farmer and total acreage of land	44
Table 4.11	Type of farmer and land diversity.....	49
Table 4.12	Type of farmer and source of wood-fuel	50
Table 4.13	Disposal of tobacco production waste	55
Table 4.14	Gender roles in tobacco production	57
Table 4.15	Farmers' level of education and use of protective devices	59
Table 4.16	Level of awareness and use of protective devices	59
Table 4.17	Protective devices used in tobacco production	60
Table 4.18	Source of protective devices	61
Table 4.19	Reasons for not using protective devices.....	61
Table 4.20	Level of education and knowledge of tobacco rules.....	65
Table 4.21	Ownership and usage of protective devices.....	67

LIST OF FIGURES

Figure 2.1	Conceptual framework.....	23
Figure 3.1	Study area.....	25
Figure 4.1	Number of years in tobacco production.....	38
Figure 4.2	Changing acreage of tobacco farms.....	43
Figure 4.3	Prevalence of shifting cultivation among farmers.....	46
Figure 4.5	Methods of tobacco curing.....	47
Figure 4.6	Wood displayed in a local market in Malakisi.....	48
Figure 4.7	Stack of wood-fuel in Malakisi.....	50
Figure 4.8	Tobacco production's impact on aquatic life.....	51
Figure 4.9	Ownership of tobacco nursery	53
Figure 4.10	Tobacco nursery located next to a stream	54

LIST OF ACRONYMS

BAT	British American Tobacco
CBO	Community-Based Organization
FAO	Food and Agriculture Organization
FCTC	Framework Convention on Tobacco Control
GTS	Green Tobacco Sickness
ILO	International Labour Organization
KEMRI	Kenya Medical Research Institute
MTK	Mastermind Tobacco Kenya Ltd
NCT	Naturally Cured Tobacco
NIOSH	National Institute for Occupational Safety and Health
TCA	Tobacco Control Act
UN	United Nations
WHO	World Health Organization

ABSTRACT

Tobacco has existed since prehistoric times and is now widely grown as a cash crop in developing countries like Kenya. The number of tobacco farmers contracted by tobacco companies in Kenya increased by 67% in the period 1972 to 1991 and by 36% from 1991 to 2000. Though the industry is lucrative to most tobacco farmers due to ready markets and loans, tobacco production substantially contributes to environmental degradation and increased health and safety risks to farmers and workers. Tobacco farming practices also pose a challenge for environmental sustainability due to increased deforestation, over-application of agrochemicals and subsequent pollution.

In the process of farming, tobacco farmers are exposed to a number of occupational health and safety risks characterized by many physical, chemical, and biological hazards. Nicotine poisoning is one of the health-related complications that results from farmers' regular contact with wet tobacco leaves. Tobacco crops require constant application of agrochemicals due to their susceptibility to pests and other diseases. This frequent exposure to chemicals increases the vulnerability of farmers to health related risks. During tobacco curing, farmers are exposed to risks of physical injuries caused by fire.

This study, therefore, seeks to achieve a number of objectives: to investigate how tobacco production contributes to environmental degradation; to assess the level of environmental awareness among tobacco farmers in tobacco production; to determine the prevalence of risk factors among tobacco farmers; and to identify strategies that can help reduce the environmental impact and health and safety risks in tobacco production. A total of 100 tobacco and non-tobacco farming households were sampled for the study. Key informant interviews were also conducted

targeting the local leadership, focal persons at the two tobacco companies, extension services officials and medical practitioners based in Malakisi. Focus group discussions (FGDs) were undertaken in four groups targeting both tobacco and non-tobacco farmers based on age, gender, and experience in farming.

The study found that tobacco production that has extensively led to deforestation in the area. Indigenous trees have been cut down, and the reforestation programmes are not effective. Consequently, the rivers that were once permanent have become seasonal. The quality of soil on tobacco farms has deteriorated over time due to over-utilization of chemicals and fertilizers. The health of tobacco farmers and workers has always been at risk as the use of Personal Protective Equipment (PPE) is not always practiced. The farmers have had a range of symptoms that point to Green Tobacco Sickness (GTS). Physical injuries were also reported among family members. Besides the risk factors, tobacco farmers remain unaware of the rules and regulations governing the tobacco production process. However, there exist a proportion of tobacco farmers who are familiar with the rules but they don't follow them to the letter. Most farmers are largely ignorant of the risks that they are exposed to.

The study, therefore, recommends that tobacco farmers be regularly trained on farming and conservation best practices. Effective reforestation programmes, proper waste disposal practices and use of PPEs can significantly reduce the impact on tobacco production. Tobacco companies can also play a crucial role in the form of corporate social responsibility that promote initiatives that would lead to a sustainable environment with minimal risks to health and safety of farmers. The laws on tobacco control, which are biased towards tobacco smoking, need to be reinforced to include tobacco farming related provisions. Setting targets for tobacco companies, in terms of

environmental conservation and safety of farmers, could enhance sustainable practices in the tobacco production process.

1.0 BACKGROUND TO THE STUDY

1.1 Introduction

The tobacco plant initially originated from Peru and Ecuador, where it has existed since the prehistoric times. The plant was taken to Europe by early explorers and later re-exported to the rest of the world during colonization (Musk and De Klerk, 2003). Tobacco is now widely grown as a cash crop in developing countries where wealthy multi-national companies are growers, traders and manufacturers (Kibwage et. al., 2008). It is estimated that the number of tobacco farmers contracted by tobacco companies in Kenya increased by 67% in the period 1972 to 1991, by 36% from 1991 to 2000, and by 15% from 2001 to 2005 (Kibwage et. al., 2008).

The tobacco-related agricultural practices, especially in developing countries, have led to deforestation and soil degradation (Guindon et. al., 2003; Motaleb and Irfanullah, 2011 and Lecours et. al., 2012). The rate of deforestation is high in developing countries, amounting to 1.7% of global net losses of forest cover (Geist, 1999 and Mangora, 2005) with an estimated 200,000 hectares of forests cleared for tobacco production every year (Geist, 1999). For instance, tobacco curing demands intensive use of wood-fuel that is mostly derived from indigenous trees, causing deforestation, accelerating soil erosion and leading to loss of biodiversity (Guindon et. al., 2003 and Kibwage, et. al., 2008). Malawi, one of the largest tobacco producers, has one of the highest rates of deforestation in the world (Geist, 1999). In 1999, over 26% of Malawi's total annual deforestation was related to tobacco production (Geist, 1999 and Clay, 2004). In Brazil, tobacco production has led to loss of biodiversity, reduction of soil nutrients, and water table (Geist, 2009). Other negative consequences of tobacco production include environmental degradation caused by

leaching of chemicals from the soil and pollution from pesticides and fertilizers (Guindon et. al., 2003 and Motaleb & Irfanullah, 2011).

Farming is an occupation that is characterized by many physical, chemical, and biological hazards (Coye, 1985; Ehlers et. al., 1993 and Von Essen & McCurdy, 1998) that ultimately expose farmers to a variety of health and safety risks in the course of their daily work (Gerrard, 1998). The level of risk in tobacco farming is distinct from that faced in other forms of agriculture (Hope et. al., 1999 and ILO, 2000). One particular health problem for tobacco farmers is nicotine poisoning, which occurs when farmers come into contact with wet tobacco leaves (McBride et. al. 1998; Arcury et. al., 2002; Brown, 2003 and Arcury, 2006). The high cost of machinery, which majority of smallholder tobacco farmer cannot afford, leaves farmers with the option of hand-harvesting (Quandt et. al., 2000 and Schmitt et. al. 2007) which exacerbates the risk of exposure to nicotine poisoning. The leaves of flue-cured tobacco are usually hand-picked in stages when ripe, unlike those of other types of tobacco that are harvested once, increasing the level of exposure to wet tobacco leaves (Schmitt et. al., 2007). The frequency with which pesticides have to be applied throughout the tobacco production period is an indicator of tobacco farmers' increased level of exposure to health and safety-related risks (Brown, 2003 and Cornwall, 1995).

The Framework Convention on Tobacco Control (FCTC) is a treaty that provides an internationally coordinated response to combat, among others, problems related to tobacco production and consumption. The parties to the FCTC are required to “promote and strengthen public awareness of tobacco control issues...and adopt and implement effective legislative, executive, administrative or other measures to promote public awareness of and access to information regarding the adverse health, economic, and environmental consequences of tobacco

production and consumption”. Parties are also called upon to “agree to have due regard to the protection of the environment and the health of persons in respect of tobacco cultivation and manufacture within their respective territories”. Kenya signed and ratified this convention in July 2004 committing itself to implement the measures outlined in the convention. This commitment is further evidenced in the 2014 progress report on the FCTC submitted to the World Health Organization (WHO). The report acknowledges that the government of Kenya has made significant progress in safeguarding the environment and health of persons involved in tobacco production by “requiring 10% of land for cultivation of tobacco to be reserved for planting trees and requiring protective gear for tobacco farmers and industry workers”. However, no significant milestones have been achieved in Kenya, and specifically Malakisi, in terms of reducing the impact of tobacco production on the environment and health of farmers.

In line with the FCTC, the Kenya Tobacco Control Act 2007 (TCA 2007) aims at controlling the production, manufacture, sale, labeling, advertising, promotion and sponsorship of tobacco products. The Act provides that every person has a right to a clean and healthy environment. Despite the existence of these provisions, the TCA has not been fully implemented. Furthermore, the two legislative documents are biased toward regulating tobacco smoking as opposed to tobacco production aspects. A study carried out in Kenya in 2007 assessed the level of public support for tobacco control policies (Maina, et. al., (2013). The results of this study show that majority of respondents supported tobacco control policies as proposed by FCTC. In fact, about 60% of all the respondents thought that there was very little commitment by the government in tobacco control especially in terms of implementing policies that would protect the public from the harmful effects of tobacco (Maina, et. al., 2013). The Health and Safety in Agriculture Convention, 2001 (No. 184) is the first international instrument that comprehensively addresses the health and safety

hazards facing workers in agriculture. Kenya is among the countries which have not ratified this convention yet. The convention covers preventive and protective measures regarding machinery safety, handling and transportation of materials, chemicals management and the construction and maintenance of agricultural facilities.

1.2 Statement of the research problem

Tobacco poses major challenges to both the environment and the health of farmers (Ochola and Kosura, 2007). A tobacco farmer is in frequent contact with wet tobacco leaves and agrochemicals that increase health-related risks (McBride *et. al.*, 1998 and Arcury, 2006). The kind of tobacco grown in Malakisi division is flue-cured hence a lot of wood-fuel is required for curing, leading to deforestation and soil erosion (Guindon *et. al.*, 2003 and Kibwage *et. al.*, 2008). The widespread deforestation activities have also led to change of the local streams from permanent to seasonal, resulting in water scarcity for agricultural and domestic use during dry season¹.

Tobacco production involves intensive use of agrochemicals from the time the nursery is put up to the time of harvest. These chemicals vary depending on the stage of the crop and are applied several times presenting a high exposure to health risks. Due to the need for frequent watering of the tobacco seedlings, most of the nurseries are located near streams or rivers to increase accessibility to water. The chemicals used in the nurseries and farms are further washed by runoff into the streams and rivers, polluting them and endangering the aquatic life. After harvesting, the leaves are subjected to the curing process that requires close and continuous monitoring and

¹After deforestation has occurred, the new vegetation with fewer leaves and shallower roots, takes up less water than the previous vegetation. As a result, the rate of evapotranspiration slows down leading to less water uptake, increased run-off and stream/river flow during rainy seasons and reduced or no water level during dry seasons.

contact which exposes tobacco farmers to health and safety risks that arise from exhaustion, burns and pollution through smoke.

1.3 Research questions

The main research question of the study is: “What are the environmental impacts and occupational health and safety risks associated with tobacco production in Malakisi? The specific research questions of the study were:

- i. How has tobacco production led to deforestation?
 - a. What is the current state of forests and how has it changed over the last decades?
 - b. How do tobacco farmers acquire land for tobacco farming?
 - c. Where do tobacco farmers acquire wood-fuel for tobacco curing?
 - d. Do the existing reforestation programmes have any impact on the forest cover?
- ii. What knowledge and practices are associated with the use of agrochemicals in tobacco production?
 - a. How does tobacco production affect water, aquatic life and soils?
 - b. Which agrochemicals do farmers use in tobacco production?
 - c. How does the frequent application of agrochemicals affect the health of farmers?
 - d. Is there any training given to farmers regarding application of agrochemicals?
 - e. Do farmers/workers use PPEs when applying agrochemicals and harvesting tobacco leaves?
 - f. Which health risks are farmers/workers exposed to when using agrochemicals without proper protection?

- iii. How prevalent are the risk factors associated with green tobacco sickness (GTS) among tobacco farmers?
 - a. Do farmers or their workers use PPEs when harvesting tobacco?
 - b. What are the major symptoms experienced by tobacco farmers or their workers when they come in contact with wet tobacco leaves?
 - c. Are tobacco farmers aware that tobacco farming practices can lead to degradation of the environment?
- iv. What strategies are in place to ensure protection of the environment and the welfare of farmers in the process of tobacco production?
 - a. What are the roles of institutions that exist in Malakisi in terms of reducing the impact of tobacco production?
 - b. Which measures have been put in place by tobacco companies to promote environmental conservation?
 - c. What are the gaps in the current tobacco related policy frameworks and what are the implications of such gaps?

1.4 Objectives of the study

The goal of this study is to assess the impact of tobacco farming on the environment and to determine the occupational health and safety risks that tobacco farmers are exposed to in the process of production. More specifically, this study sought to achieve the following objectives:

1. To investigate how tobacco production contributes to environmental degradation
2. To assess the level of environmental awareness among tobacco farmers in tobacco production

3. To determine the prevalence of risk among tobacco farmers
4. To identify strategies that can help reduce the environmental impact and health and safety risks in tobacco production

1.5 Justification of the study

Kenya's agricultural sector is ranked as a major driver of Kenya's economy and a means of livelihood for the majority of the Kenyan people, providing employment to more than two-thirds of the population (Smale and De Groote, 2015). Tobacco farming is the mainstay for majority of the rural populace in Malakisi division in western Kenya. Despite the main significance attached to the tobacco production by tobacco farmers, little and often out-of-date data exists on the environmental and occupational health and safety of tobacco production in Kenya.

Although tobacco legislative tools exist in Kenya, they are not often implemented to the letter by respective entities like the government, tobacco companies and the farmers. In 2012, the WHO spearheaded a joint national capacity assessment on the implementation of effective tobacco control policies in Kenya and found out that enforcement of most of these policies was still not optimal (WHO, 2012). Among the issues highlighted in the report were lack of clear coordination among different government entities in tobacco control; fragmented and uneven enforcement of the TCA; and lack of monitoring and evaluation framework. Furthermore, the existing policies are biased towards tobacco smoking. The existing provisions related to the environment and health and safety of farmers (as opposed to smokers) still lack enough depth. Many studies have been undertaken with a main focus on tobacco smoking and the subsequent effect on health of smokers (Taylor, P. 1984; Hammond, *et. al.*, 1995 and Torres, L. 2000; Lo, *et. al.*, 2013; Maina, *et. al.*, 2013; Kassim, *et. al.*, 2014; Brathwaite, *et. al.*, 2015; and Islami, *et. al.*, 2015). Other studies have

majorly focused on the viability of alternative crops and the need for tobacco farmers to diversify their livelihoods (Khumalo, C., 2013; Chavez, *et. al.*, 2014; Kibwage, *et. al.*, 2014; and Kienle, *et. al.*, 2015).

The study therefore provides data and knowledge on impacts of tobacco production activities on the environment in terms of deforestation and degradation of environmental resources like water and soil. Moreover, the study reveals the effects of tobacco related activities on the health and safety of tobacco farmers and workers as a consequence of their exposure to agrochemicals and nicotine. This study provides a set of best practices to tobacco farmers in Kenya in terms of environmental sustainability and reducing risk exposure in tobacco farming.

The information from this study will also play an important role in guiding tobacco policies at national level. More importantly, the findings of the study will be critical in reinforcement of Article 18 of WHO Framework Convention on Tobacco Control, which outlines the need for parties to protect the environment and the health of persons involved in tobacco production. From the 2014 progress report on FCTC, Kenya as a signatory to the convention has not fully addressed or implemented most of the provisions. The data from this study would therefore help highlight various tobacco-related issues at the local level and contribute to decision-making at government level.

1.6 Scope and limitations of the study

The research was carried out in Malakisi division in Bungoma County. Malakisi is one of the major tobacco growing regions in Kenya. This study targeted both smallholder tobacco and non-tobacco

farmers. The two sets of farmers were interviewed to offer comparison in terms of experiences and impacts faced. Non-tobacco farmers acted as a control group in the study.

The study was only limited to tobacco production, ranging from nursery development through to the curing and storage of leaves. Given enough time and resources, the researcher would have focused on the whole tobacco value chain from preparation of seedlings to the manufacturing and use of cigarettes. However, the researcher decided to focus on the tobacco farming aspects, an area that has often been overlooked in a number of tobacco studies in Kenya. For non-tobacco farmers, the study was interested in the experiences of both the former tobacco farmers and those who had never grown tobacco. However, it was a challenge to tell which non-tobacco farmer had or had never grown tobacco. The researcher relied on the guidance and assistance from the local administration in terms of selecting tobacco and non-tobacco households.

The study was also limited to field data and information received from respondents - through household surveys, key informants and focus group discussions (FGDs) – for analysis. No laboratory tests were carried out on soil and water samples due to limited resources. In this case, the study relies on secondary data from studies carried out by various researchers across the world. Although the information on the patients who have sort medical treated from nearby hospitals was crucial in informing whether the symptoms exhibited could be linked to tobacco production-related illnesses, the researcher had a challenge acquiring this information as it was regarded confidential. To counter the challenge, the researcher attempted to compare information from victims of tobacco-related illnesses to that reviewed in literature in making a conclusion. More importantly, the information received from key informants (medical practitioners) helped in verifying the symptoms outlined by the respondents.

1.7 Operational definition of terms

Curing barn: This is a structure for curing. Most curing barns in Malakisi are designed with over-lay pipes and enough ventilation to allow circulation of heat and air.

Flue-curing: This is one of four main methods of curing tobacco, which uses only artificial heat pipes and fans that circulate the heat for even distribution, and involves burning of wood-fuel for several days at constant high temperatures. This type of curing is thought to be a major driver of deforestation to tobacco growing zones.

Nicotine: A colorless, poisonous compound occurring naturally in the tobacco plant. It is used in medicine and as an insecticide, and it is the substance in tobacco products to which smokers can become addicted.

Occupational Health and Safety: This concerns the health and safety welfare of tobacco farmers and their workers in the process of tobacco production.

2.0 LITERATURE REVIEW

This chapter describes the theoretical and conceptual framework employed in analysing the implications of tobacco production. The chapter documents the impacts of tobacco production on deforestation, soil, water, and the health and safety of tobacco farmers. It establishes the conceptual framework that links various elements of tobacco production from tobacco nursery preparation to the curing stage. A number of research gaps that this study seeks to bridge are also highlighted. Studies have found out that tobacco production affects the socio-economic development and sustainability of the environment and natural resources (Geist *et. al.*, 2009). In particular, the production activities contribute to increased negative impacts on the environment and the health of farmers (Lecours *et. al.*, 2012).

2.1 Tobacco production and deforestation

The main tobacco farming practices that are responsible for environmental degradation are deforestation and the use of agrochemicals. Concerns about tobacco-related deforestation in developing countries started to be raised in the 1980s by international organizations like the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) (Chapman, 1994 and Geist *et. al.*, 1999). Tobacco contributes to deforestation through clearing of forests for cultivation and stripping of wood-fuel from forests for curing tobacco leaves (Lecours *et.al.*, 2012).

The total land cleared globally for tobacco growing and curing is projected to double by the year 2016. On a global scale, tobacco-related deforestation accounts for 1.7% of all the forest cover cleared annually (Geist *et. al.*, 1999). In Brazil, reduced forest cover has occurred in areas surrounding tobacco farms (Merten and Minella, 2006). The impact of tobacco production on

forests has reached high or serious levels in almost one third of the 66 developing countries in which tobacco is grown (Geist *et. al.*, 1999 and Mangora, 2005). In developing countries, tobacco is estimated to cause 5% of deforestation annually (Clay, 2004 and Lambin and Geist, 2006). According to various studies, tobacco-related deforestation accounts for approximately half of the total annual loss of forests in Tanzania and other countries that are largely dominated by Miombo woodland. A study conducted in Malawi found out that 21% of the national wood-fuel consumption and approximately 47% of total deforestation was linked to tobacco production (Rath and Chaudhary, 1999).

In assessing the annual global amount of deforestation caused by tobacco production, Geist (1999) challenges the hypothesis that tobacco-related deforestation does not have a significant negative effect on the environment. In this study, he demonstrates that the impacts of tobacco-related deforestation are significantly in 35 regions of the developing world. Furthermore, Geist (1999) emphasizes the fact that tobacco-related deforestation has significantly contributed to environmental degradation especially in the fragile dry lands and the upland areas where tobacco is mostly grown. Although Mangora (2005) finds that tobacco production has no significant negative effect on the diversity of tree species in Tanzania, he also notes that there is a significant reduction of biomass and change in vegetation structure. He attributes the increasing rate of deforestation to the clearing of land for tobacco production (shifting cultivation) and for curing of tobacco leaves.

Various studies (Mangora, 2005; Abdallah *et. al.*, 2007; Sauer & Abdallah, 2007; and Yanda, 2010) discuss the threat to forests that is posed by shifting cultivation. Mangora (2005) and Yanda (2010) discuss the implications of shifting cultivation and the threat to forest ecosystems in

Tanzania. They argue that tobacco farmers in Tanzania regularly obtain land for tobacco production by clearing forests through shifting cultivation. They contend that virgin land is often preferred by tobacco farmers for fear of soil-borne diseases and the need to achieve high tobacco yields. Mangora (2005) found out that for every planting season, 69% of tobacco farmers cleared forest land for tobacco farming, 25% after every two seasons while only 6% used the same land for more than two seasons. He further noted that the duration of the fallow period had significantly reduced from ten to four years, thus threatening the capacity of deforested areas to recover. In fact, Abdallah *et. al.*, (2007) estimates that as much as 96% of land use change in the Miombo region is as a result of shifting cultivation. Mangora (2005) and Yanda (2010) concur that the high demand for land and wood-fuel in tobacco production can no longer be sustained under the current pace of deforestation.

Studies conducted in the 1990s (Kweyuh, 1994 and Waluye, 1994) documented the impact of deforestation caused by tobacco production (especially in terms of loss of indigenous trees) and resulting impact on soils, biodiversity and water resources. In Kenya, Kweyuh (1994) noted that indigenous trees in Malakisi had significantly reduced in number within a stretch of 30 km from the Mount Elgon region. He further noted that tobacco farmers used up to 45% of the tobacco woodlots acquired from tobacco companies' afforestation programme for tobacco curing, thus leading to continuous deforestation despite afforestation efforts. Muwanga-Bayego (1994) established that Uganda's forest cover had greatly declined from approximately 31, 000 km² to less than 6,000 km² within four years, majorly due to high demand for tobacco production related activities. On the other hand, Waluye (1994) conducted a similar study in Tanzania and found that although tobacco farmers were aware that wood-fuel for tobacco curing was scarce, they were not taking any measures in restoring the forest cover. He further noted that most of the natural trees

that had been cut down would take 30-50 years to regenerate hence leaving deforested areas bare for a long period of time. These impacts are still present as illustrated in Kibwage (2009). This study will also attempt to investigate whether tobacco production contributes to environmental degradation.

The majority of the tobacco varieties grown, especially in the developing countries, require curing with wood-fuel. Brazil, India, the Philippines and most African countries use wood-fuel for curing tobacco. In 2003, over 100,000 Brazilian tobacco farmers required wood from 60 million trees to cure tobacco leaves (FAO, 2010). In 2000, there was a shortage of wood-fuel in Malawi and Tanzania with increasing deforestation in the tobacco-growing regions (Lal, 2000). The type of tobacco grown in Kenya (*Virginia*) is flue-cured hence the high demand for wood-fuel. Further, indigenous trees are normally used for curing of tobacco since studies have shown that the smoke from these trees enhances the quality of the final product, a trend that has caused massive destruction of indigenous trees (Chacha, 1999).

The flue-curing process involves burning of wood-fuel for several days at constant high temperatures (Mangora, 2012) that ultimately consumes a lot of wood-fuel. In East and Southern Africa, as in most other developing countries where there is tobacco growing, the curing methods have remained the same over the past decades. The energy efficiency and ecological conservation mechanisms are rarely considered (Mangora, 2005 and Torres, 2000) as tobacco farmers continue to exploit forests for wood-fuel that is utilized in tobacco-related activities. Studies undertaken over a decade ago (Novotny *et. al.*, 1999; Torres, 2000 and Lal, 2000) found out that there was no alternative method of tobacco curing.

Tobacco farmers heavily rely on wood for construction of the curing barn, tying of tobacco leaves and fuel for curing of tobacco. Primarily, the quantity of wood-fuel that is required to cure tobacco depends on the size of the tobacco field and the quantity of tobacco harvested (Mangora, 2005 and Mangora, 2012). Mangora, 2005 estimates that, 0.6 hectares of forests have to be cleared to cure one hectare of tobacco. In Brazil, which is the third largest producer and number one exporter of tobacco in the world (FAO, 1995), approximately 60 million trees are utilized annually for tobacco production (Tailor and Peter 1994). According to Chapman (1994), 69% of the wood consumed by the tobacco industry globally is utilized in curing only. This study also attempts to assess the level of deforestation due to tobacco curing.

The World Bank report published in 2012 stated that the area covered by forests in Kenya in 2010 was 6.9%. This area is still below the United Nations (UN) requirement of a 10% forest cover. Some of the likely consequences of deforestation include disruption of ecosystem services and increased rate of climate-induced extreme events-floods, drought, landslides and diseases.

2.2 Impact of tobacco production on soil quality

Tobacco causes environmental degradation through pollution from agrochemicals that are applied to the tobacco fields (Abila, 2006). The high chemical level in the tobacco farms affects the growth of other subsequent crops (Abila, 2006 and Kibwage *et. al.*, 2009). When planted as a mono-crop, which is often the case, tobacco is highly vulnerable to pests and diseases, hence the need for fungicides and herbicides (Tobacco Free Kids, 2001). A study in Bangladesh showed that the use of agrochemicals to control persistent weeds found on tobacco farms destroys the organisms that are necessary in maintaining healthy soils (Akhter *et. al.*, 2008). Other studies have demonstrated that tobacco rapidly extracts nutrients – phosphorous, nitrogen and potassium – from the soil than

any other crops, hence necessitating the need for more fertilizers to be applied on tobacco farms (Tobacco Free Kids, 2001 and Geist *et. al.*, 2009).

To avoid soil exhaustion, soil borne diseases, and to increase tobacco yield, most tobacco farmers have, for a long time practiced mono-cropping and shifting cultivation (Temu, 1980; Goodland *et. al.*, 1984; Clay, 2004; Mangora, 2005 and Abdallah *et. al.*, 2007). Each season, globally, about 69% of tobacco farmers clear a new area of land for tobacco cultivation (Mangora, 2005; Abdallah *et. al.*, 2007 and Mangora, 2012). The remaining percentage of farmers utilizes the same pieces of land for two or three consecutive seasons.

The common pesticides used in tobacco production contain highly toxic substances. For instance, Methyl bromide which is an ozone depleting chemical, is also used to fumigate the soil prior to the planting of tobacco seedlings. These chemicals find their way into the soil and eventually into rivers, streams and food chains, thus interfering with the ecological system by affecting animals, aquatic life and people that use the water (Ochola and Kosura, 2007). The growing of tobacco along riverbanks and the general use of fertilizers and pesticides cause the death of some indigenous fish species in local streams and rivers (Kibwage *et. al.*, 2009). Poor disposal of wastes (for example, fertilizers, chemicals and tobacco leaves) by tobacco companies is also an environmental issue of concern. The current study attempts to look at the inter-linkage between tobacco production practices in and the level of soil fertility in Malakisi.

2.3 Impact of tobacco production on health and safety

The agricultural industry employs half of the world's labour force, and its work often involves family labour (Schenker, 1996; Meyers *et.al*, 1997 and ILO, 2003). Compared to other industries

(except mining), the agriculture industry poses a greater risk of death and injury to farmers and workers (Von Essen et.al, 1998). For instance, Meucci, *et. al.*, (2015) conducted in southern Brazil on chronic low back pain (CLBP) prevalence among tobacco farmers and found that CLBP is a significant health problem among tobacco farmers, mostly caused by physical and chemical impacts that result from tobacco production.

Breathing in high doses of pesticides can result in respiratory irritation, nausea, headache, and fatigue. It is estimated that over 25 million pesticide poisonings occur every year in developing countries (Brown, 2003). The magnitude of health-related impacts of agrochemicals varies according to the frequency of agrochemical application, the type of agrochemical, the individual's level of vulnerability and climatic conditions (ILO, 2003). Most of the agricultural practices take place in remote areas where availability and access to health and medical services are not guaranteed. This is particularly evident in developing countries (ILO, 2003) and especially in rural areas where farming is the major source of livelihood yet, in case of farm-related emergencies/illnesses, access to information and medical facilities is problematic. Statistics show that developing countries consume more than 20% of the world's agrochemicals and are responsible for approximately 70% of the total number of cases (i.e. 1.1 million cases) of acute poisoning globally (ILO, 2003). In rural Kenya, the populace relies on water from these rivers and streams for general domestic use and farming (Ochola and Kosura, 2007). This is true for Malakisi where the chemically polluted waters are relied upon for domestic consumption posing a health risk to the consumers.

Approximately 33 million people worldwide work in tobacco farming (Jha and Chaloupka, 2000). Tobacco farming requires an estimated 3,000 hours of work per year per hectare, compared with

only 265 hours for maize (Cordeiro et.al, 1998). More time spent in the field leads to greater exposure and a higher propensity to occupational health and safety risks. For instance, tobacco companies recommend 16 separate applications of pesticides in the tobacco nurseries (Goodland *et. al.*, 1984) which exposes tobacco farmers to greater risks of pesticide poisoning and other serious public health challenges (Arcury et.al, 2006 and Barbeau et.al, 2004).

Tobacco-related health problems are known to be induced through direct contact with tobacco plants (nicotine poisoning), high levels of exposure to toxic pesticides and the physical hazards (Ballard *et. al.*, 1995; Cox, 1995 and McBride et.al, 1998 and Arcury et.al, 2001). In the United States of America (USA), the National Institute for Occupational Safety and Health (NIOSH) estimated that there were 10,000 physician-diagnosed pesticide poisonings annually (Brown, 2003) among tobacco farmers. In Brazil, 300,000 tobacco farmers are poisoned from pesticide use annually (Golden, 2001). Barry (1991) found out that storage of tobacco in the residential premises of farmers had adverse effects on the health of tobacco farmers. A study in northern Greece (Damalas *et. al.*, 2006) showed that almost all farmers (99%) are aware that pesticides can potentially impact negatively on them, but about half of the farmers interviewed (46%) did not use any special PPE when spraying pesticides. Other studies in the USA (Carpenter *et. al.*, 2002 and Perry *et. al.*, 2002), Gaza Strip (Yassin *et. al.*, 2002), and Ethiopia (Mekonen and Agonafir, 2002) also reported the lack of protective equipment. The poor are more vulnerable to the harmful effects of tobacco growing due to lack of resources (Mackenbach, 2002 and Yiengprugsawan *et. al.*, 2007) hence they cannot afford to buy PPE.

Although farmers and workers in other types of agricultural production face some of these hazards, tobacco production presents some unique hazards. For instance, acute nicotine poisoning, a

condition also known as green tobacco sickness (GTS), is unique to tobacco farmers and workers (Gehlbach, 1975; Arcury *et. al.*, 2001 and McKnight and Spiller, 2005). The GTS occurs when workers absorb nicotine through the skin as they come into contact with wet leaves of the mature tobacco plant. In the process of tending to tobacco plants, leaves and stalks are often cracked, emitting a gummy substance that coats workers hands, skin and clothing (Weizenrecker and Deal 1970). The GTS is a threat to those who handle green and wet tobacco because of the high solubility of nicotine in water (Goldfrank *et. al.*, 1980). Nicotine can be drawn out of tobacco by rain, dew, or perspiration and subsequently absorbed through the skin (Gehlbach *et. al.*, 1975 and Ghosh *et. al.*, 1979) in large quantities.

Though there is no precise measurement of the quantity of nicotine-laden dew to which tobacco harvesters are exposed, Gehlbach *et. al.*, (1975) suggested that 600 ml would be a conservative estimate. The percentage of dew-laden nicotine absorbed transdermally, however, is not known. Once nicotine is absorbed, it is distributed throughout the body, including the brain. The residual moisture or dew significantly increases the risk of GTS as it contains as much as 9 mg of dissolved nicotine per 100 ml of dew, which is roughly equivalent to the nicotine content of six cigarettes (McKnight and Spiller, 2005). On a humid day, especially after a rain shower, a farmer may be exposed to as much as 600 ml of dew (McKnight and Spiller, 2005), leading to absorption of 54 mg of dissolved nicotine. The symptoms of GTS include dizziness or headache and nausea that mostly occur in the evenings. Other symptoms may also include abdominal cramps, headache, difficulty in breathing, diarrhea, and (occasionally) fluctuations in blood pressure or heart rate (Gehlbach, 1974; Ghosh, 1986; Hipke, 1993; Ballard, 1995; Edmonson, 1996; McKnight, 1996 and McKnight and Spiller, 2005). This study will therefore rely on the studied symptoms to assess whether GTS is a common occurrence in Malakisi.

Flue-cured tobacco is harvested one leaf at a time over several progressive stages as the leaves ripen. Pluckers have to walk frequently through rows of tobacco plants and reach down the stalks to pluck off individual mature leaves. With this type of harvesting, there is additional skin contact. Three to ten "trimmings" are completed for each field over a six to eight week period, (McKnight and Spiller, 2005) thus increasing the farmer's level of exposure to nicotine poisoning.

The International Labour Organization has documented various aspects of occupational health and safety in agriculture. However, it has used a general approach as opposed to a crop-specific approach hence not highlighting the health and safety issues in tobacco farming. In Kenya, the existing TCA has a bias on health-related issues of tobacco smoking, and fails to address tobacco farming and its impacts, an issue that needs to be addressed at the policy level. A number of studies (Barbeau *et. al.*, 2004; Codeiro *et. al.*, 1998; Cox, 1995 and McBride *et. al.*, 1998) have concentrated more on labour dynamics of tobacco production and less focus on all the health and safety risks. Other studies (Arcury *et. al.*, 2001; Ballard, 1995; Genlbach, 1975; Hipke, 1993; McKnight, 1996 and McKnight and Spiller, 2005) have focused on GTS as a major health impact of tobacco farming. A study by KEMRI on occupational poisoning in agriculture took a generic approach and did not show a breakdown of the poisoning by specific crops. Apart from that, there are no other existing studies in Kenya that have attempted to detail the occupational health and safety implications of tobacco farming. This study attempts to fill in these gaps by focusing on the health and safety risks that tobacco farmers are exposed to in the tobacco production process.

The present research provides an overview of how tobacco production has contributed to change in the state of the environment and the health of tobacco farmers at a more local level – Malakisi Division. The research seeks to determine the underlying socio-economic dynamics that would

have prompted farmers to engage in tobacco production, which also determines the extent to which the environment is degraded and the level at which farmers are exposed to health risks. The results of this work are synthesized to highlight to problems related to tobacco farming, that in turn have an impact on the environment and health of farmers. As opposed to the often highlighted issue of tobacco smoking, the current research presents tobacco farming as the central issue that needs to be addressed by tobacco farmers, tobacco companies and the government, as per Article 17 and 18 of the FCTC

2.4 Conceptual framework

Tobacco production relies on a number of processes that are often chronological in nature. These involve preparation of the tobacco nursery, preparation of land, transplanting of seedlings, general farm care (spraying, fertilizer application and topping), and curing of tobacco leaves. These processes result in various impacts on the environment and have adverse occupational health risks for tobacco farmers. Cutting down of forests is commonly carried out to provide land for tobacco farming, wood-fuel for tobacco curing and material for construction of tobacco curing barns. The end result is that there is loss of biodiversity like indigenous trees and wildlife; occurrence of extreme climate events like floods and drought; and the decline in the quantity and quality of water in rivers and streams.

The frequency at which agrochemicals are utilized in tobacco production leads to high accumulation of these chemicals in the soils that are then washed off into nearby rivers and streams by runoff. The resulting effect is increased pollution of water bodies that subsequent loss of aquatic life. Furthermore, the quality of water for human consumption is compromised. Over-utilization of agrochemicals coupled with accelerating rates of tobacco-related deforestation significantly

contributes to soil degradation. Tobacco plants are also known to deplete nutrients from the soil necessitating the need for continued application of fertilizers and other agrochemicals. Due to deforestation, accelerated rates of soil erosion are experienced as soils are left loose and easily washed off by run-off. The effect of soil degradation and erosion contributes to low yields especially for other food crops. Deforestation, soil degradation and biodiversity loss ultimately result in ecological disruptions

The health and safety of tobacco farmers is of importance in the process of tobacco production. However, tobacco farmers are constantly exposed to a number of risk factors in their daily activities. The frequent exposure to agrochemicals, nicotine poisoning and physical hazards put tobacco farmers at a risk of contracting diseases. Varied symptoms are experienced among farmers when exposed to hazards as shown in Figure 2.1.

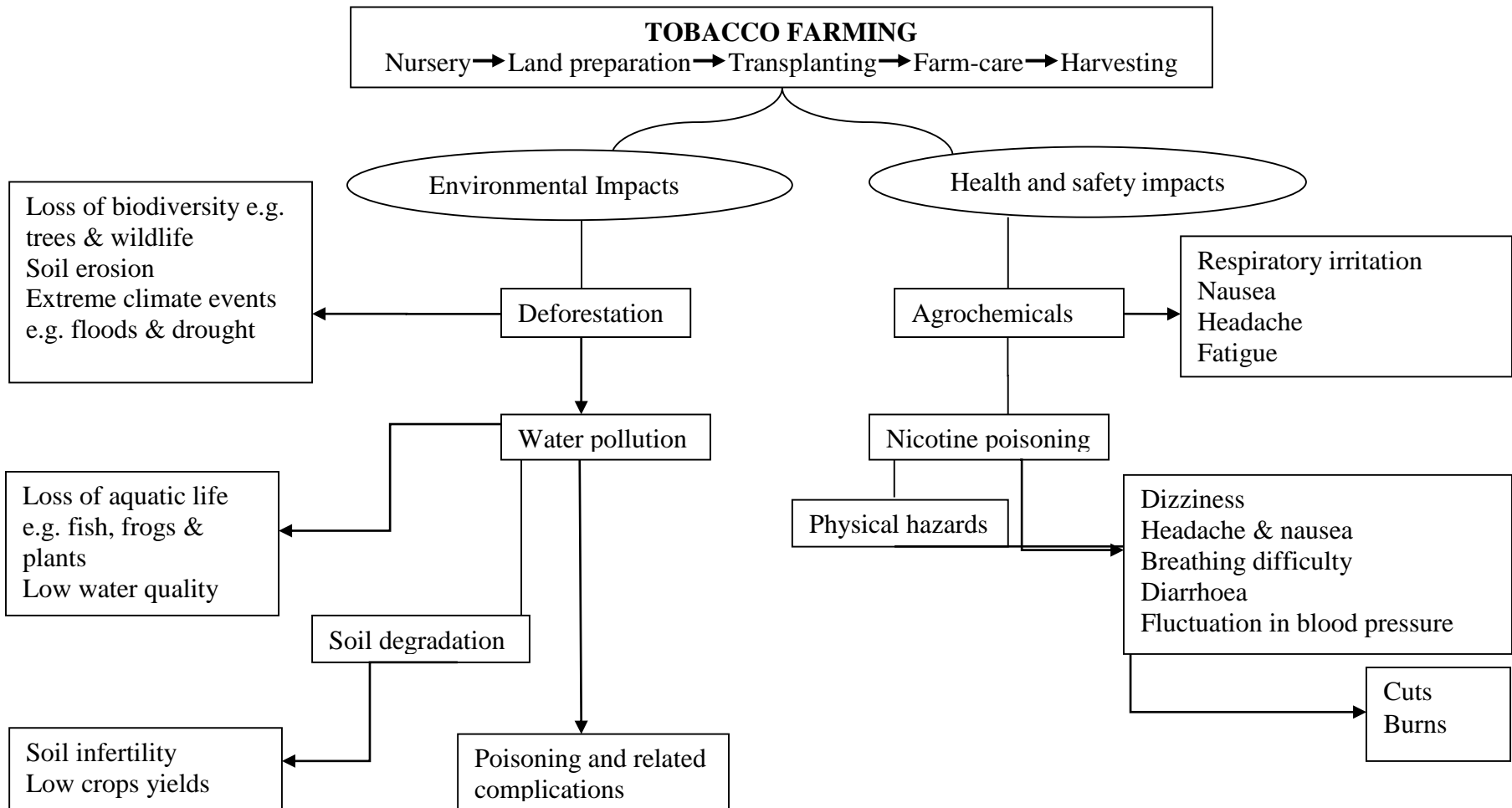


Figure 2.1 Conceptual framework

Source: *Fieldwork data, 2014*

3.0 METHODOLOGY

3.1 Study area

The study was carried out in Malakisi location in Bungoma County (Figure 3). This location lies between latitude 0°25.3' and 0° 53.2' north and longitude 34° 21.4' and 35° 04' east and covers an area of 101.2 km² with total arable land amounting to 98 km². The local community members own small pieces of land and carry out small-scale agricultural activities including production of tobacco.

3.1.1 Economic activities and employment

The economy of Malakisi location is mainly centered on agriculture which is mostly traditional hence rain fed. Most farmers in the area are involved in the cultivation of tobacco and sugarcane (mainly for commercial purposes) and maize, beans, sweet potatoes and a range of traditional vegetables. However, due to existence of two major tobacco companies in Malakisi – BAT and Mastermind – that have consequently provided ready market and inputs, most farmers also practice tobacco farming.

A number of institutions, both government and non-government, exist in Malakisi to contribute to the enhancement of livelihood system of the population. Non-Governmental Organizations (NGOs) like the One Acre Fund and One Village Fund also exist in Malakisi to work towards improving farmers' income through introduction of more profitable crops and farming techniques and providing farming inputs to in exchange for a share of future revenues. Apart from agricultural practices, a smaller portion of the population in Malakisi is engaged in formal employment and

businesses either within or outside the location although the level of formal employment in the area is still very low.

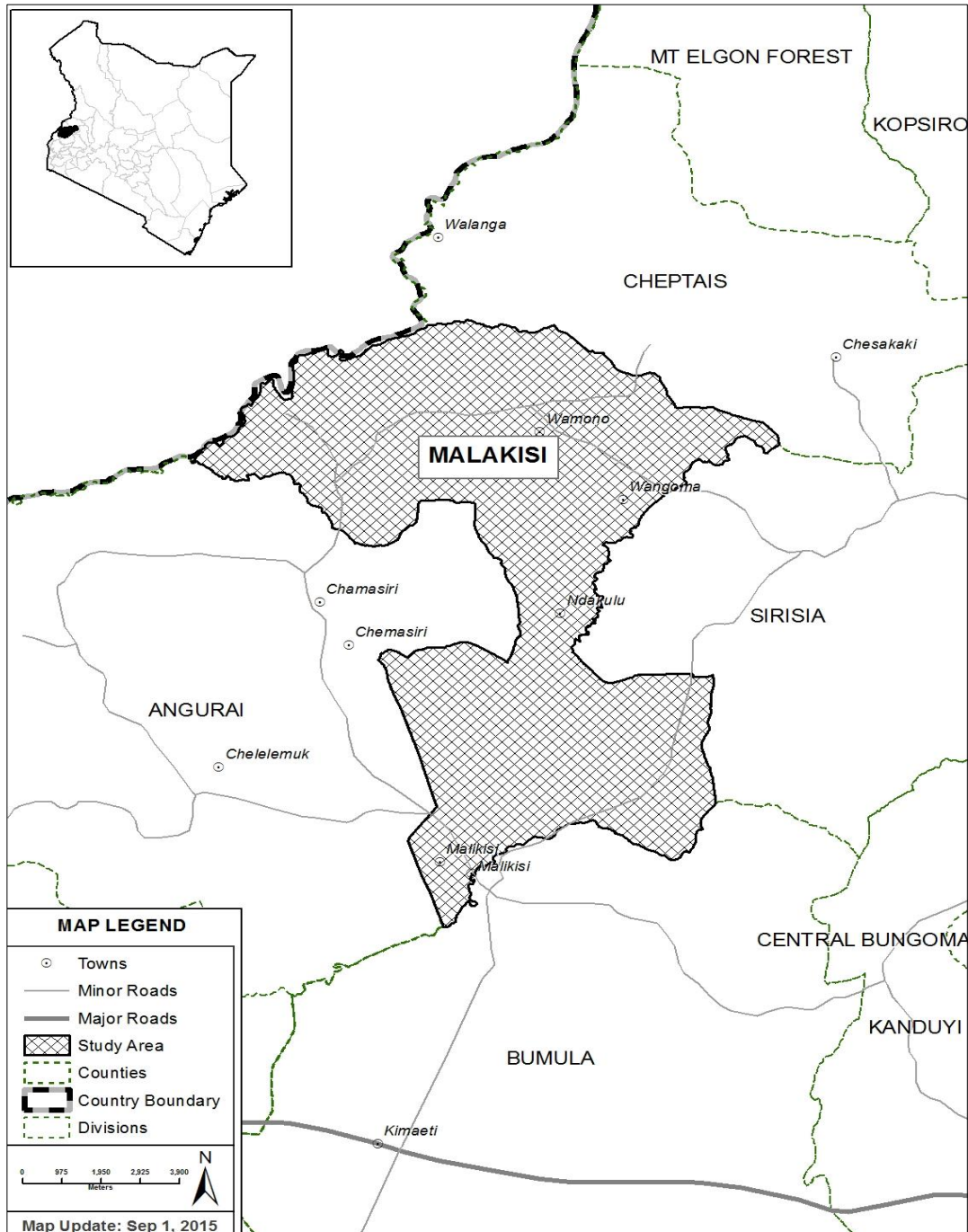


Figure 3.1 Study area

Source: Adapted from USAID/FEWS, 2014

3.1.2 Climate

Malakisi location has a hot and wet climate. The annual rainfall is 800-1500mm per year, and the temperature fluctuates between 25-30 degrees Celsius. The rain comes in two seasons: long rainy season (March to May - MAM) and short rainy season (September to December - SOND). There is often a dry spell in the months of July and August, as well as December, January and February. The lack of reliable rainfall in the area adversely affects agriculture, resulting in frequent food shortages.

3.1.3 Soil and Topography

The topography assumes a variety of forms from low-lying plains, undulating surfaces dissected by several rivers and seasonal streams, to hilly areas. The soils are mainly shallow sandy clay to clay loams, supporting a variety of food crops like maize, beans, cassava, groundnuts and potatoes but poor husbandry methods and a bulging population have resulted in declining yields, deforestation and soil erosion. Manure is therefore needed to improve soil structure in addition to fertilizers in order to improve yields of crops. Tobacco, being a one season crop, is cultivated from October/November (when there is enough rainfall) to around June in the following year although there have been changes in seasons overtime.

3.2 Study design

This was a cross-sectional household survey, targeting both tobacco and non-tobacco farming households within Malakisi. The sample was selected from all the five sub-locations of Malakisi location – Bukokholo; Butonge; Mwalie; Sitabicha; and Tamlega – at varying ratios that were

dependent on the respective population sizes. Apart from tobacco farming, farmers in these five areas also cultivate other crops such as maize, sugarcane, potatoes, beans, cassava and cotton.

Malakisi was purposively selected because it is a major tobacco production area in Bungoma County, and is easily accessible. According to the 2009 National Population and Housing Census, the location has a total population of 6,668 people with approximately 1,329 households. The ratio of male to female in the area is 1:1 although majority of the population comprises young people below the age of 20 years. The unit of analysis was the household where the head of the household² was targeted for interview. The population under study was first stratified into the five sub-locations and further sub-divided by the type of farmers: tobacco and non-tobacco farmers.

The number of households in the respective sub-locations was used proportionately to arrive at an estimate sample size in various sub-locations. For instance, Bukokholo has approximately 239 households. To get the proportion of sample size in Bukokholo, the number of households in the sub-location (239) is divided by the total number of household in Malakisi (1,329) then multiplied by the study sample size (100).

² The head of the household was understood as a member of the household who, under legal or moral obligation and irrespective of gender or marital status, manages the affairs of the house by providing basic needs to the members of the household. To determine who the head of the household was, an inquiry was directly done at a household level in a way that did not come out as disrespectful. For instance, the enumerators asked for the ‘owner’ of the home, and from the explanation given, it was easy to understand who the head of the household was.

Table 3.1 Sampled Sub-locations

Sub-location	Number of households	Sampled households	
		<i>Tobacco</i>	<i>Non-tobacco</i>
Bukokholo	239	9	9
Butonge	213	8	8
Mwalie	226	8	9
Tamlega	252	9	10
Sitabicha	399	16	14
Total	1,329	50	50

Source: Fieldwork data, 2014

The farmers were further stratified – as tobacco and non-tobacco farmers – based on the statistics available at the local chiefs’ offices. There was a variation in the number of farmers in the respective sub-locations hence the need to get a proportionate sample size for each. To get the actual sample size, the first household was randomly selected, followed by a standard interval between households. The stratification of the sample was critical in ensuring that all the five areas which would have been ignored during random sampling would be covered adequately. Furthermore, stratified sampling allows for easy comparisons among farmers. The two main advantages of stratified sampling are that it enhances proportionality in sampling in respect to the target population hence ensuring that the sample is a good representative of the population. This therefore implies that the sample of the study is representative and sufficient to allow drawing of statistical inferences.

Purposive sampling was also used in getting respondents for the key informant interviews and the focus group discussions (FGDs) participants. Two local leaders (chiefs), three agricultural extension officers and two representatives from tobacco companies were selected as key informants. The FGDs were grouped in terms of type of farmer and gender. Four FGDS – 2 for tobacco and 2 non-tobacco farmers – consisting of 5 members each, drawn from the respective sub-locations, were conducted. The groups were segregated in terms of gender to allow for an atmosphere where respective genders were free to discuss issues and share experiences. Furthermore, the experiences of women and men in the tobacco production value chain vary substantially hence the two genders cannot be treated as homogenous. There was a significant age variation among the groups as shown in table 3.2.

Table 3.2 Age variation of FGD participants

FGD/Type	Youngest	Oldest	Average age
1/Tobacco/Men	25	79	46
2/Tobacco/Women	27	68	41
3/Non-tobacco/Men	24	60	39
4/Non-tobacco/Women	30	59	35

Source: Fieldwork data, 2014

3.3 Data collection

Two interviewers were locally recruited and trained to conduct the household surveys using a semi-structured questionnaire. The enumerators were selected based on their understanding of Malakisi and their previous experience in undertaking household surveys. Both quantitative and

qualitative techniques for data collection were utilized. The two groups of farmers, tobacco and non-tobacco farmers, were interviewed using different questionnaires. The enumerators asked questions in languages that were well understood by respondents – in most cases, the questions were translated into local languages and answers written down by enumerators in English. A total of 100 questionnaires were administered: 50 to tobacco farmers and 50 non-tobacco farmers.

The FGDs were central to the research especially in consolidating qualitative data and tapping on the wealth of knowledge among different groups. Most of the issues raised during the household and key informant surveys were further elaborated through the FGDs which were conducted in four groups, each comprising five members drawn from the five sub-locations. The tobacco and non-tobacco farmers were separately grouped. In order to allow for a free atmosphere, and to respect the cultural settings of Malakisi, women and men were also interviewed separately. The researcher endeavored to introduce each topic as well as moderate the discussion. An extra note-taker supported in writing down all the points that were being discussed.

3.4 Data analysis, interpretation and presentation

The household data obtained from all the respondents was coded for subsequent statistical analysis using Statistical Packages for Social Sciences (SPSS) for windows, version 20.0. While quantitative methods provided a high level of measurement precision and statistical power, qualitative methods gave a greater depth of information about the nature of tobacco farming and its implications. Qualitative data was analyzed through a more descriptive way e.g. use of quotations from respondents and the coding of FGDs results. A higher degree of reliability and validity was achieved by combining the use of both qualitative and quantitative methods.

Another statistical technique utilized in this study is the cross-tabulation – a useful way of representing values of two or more variables at the same time. Cross-tabulation displays the number of cases that have distinctive combinations of responses to two or more questions and analyses the association between such responses.

3.5 Ethical considerations

The researcher sought approval from the local administration in the respective sub-locations to undertake the survey within the specified period. Other local structures that include representatives of farmers' groups and Community-Based Organizations (CBOs) were also consulted. The interviewers were trained to seek approval from the respondents and assure them of confidentiality before proceeding with the interview. Clear information about the research was provided to respondents who were then asked to participate voluntarily without fear of victimization.

4.0 RESULTS AND DISCUSSION

4.1 Respondents' demographic characteristics

To assess the demographic characteristics of the respondents, the researcher sought to analyse data on gender, age and level of education of all the respondents (Table 4.1). The gender aspects of tobacco production are also elaborated in terms of the gender roles and general perceptions from respondents. Education levels of the different sets of farmers are very crucial in linking knowledge gained (literacy levels) to the farming practices undertaken by farmers. To this end, the demographic characteristics of respondents are useful in understanding the inter-linkages between human characteristics, the environmental parameters and the health and safety of farmers.

Table 4.1 Gender and education level

Variable		Tobacco farmers	Non-tobacco farmers
Gender	Male	70%	74%
	Female	30%	26%
Education level	None	10%	6%
	Primary	42%	40%
	Secondary	38%	40%
	College/University	10%	14%

Source: Fieldwork data, 2014

Tobacco production involves various activities that are undertaken by different people at different stages. The gender disparity in the number of respondents is attributed to the fact that most women

in Malakisi do not legally own land hence cannot be contracted by tobacco companies. According to Kibwage *et. al.* (2007), tobacco companies only contract farmers who own land. The contractual nature of tobacco production is significant in promoting compliance of farmers to tobacco companies' rules and regulations, and to ensure controlled production.

The age disparity (Table 4.2) is majorly attributed to a number of economic factors and land ownership systems in Kenya. The study revealed that due to the need to make a lot of profit from tobacco production, through expansion of land, parents often fail to hand over part of the land to their sons (and daughters in very exceptional cases) as it is the norm. Therefore, majority of tobacco farmers (owning land) are mostly aged above 30 years and above.

Table 4.2 Age of respondents

Age range	Percent
<25	4%
26-30	8%
31-35	23%
36-40	11%
41-45	17%
46-50	6%
51-55	11%
56-60	5%
>60	15%
Total	100%

Source: *Fieldwork data, 2014*

Although there is no significant difference in the levels of education among tobacco and non-tobacco farmers, the level of education of tobacco farmers/households is lower than that of non-tobacco farmers/households. For instance, most tobacco farmers have not had an opportunity to go to school as compared to non-tobacco farmers. The level of education is a significant indicator of how literacy levels affect various farming decisions and how they translate into environmental management practices. The ability to read and write, for instance, influences the choice and amount of agrochemicals a farmer is exposed to.

4.2 Background of agricultural practices

Prior to the 1950's there were many traditional cattle and indigenous trees in Malakisi (Table 4.3). The population heavily relied on millet, groundnuts, sorghum and "*simsim*". Notable events in this period included the introduction of cotton in 1927 and the prolonged famine of 1948 that resulted in massive loss of livestock. In 1986, there was an outbreak of trypanosomiasis (sleeping sickness) that wiped out most livestock.

Table 4.3 Indigenous trees in Malakisi

<i>Bukusu</i> names of indigenous trees	English name
<i>Kumukhuyu</i>	Fig tree
<i>Kumulaa</i>	Combretum
<i>Kumusitole</i>	Plum
<i>Kumurumba</i>	Miliciaexelsia
<i>Kumubenunu</i>	Hyssop
<i>Lantana</i>	Lantana camara
<i>Likhendu</i>	Palm tree
<i>Kumutiokotioko</i>	Aloe Vera
<i>Litaya</i>	Quiver
<i>Lufufu</i>	Wicker
<i>Lirarandula</i>	Sodom apple

Source: *Fieldwork data, 2014*

The mid-1950's saw the introduction of coffee in Malakisi and by the end of 1960s, coffee and cotton were the most dominant crops. These crops became the major sources of livelihood among households as a due to ease of access to processing firms and availability of market for outputs. However, the occurrence of famine in the 1970's affected crops and yields, and also led to loss of livestock. Coffee growing was expanded again in the late 1970's due to a favorable international market that greatly improved standards of living for the people. Farmers also benefited from loans given by the Ministry of Agriculture to support dairy farming and this enabled them to buy more livestock. The farmers received technical support on proper farming practices through extension services. However, there was a decline in coffee farming in the area in early 1990's as a result of introduction of other crops. In 1992, the cotton industry was also closed down due to the decline in cotton production. Farmers felt that the returns from cotton farming were too low, coupled with

low yields and delayed payments from cotton firms. In the late 1970s and early 1980s, sunflower was introduced as a cash crop. There was also a great famine in 1980 that led to the introduction of yellow maize.

In 1974, the British American Tobacco (BAT) and the government of Kenya decided to experiment on the viability of tobacco farming in Malakisi. Success in the experiment saw the introduction of tobacco as a commercial crop in Malakisi in 1975. The beginning of the 1990s saw more farmers grow tobacco in the area due to high prices and prompt payment by the tobacco companies. The move, however, made farmers neglect other food crops and food shortage in the area ensued. The competition and expansion in tobacco farming was enhanced when Mastermind Kenya entered the market in 1987.

There were mixed fortunes in tobacco farming in the area in the beginning of 2000. There was a notable increase in tobacco farming due to increasing BAT and Mastermind operations in the region. However, the area has seen a decline in tobacco farming because of a change in tobacco planting seasons and the decline in tobacco prices over time. Another factor for decline tobacco farming in Malakisi is the introduction of horticultural crops like water-melons and oil palm trees that are fetching good prices and are less labour intensive.

4.3 Tobacco farming

4.3.1 General information on tobacco farming

From the agricultural timeline, it is evident that tobacco farming is a long time practice in Malakisi. Apart from growing tobacco for sale, farmers utilize it in a number of ways at household level (Table 4.4).

Table 4.4 Household uses of tobacco

Uses	Percent
Smoking	34.3%
Sniffing	37.1%
Chewing unprocessed	5.7%
Making own pesticide	5.7%
Control pests through intercropping	5.7%
No Response	11.4%
Total	100%

Source: Fieldwork data, 2014

One respondent has been involved in tobacco production for over 35 years while majority (5) had been practicing tobacco production for 17 years (Figure 4.1). There was a varied range of the farming period for all tobacco farmers. The range in the number of years the farmers have been engaged in tobacco farming presents a unique opportunity to document their experiences across different years, as evident in the history of tobacco farming in Malakisi.

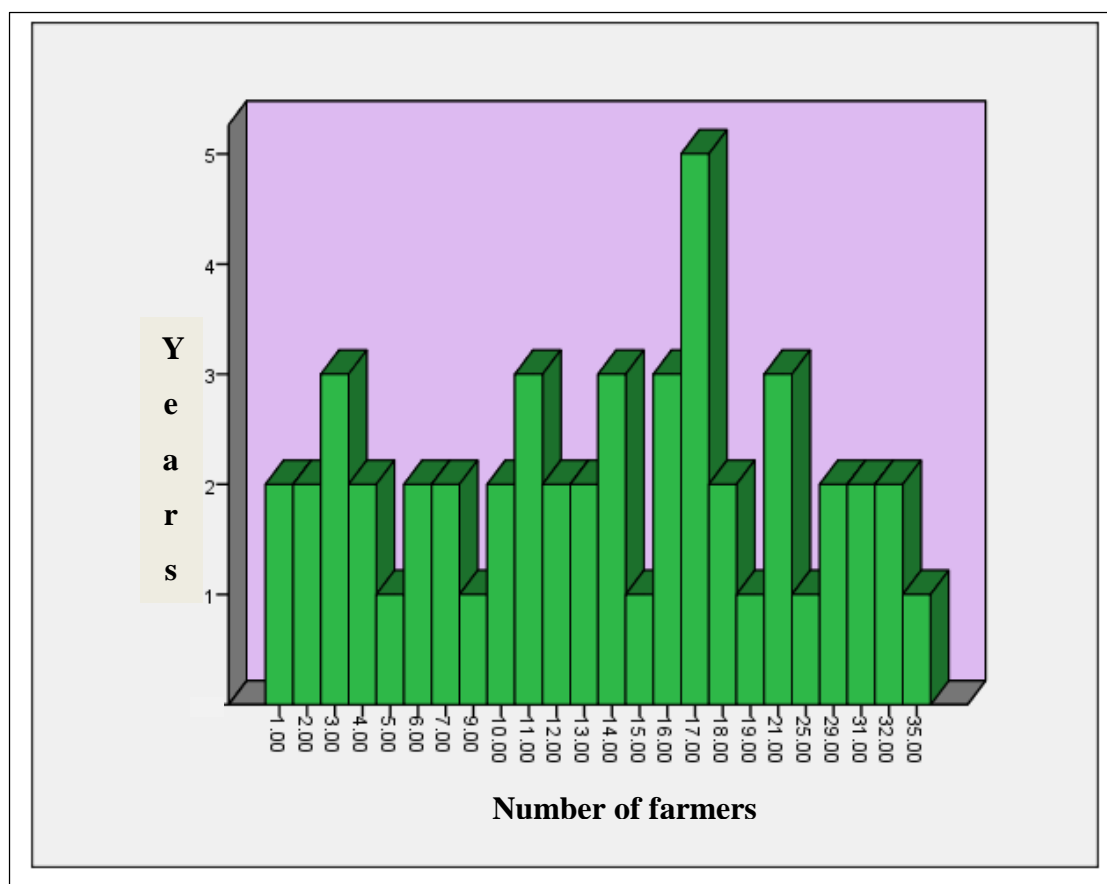


Figure 4.1 Number of years in tobacco production

Source: Fieldwork data, 2014

Most smallholder farmers who can't afford the farming costs tend to be attracted to a crop from which they are able to receive lucrative terms and services. Tobacco companies have strategically positioned themselves to meet the farmers' needs by providing incentives which are in form of loans (farm inputs) and market for tobacco. Despite the challenges encountered in the different stages of tobacco production, a number of farmers continue to produce the crop due to various reasons (Table 4.5).

Table 4.5 Reasons for tobacco production

Reason	Percent
Anticipated ready market	22.3%
Incentives from Tobacco Companies	19.9%
Promotion From Government Agricultural Officers	3.4%
Influence from other tobacco farmers	13.1%
Culture/ Inheritance	11.2%
Availability of land	14.6%
There was no cash crop by then	15.5%
Total	100%

Source: Fieldwork data, 2014

The study revealed that agricultural extension officers play a crucial role in promoting tobacco production. One of the conditions that tobacco companies set is that an eligible tobacco farmer has to own land before signing a contract with them. By signing a contract, a tobacco farmer becomes entitled to loans that are offered in terms of farm inputs and tools. Nonetheless, tobacco farmers rely on different sources for farm inputs like fertilizer, seeds, pesticides, and PPEs etc. Table 4.6 shows that tobacco companies are the major providers of farm inputs at 71.2%.

Table 4.6 Source of farm inputs

Source	Percent
Self	26.4%
Tobacco Company	71.2%
Other tobacco farmers	2.4%
Total	100%

Source: Fieldwork data, 2014

The non-tobacco farmers who have never grown tobacco have a number of reasons for not doing so. Nearly a third (35%) of non-tobacco farmers felt that tobacco poses health risks to tobacco farmers/workers, and 21% cited the labor intensiveness of tobacco production. The non-tobacco farmers who had previously grown tobacco said that they abandoned tobacco farming because it is labor intensive, has low returns and due to the health related issues. Table 4.7 shows the varying reasons given by non-tobacco farmers for never having grown tobacco.

Table 4.7 Reasons for not growing tobacco

Why never grown tobacco	Percent
Religion/denomination	14.6%
Lack of seeds and other farm inputs	12.5%
inadequate land	10.4%
Tobacco-related health issues	20.8%
Tobacco is labor intensive	35.4%
others	6.3%
Total	100%

Source: Fieldwork data, 2014

Farmers in Malakisi acknowledged that they face a number of problems in tobacco production (Table 4.8). Crop pests and diseases (22.5%) and drought (16.9%) are ranked in terms of their occurrence. Most of the problems encountered in tobacco production are as a result of environmental degradation.

Table 4.8 Problems faced in tobacco production

Problem faced in tobacco production	Percent
Conflicts(disputes, wars)	3.4%
Poor soil fertility	12.4%
Floods	7.3%
Drought	16.9%
Wild animals	3.4%
Pests and diseases	22.5%
Time constraints	13.5%
Labor shortages	15.2%
Market for the produce	5.6%
Total	100%

Source: Fieldwork data, 2014

Hydrological problems like floods and drought are not only unique to tobacco farmers. However, other problems like poor soil fertility, time constraint and labor shortages seem to affect tobacco farmers more than non-tobacco farmers. For instance, tobacco farmers in Malakisi tend to have a significantly higher problem of poor soil fertility compared to tobacco farmers (Table 4.9). Unlike in non-tobacco farms, tobacco farms are exposed to frequent agrochemical applications and over-tillage, affecting the fertility of soil.

Although the soil fertility level is generally high in Malakisi – more than half of the respondents rated the fertility of their land as high – it tends to vary among farms. Less than half (48%) of the tobacco farmers, compared to more than half of non-tobacco farmers agreed that the level of soil fertility was high.

Table 4.9 Type of farmer and level of soil fertility

		How do you rate the soil fertility level in your farm?			Total
		Very high	High	Low	
Type of farmer	Tobacco		48.0%	52.0%	100.0%
	Non Tobacco	2.0%	56.0%	42.0%	100.0%
Total		1.0%	52.0%	47.0%	100.0%

Source: Fieldwork data, 2014

Nearly half (52%) of the tobacco farmers indicated that the fertility level of their land had declined overtime. Some of the reasons cited for reduced soil fertility include intensive utilization of tobacco farms through regular tillage, application of agrochemicals, mono-cropping and shifting cultivation. The impact of tobacco production on the quality of soil is further reinforced in the following quotation from a tobacco farmer.

“Look at the state of our soil. During the old days before tobacco was introduced, we used to harvest very huge potatoes which were, and still are a popular crop in the area. I could not fit one in both my palms and when cooked, one potato would be enough to feed two adults. Now it’s very rare to get such big potatoes. The sizes have really reduced over the years and we no longer have reserves. Our soil cannot give us good yields nowadays, yet before tobacco, all forms of crops could be grown here. Our soil was very rich but now they have been eroded due to deforestation and too many chemicals”.

4.3.2 Tobacco farming and land system

Most farmers acknowledged that availability of land played a very significant role in their decision to venture into tobacco farming. The increasing demand for land, due to the need to increase tobacco yields, has led to an increase in the size of land allocated to tobacco production. The findings indicate that most tobacco farmers have larger portions of land compared to non-tobacco farmers although the portion of land allocated to tobacco farming varies depending on the total size of land.

Approximately 58% of the tobacco farmers seem to have neither increased nor reduced the sizes of their tobacco farms (Figure 4.2). This is attributed to a number of factors ranging from the low returns due to decline in tobacco prices over time, unavailability of land for expansion, change in tobacco planting seasons. Most farmers have also resorted to planting horticultural crops like water-melon and oil palm trees due to the favorable prices and less labour needed in production. This has influenced most farmers' decisions in Malakisi to retain their tobacco crops but diversify with other crops.

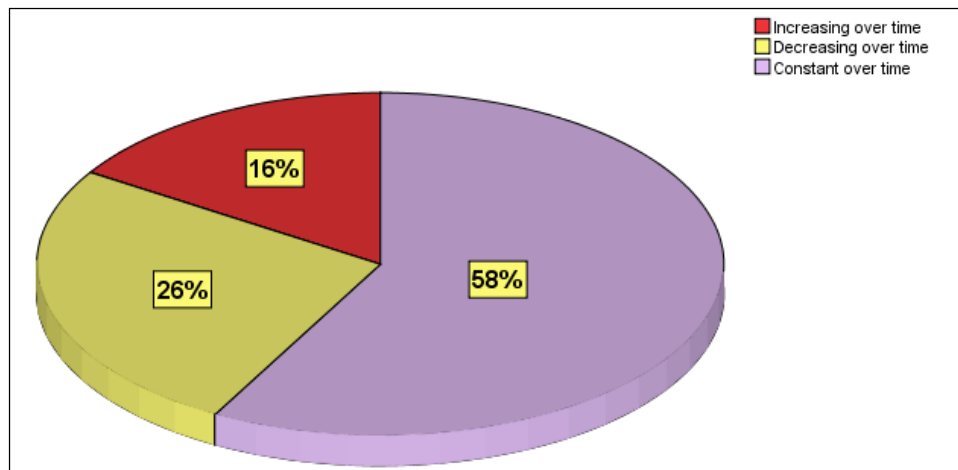


Figure 4.2 Changing acreage of tobacco farms

Source: *Fieldwork data, 2014*

However, the small number (16%) of who have increased the size of their tobacco land cited a number of reasons including the need to increase yields, availability of land for expansion, lack of better options in terms of cash crops and the prevailing market situation. Reduction of size of tobacco land was majorly attributed to low returns, labour intensiveness, low soil quality and availability of better crop alternatives especially food crops.

The size of tobacco farms also varies depending on the number of years that farmers have been producing tobacco (Table 4.10). Nearly three-thirds (68%) of the farmers in Malakisi own land between 1-5 acres but a significant number of these farmers (70%) practice tobacco farming.

Table 4.10 Type of farmer and total acreage of land

		Total acreage of land						Total
		<1 acre	1-5 acres	5.1-10 acres	10.1-15 acres	15.1-20 acres	>20 acres	
Type of farmer	Tobacco	8.0%	70.0%	16.0%		2.0%	4.0%	100.0%
	Non Tobacco	16.0%	66.0%	12.0%	6.0%			100.0%
Total		12.0%	68.0%	14.0%	3.0%	1.0%	2.0%	100.0%

Source: *Fieldwork data, 2014*

In terms of land ownership, majority of farmers (both tobacco and non-tobacco) own land through free-hold, purchase or inheritance. More than half of the farmers (51%) agreed that tobacco farming had changed the means of land ownership, attributing the change to a number of factors:

- Need for more land to expand tobacco production. Due to the contractual nature of tobacco companies i.e. contracts given to legal land owners only, most tobacco farmers prefer purchasing or inheriting land to ensure legal acquisition.
- Increasing levels of poverty

- Lack of diversified of employment opportunities leading to over-reliance on agriculture
- Increasing population that has resulted in shrinking of available land resources and the demand for more land for farming.

4.4 Environmental impacts of tobacco farming

4.4.1 Impact on forests and aquatic life

The impact of tobacco farming on biodiversity is categorized into impacts on the land cover and aquatic life. Based on the FGDs conducted and the timeline that was developed, it is apparent that a lot has changed for the past over 40 years – since tobacco farming was first introduced in Malakisi - that has significantly contributed to environmental degradation and loss of biodiversity. The change in livelihood patterns in terms of crops grown, loss of indigenous trees, loss of livestock, have been inextricably linked to the nature of tobacco production processes. For instance, there is increased deforestation due to the need for tobacco production land, increased demand for wood-fuel used in the tobacco curing process and the resulting flow of chemicals into rivers and streams that eventually affect aquatic life through poisoning and reduced quality of water.

In the process of acquiring more land for tobacco production, and to allow for shifting cultivation, farmers who have increased the sizes of their tobacco land overtime acknowledged that they had to clear nearby bushes/forests. Shifting cultivation is a common practice in tobacco farming as is done to avoid pests and diseases. Notwithstanding the lack of enough land in Malakisi, farmers are encouraged to practice shifting cultivation in order to reduce chances of crop diseases and ensure good yields are obtained. However, there is a variation among farmers on how regular they

can shift their tobacco farms (Figure 4.3). Most tobacco farmers, as compared to non-tobacco farmers, practice shifting cultivation every season due to the nature of tobacco crop.

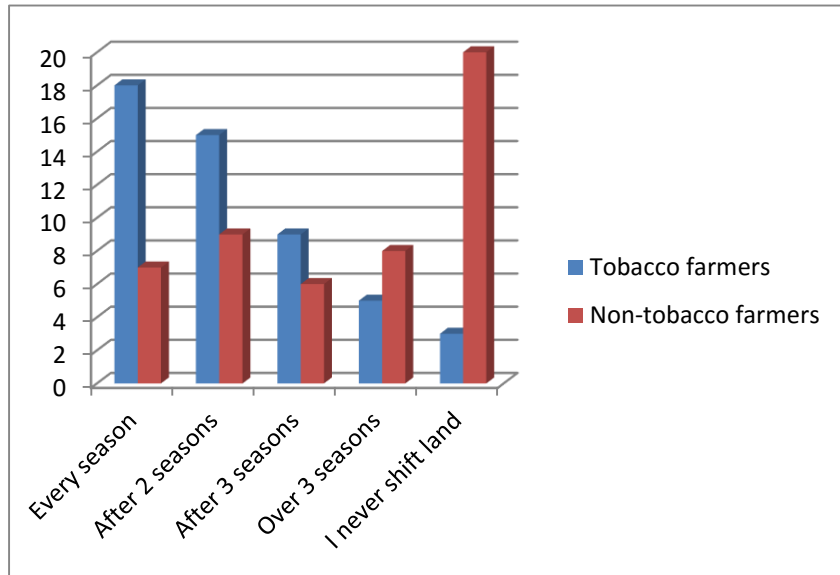


Figure 4.3 Prevalence of shifting cultivation among farmers

Source: *Fieldwork data, 2014*

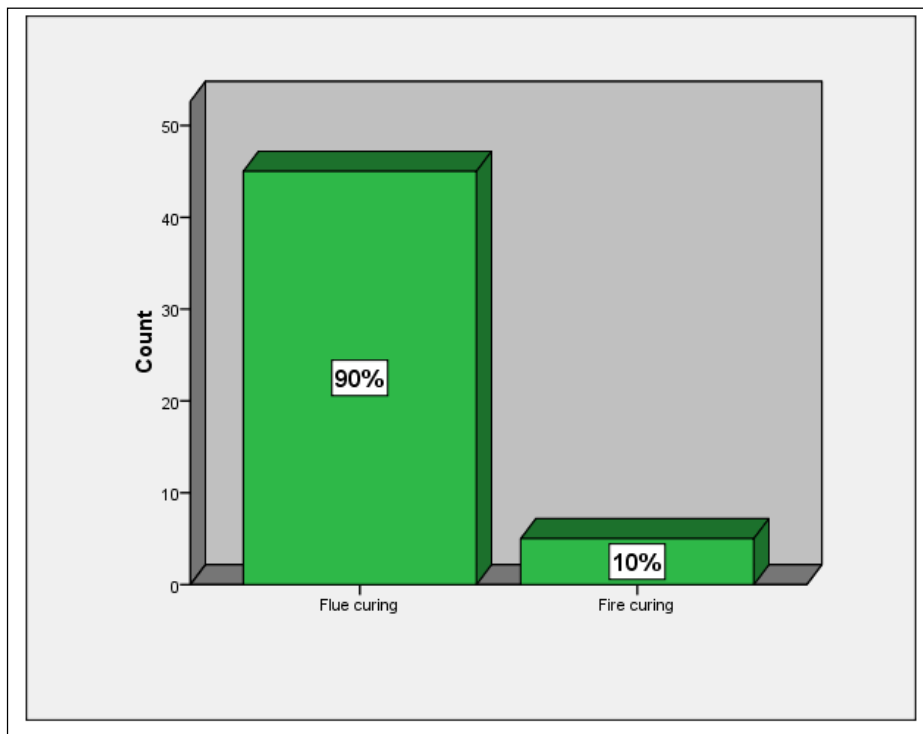


Figure 4.4 Methods of tobacco curing

Source: Fieldwork data, 2014

Regular shifting of tobacco farms in Malakisi has significantly contributed to environmental degradation. The multiple effects resulting from over-application of agrochemicals and pollution of rivers and streams are witnessed every season by farmers. To avoid competition for nutrients, tobacco crops are not intercropped with any other crop. As a number of studies have shown, the soils previously used for tobacco farming are not suitable for other crops unless left fallow for some time to allow for reduction of excess chemicals in the soil.

Tobacco farmers in Malakisi mostly use the flue-curing method which relies on a lot of wood-fuel (Figure 4.5 and 4.6) as compared to other methods of curing. Respondents estimated that the tobacco from one acre of land (producing approximately two Tons of tobacco) consumes five



Figure 4.5 Wood displayed in a local market in Malakisi

Source: Fieldwork data, 2014

The results also indicate that 44% of sampled tobacco farmers relied on wood-fuel from their farms for tobacco curing, 47% of the farmers got their wood-fuel from the nearby markets and 9% of the farmers got from the nearby bushes, up the hills or along the rivers. The depletion of indigenous trees and nearby bushes has prompted tobacco farmers to establish and manage their own woodlots by utilizing the tree seedlings provided by tobacco companies. Despite the demand for more wood and wood-fuel in tobacco production, an assessment of the portion of land allocated to woodlots shows that tobacco farmers have allocated less land to woodlots and bushes as compared to non-tobacco farmers (Table 4.11). Only 2% of tobacco farmers have allocated some land to woodlots, growth of bush (es), Napier grass or left the land fallow. The main reason is the need to utilize enough land in order to maximize returns. A low percentage (8.4%) of non-tobacco farmers have also allocated land to woodlots, bush, fallow and napier grass due to the need to produce more

food crops and partly because their demand for wood-fuel is much lower as compared to that of tobacco farmers.

Table 4.11 Type of farmer and land diversity

		Land enterprise diversity (land allocation)			Total
		Woodlots, bush, fallow, Napier grass	Maize, beans, vegetables etc	Crops, plus 1 or 2 other uses	
Type of farmer	Tobacco	2.0%	41.7%	58.3%	100.0%
	Non Tobacco	8.4%	72.9%	16.7%	100.0%
Total		5.2%	57.3%	37.5%	100.0%

Source: *Fieldwork data, 2014*

Tobacco companies largely distribute tree seedlings (mostly eucalyptus and cypress varieties) to contracted tobacco farmers every growing season. However, the tree planting programme is not effective in meeting the demand for wood-fuel as tobacco farmers have to still purchase wood-fuel or source it from nearby bushes. A significant number of tobacco farmers (47%) purchase wood-fuel from nearby markets, majorly for tobacco curing (Table 4.12). Non-tobacco farmers seem to rely more on their own farms as a source of wood-fuel for domestic use. There is lower reliance on nearby bushes, hills and rivers for wood-fuel because of near depletion of trees and vegetation. Most of these places have been left bare as a result of high demand for wood-fuel that is rarely reciprocated with effective re-forestation measures.

Table 4.12 Type of farmer and source of wood-fuel

		Source of wood-fuel			Total
		Own farm	Nearby bushes/up the hill/main rivers	Purchase from nearby markets	
Type of farmer	Tobacco	33.0%	12.2%	58.0%	100.0%
	Non Tobacco	68.1%	8.0%	20.6%	100.0%
Total		50.5%	10.1%	39.4%	100.0%

Source: *Fieldwork data, 2014*



Figure 4.6 Stack of wood-fuel in Malakisi

Source: *Fieldwork data, 2014*

The almost drastically reduced forest cover in Malakisi has an effect on climate regulation and biodiversity loss. The wild animals that once existed in the nearby bushy and forested areas have

shifted locations due to habitat destruction. It is also not clear how the tobacco companies intend to plant trees on the already bare hills in Malakisi and at the same meet the tobacco farmers' demand for wood-fuel.

The pollution of nearby rivers and streams mostly from tobacco farms, has also affected the aquatic life i.e. depletion of fish stocks, disappearance of frogs, the general distortion of the water ecosystem. There was a general consensus (60%) among both tobacco and non-tobacco farmers that various activities involved in tobacco farming have an influence on the local water bodies and the living organisms and plants.

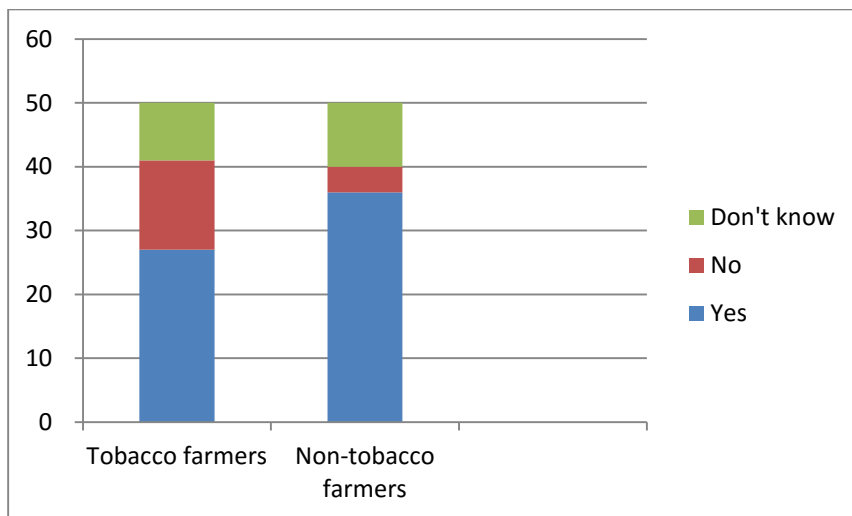


Figure 4.7 Tobacco production's impact on aquatic life

Source: Fieldwork data, 2014

The impact of tobacco production on local water bodies is attributed to the fact that most tobacco farms are located next or closer to rivers and streams hence whenever it rains, the excess water that is loaded with chemicals is washed off into the nearby water bodies. The study revealed that the quantity of fish in rivers found next to the tobacco farms has reduced significantly over the last 20 years. The quality of water has also changed over time, leading to loss of aquatic animals like

fish and frogs through either death or migration. Although the quality of water was mainly attributable to chemicals from nearby tobacco farms, other human-related factors like over-utilization of water, deforestation along rivers and streams, poor waste management and the frequency of extreme climate events like droughts and floods contribute to poor water quality in Malakisi. The impact of tobacco production on the aquatic life was further reinforced by the two quotations.

“I have been living in Sitabicha for close to 60 years. My family moved here from an area called Sikhendu. During that time, the rivers and streams used to flow with clean water. We would fish and use the water for cooking. Later, with the introduction of tobacco in the 1970s, the state of these waters changed and the aquatic life started disappearing. The problem is that the chemicals are left to drain into the water bodies and end up killing our fish. I no longer find clean water or fish around here.”

“So many tobacco nurseries are prepared next to the rivers, wells and the streams. Most tobacco farms are also located next to water sources because tobacco farmers need to irrigate their crops easily. When I was growing up in the early 1970s, I used to see so many flying organisms, small fish and frogs in these water bodies; they are no more. The chemicals that farmers use in tobacco farms have always been washed up into the rivers and have killed so many organisms. Those who were born in 1990s can't even know that this area was green and with many organisms in the water and on the land. Vegetation along the rivers has been cleared to pave way for tobacco nurseries and cater for wood-fuel. The water levels have gone down. The water is also not safe for use.”

As outlined in the quotations, tobacco production has a significant impact on the quality of nearby rivers and streams. The past decades have seen significant changes both in terms of quality of water and the aquatic life. The depletion of fish, disappearance of frogs and other flying organisms result from the changing water conditions in terms of quality and quantity. For instance, fish thrive better in clean water and frogs inhabit rivers and streams that have clean and enough water.

4.4.2 Impact on water resources

Water is an essential resource in all the tobacco production processes, right from the nursery management to curing of tobacco leaves. The community in Malakisi heavily relies on water from the nearby rivers and streams, for both farming and domestic consumption. The distribution of, and access to water resources in Malakisi is affected through over-utilization, deforestation and pollution. A case in point is the tobacco nursery preparation.

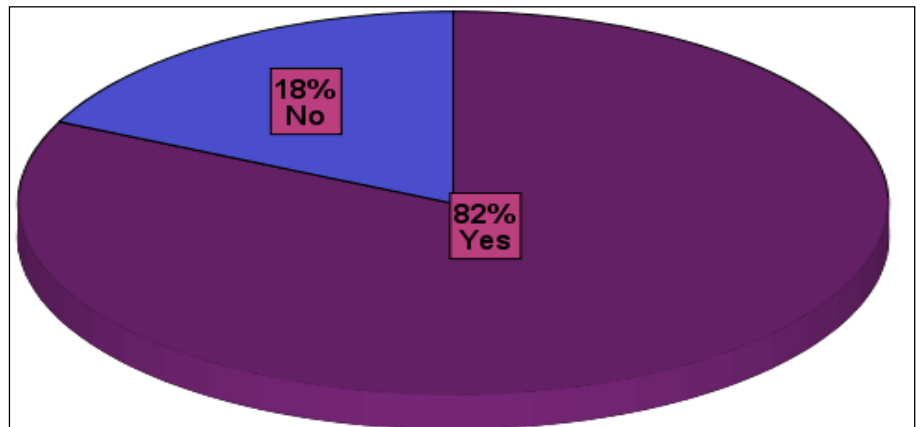


Figure 4.8 Ownership of tobacco nursery

Source: Fieldwork data, 2014

Before tobacco farmers are supplied with tobacco seedlings, the tobacco companies encourage them to have tobacco nurseries with enough tobacco seedlings. To ensure effective management of nurseries and maximize on the tobacco seedlings, farmers strategically locate the nurseries next to rivers and streams for easy access to water. Majority of tobacco farmers (82%) in Malakisi own tobacco nurseries (Figure 4.8). Those who did not have the nurseries were mainly non-contracted farmers who had to source

for seedlings from elsewhere. For instance, 71% of tobacco farmers who do not own nurseries buy seedlings from neighboring farms.

Ownership and good management of tobacco nurseries determine the quality of seedlings that



Figure 4.9 Tobacco nursery located next to a stream

Source: Fieldwork data, 2014

farmers will transplant. Tobacco companies loan out seeds to contracted farmers each planting season and deduct the costs when tobacco leaves are delivered at the company. To acquire good quality seedlings, tobacco farmers invest a lot of time and resources into the management of the tobacco nurseries through frequent application of agrochemicals and watering of tobacco seedlings twice in a day. Tobacco nurseries are located next to the rivers and streams (Figure 4.9) to allow for easy access to water sources. The excess water from these nurseries drains back into the water sources affecting the quality of water. When streams and rivers are filled with chemicals, they become a threat to the aquatic life and people that rely on the water for domestic use.

4.4.3 Waste management

The results of this study show that most tobacco farmers do not often dispose farm wastes appropriately and therefore heightening the risk of environmental degradation and contamination. The wastes produced in the tobacco production process include plastic and metallic containers/bags (used for handling seedlings, pesticides, fertilizer and other chemicals) and substandard tobacco leaves. Most tobacco farmers in Malakisi acknowledged that they dispose these wastes by either burning them, dumping in a common dumping site or closer to the rivers/streams (Table 4.13).

Table 4.13 Disposal of tobacco production waste

Attitude	Per cent
I dump them on the farm	16%
I re-use them	6%
I sell them	4%
I bury them in the field	10%
I burn them	18%
I dump them in a common dumping site	20%
I throw them closer to the rivers/streams	22%
No response	4%
Total	100%

Source: Fieldwork data, 2014

Although the study established that tobacco leaves add to the nutritional value of the soil once they decompose, the same leaves pollute the nearby water sources when they are washed off by runoff, lowering the water quality. The study found that the plastic and metallic waste are often left on the farms hence interfering with the structure and quality of the soil.

4.5 Tobacco production impact on health

Tobacco farmers in Malakisi listed various health-related complications that they had encountered in the tobacco production process: headaches 19.6%; coughing 18.5%, chest problems 17.3%; fever 11.3%; eye problems 10.7%; back problems 8.9%; dry throat 5.4%; itching skin 3.6%; stomach problem 3%; and boils 0.6%. Most of these complications were majorly attributed to farmers' frequent exposure to agrochemicals and wet tobacco leaves without PPEs. The chances of farmers contracting GTS increases with exposed to a number of risks.

A number of agrochemicals are sprayed on the tobacco farm from the nursery stage to the time the crop is almost mature for harvesting. These range from insect-killers, weed-killers and plant growth regulators. The chemicals are applied at least twice a day especially for tobacco nurseries. The level of exposure to agrochemicals in tobacco production is therefore higher compared to that imposed by food crops like maize, beans, sorghum etc. The chances of tobacco farmers being affected by these chemicals are therefore higher. For instance, tobacco nurseries require a lot of attention in terms of preparation of seed-bed, planting seeds, resetting seeds in plastic bags, spraying, weeding and watering. The pesticides used in tobacco production include aldicarb, which according to WHO, is a highly toxic insecticide that causes genetic damage in human and negatively affects the nervous system.

Personal protective equipment (PPEs)

According to the rules set out by tobacco companies, tobacco farmers are obliged to use PPEs in any activity that has the potential to cause harm or injury. The process of planting, harvesting, transporting and curing tobacco exposes farmers to risks that include skin irritation due to exposure

to chemicals, injuries resulting from farm accidents and burns that may be encountered during the curing process. The level of risk is exacerbated by non-utilization of PPEs in the tobacco production process, which arises due to non-utilization of PPEs. The results indicate that nearly 80% of the farmers own PPEs but majority (61%) of them do not use PPEs in tobacco-related activities.

This is despite the fact that the farmers acknowledged the importance of using PPEs in order to reduce risk of injuries and poisoning. For instance, approximately 67% of farmers who do not use PPEs have experienced tobacco-related health complications. A much smaller proportion (33%) of the farmers who use PPEs had health complications mainly due to improper utilization or irregular usage.

The extent of tobacco-related health and safety risks to farmers’ households is also assessed based on the number of incidences where family members suffered any form of injury in the tobacco production process. About 64% of the farmers admitted that their family members had suffered from injuries related to tobacco production including sustained burns during tobacco curing and cuts during tilling and weeding (Figure 4.12). Furthermore, weeding of tobacco nurseries is mostly done with bare hands to ensure minimal destruction to seedlings, thereby increasing the exposure to risk of chemical absorption. Tobacco farm care involves the application of fertilizer (DAP and NPK); weeding and spraying on a more regular basis than it’s done for other crops. The situation exposes tobacco farmers to a higher risk of chemical poisoning especially when no protective devices are utilized in the process.

Table 4.14 Gender roles in tobacco production

Tobacco-related activity	Male (√)	Female(√)	Children(√)
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Preparation of land	√	√	
Construction of tobacco curing barns	√		
Cutting fire woods for curing	√		
Preparation of Nursery	√	√	
Sowing of tobacco seeds	√	√	
Watering of seedlings/ tobacco plants	√	√	√
Transplanting the seedlings	√	√	√
Weeding	√	√	
Application of fertilizer	√	√	
Application of pesticides	√	√	
Topping and de-suckering	√	√	
Harvesting of tobacco	√	√	√
Sorting tobacco leaves	√	√	
Grading tobacco leaves	√	√	
Belling	√	√	√
Transportation of leaves from the field to the barns	√	√	
Curing	√	√	

Source: Fieldwork data, 2014

Tobacco production involves various activities that are undertaken by different people at different stages (Table 4.14). The impact of these activities on people's health and safety varies based on their respective gender roles. Almost all households in Malakisi constitute school-going children (mostly below 18 years) whose role in tobacco production is limited to watering, transplanting, harvesting, and transportation of tobacco leaves. Male members of the family (majority of whom were respondents) are active in all stages of the tobacco production chain hence are highly exposed to various health and safety risks.

The level of farmers' education seems to have an influence on the usage of PPEs. A significant proportion of farmers – 77.8% and 60% - who have acquired secondary and college/university

respectively use PPEs in tobacco-related activities (table 4.15). On the contrary, a much lower proportion of farmers with low levels of education do not use PPEs, posing a risk to their health and safety.

Table 4.15 Farmers’ level of education and use of protective devices

		Do you use protective devices when carrying out tobacco related activities		Total
		YES	No	
Level of education of respondent	None	40.0%	60.0%	100.0%
	Primary	47.6%	52.4%	100.0%
	Secondary	77.8%	22.2%	100.0%
	College/University	60.0%	40.0%	100.0%
Total		61.2%	38.8%	100.0%

Source: Fieldwork, 2014

A reasonable level of education enables farmers to be intellectually empowered in terms of having the ability to read instructions and understand the importance of protecting their health and safety. The level of awareness among farmers on the harmful effects of tobacco production is directly proportional to the usage of PPEs (Table 4.16). A significant number (61.7%) of tobacco farmers do not use PPEs in carrying out tobacco-related activities. However, majority of them (80%) are not actually aware of the harmful effects associated with tobacco production mainly due to factors ranging from lack of information, ability to read and understand the rules and the individual choices.

Table 4.16 Level of awareness and use of protective devices

	Use of protective devices in carrying out tobacco-related activities		Total
	YES	NO	

Are you aware of any risks or harmful effects associated with tobacco production	YES	43.2%	56.8%	100.0%
	NO	20.0%	80.0%	100.0%
Total		38.3%	61.7%	100.0%

Source: Fieldwork data, 2014

Tobacco farmers in Malakisi use the various PPEs in carrying out tobacco-related activities as shown in table 4.17. The study established that tobacco farmers mostly used spray coats with hoods, hand gloves and gumboots because spraying of tobacco crops is done on a more regular basis. This was also attributed to the fact that the spraying exercise poses health-related risks to farmers than any other activity.

Table 4.17 Protective devices used in tobacco production

PPE	N	Percent
Nose masks	20	18.7%
Gumboots	25	23.4%
Spray coat with hood	27	25.2%
Hand gloves	26	24.3%
Goggles	9	8.4%
Total	107	100.0%

Source: Fieldwork, 2014

Nose masks are also used in tobacco-related activities. However, farmers are keener on protecting themselves against chemical spills than from inhalation of chemical fumes. The misconception that chemical spills are more dangerous than any other health and safety risk is a major contribution to the high incidences of tobacco-related health complications among farmers.

Among those who use PPEs, few of them (25%) reported that they purchased them individually. Most contracted farmers reported that they mostly received the PPEs on loan from tobacco companies. This is seen by farmers as a benefit of being contracted as they can easily access PPEs that would otherwise be expensive to purchase. The rest either borrowed PPEs from other farmers or received them from other unspecified sources.

Table 4.18 Source of protective devices

Source	Percent
Individual	25.0%
Tobacco company	71.9%
Others	3.1%
Total	100.0%

Source: Fieldwork, 2014

Majority of farmers who do not use PPEs do not have a contract with tobacco companies, hence do not have access to loans in form of PPEs. A number of reasons highlighted for non-use of PPEs during tobacco production include: not comfortable, high cost, not available and the thought that it is not necessary to use them. Majority of the farmers (42.11%) reported that the PPEs were not available when they needed them – either they had been misplaced or borrowed and not returned (Table 4.19).

Table 4.19 Reasons for not using protective devices

Reasons	Frequency	Percent
Not comfortable	3	15.79%

High cost	5	26.32%
Not available	8	42.11%
Not necessary	2	10.53%
Total	19	100.00%

Source: *Fieldwork data, 2014*



Figure 4.12 Tobacco farming households preparing tobacco leaves for curing

4.6 Tobacco companies' role in sustainability

4.6.1 Effectiveness of environmental conservation efforts

A lot has changed since the 1950's in terms of crops grown and various events that have occurred in Malakisi. This is evidenced in the change of crop patterns, loss of traditional livestock due to drought and famine and the disappearance of indigenous trees to pave way for more farming land and provide wood-fuel for tobacco curing. Tree varieties that once dominated the hills and rivers in Malakisi no longer exist. The tobacco companies that exist in Malakisi, British American Tobacco (BAT) and Mastermind Tobacco Limited, have tried to promote reforestation exercise

among tobacco farmers by supplying tree seedlings every growing season. However, the tree seedlings provided by these companies are not native to Malakisi and, in the long run, they are cut down and utilized in tobacco production. Varieties like eucalyptus and cypresses are problematic because they tend to absorb excessive amounts of water thereby harming food crops and reducing the water capacity in the soils.

Furthermore, there is a misconception among tobacco farmers that the trees are meant to meet their wood-fuel demand. Farmers do not clearly understand that the trees are supplied and planted to promote conservation measures. More often than not, they think that it is the companies' provision of wood-fuel. Most of the farmers utilize these trees for tobacco-related activities like construction of barns and wood-fuel for tobacco curing.

Despite tobacco companies' reforestation efforts, the once forested areas in Malakisi now stand bare. Most respondents also acknowledged that the tree seedlings provided by tobacco companies for reforestation are not enough and that the supply is inconsistent. The sustainability of this programme is also threatened by lack of training and clear guidelines to farmers on how to manage tree seedlings and plant trees. Most respondents had never been trained on how to tend to trees hence chances of these trees surviving to maturity were quite slim.

4.6.2 Energy-efficiency technology

In order for the tobacco curing process to commence, there must be an energy input, which can be from natural sources like sun or wind, commonly known as Naturally Cured Tobacco (NCT). Geist (1998) estimated that in 1993, NCT contributed 38% of the global tobacco production. According to Schmid and Kagi (2010), about 62% of the total global tobacco production is cured through

unnatural mean including the fire and flue curing. Flue-curing is a common practice in Kenya, despite its major contribution to deforestation. Alternative fuels have been used around the world to enhance energy efficiency and curb deforestation. However, wood is found to be more desirable than any other form of energy as it requires less attention, burns longer and distributes heat evenly.

BAT has introduced a new technology called 'rocket barn'³ in order to promote energy efficiency and consequently save on wood-fuel. The technology enhances the quality of tobacco leaves and prevents pollution through reduced smoke. This technology utilizes approximately half of the wood-fuel used in the old technology as the barns are insulated with grass and have double chimneys that allow in more heat, removing excess moisture for efficient and faster drying of tobacco leaves. Unlike the conventional method that utilizes huge logs of wood, rocket barn uses small twigs and branches thus allowing farmers to use branches instead of the whole tree.

The downside of this technology is that almost all smallholder tobacco farmers in Malakisi cannot afford the construction costs. Only few tobacco farmers have constructed the rocket barns. The reluctance to adopt the new technology is attributed to lack of proper training on the usage and the fear of the unknown due to lack of awareness on the importance of this technology.

4.6.3 Tobacco companies' rules and regulations

Tobacco companies have laid down rules to govern the tobacco production process and reduce any impacts on the environment and health and safety of farmers. Most of these rules are put in place

³ The Rocket Barn induces air across the leaves from front to back of the barn increasing the airflow over the leaves and subsequent convectional heat transfer. The drying capacity of the rocket barn yields higher efficiencies in terms of curing and energy conservation.

to ensure that there are minimal or no cases of health or safety-related issues in the tobacco production process. The study therefore sought to assess the level of knowledge among tobacco farmers in regards to the rules and regulations laid out by tobacco companies.

About 62% confirmed that they knew about the rules that govern tobacco production while 38% did not know. Majority of those who were not aware of the rules attributed it to their inability to read as, in most cases, the rules are normally outlined on paper written in either English or *Kiswahili*. Results show a direct link between level of education and the ability to understand the rules (Table 4.20)

Table 4.20 Level of education and knowledge of tobacco rules

		Knowledge of rules governing tobacco production		Total
		YES	No	
Level of education of respondent	None	40.0%	60.0%	100.0%
	Primary	61.4%	38.6%	100.0%
	Secondary	77.9%	22.1%	100.0%
	College/University	60.0%	40.0%	100.0%
Total		62.0%	38.0%	100.0%

Source: *Fieldwork data, 2014*

The level of education of a farmer is significantly correlated to the action towards tobacco farming rules. This is majorly attributed to farmers' ability to read, understand, and interpret any given piece of information. The study found out that most farmers who have not achieved adequate education to enable them read are often not familiar with most information provided in written form. However, these set of farmers prefer information disseminated verbally either through the extension services offered or local communication channels. According to most respondents, the

quality of extension services offered to tobacco farmers is not sufficient. Most farmers are not well aware about the existing rules and the implications of not adhering to them. In contrast, farmers with higher levels of education have the ability to read and follow any laid down rule and regulations. The farmers who were familiar with health and safety related rules outlined some of the rules as follows

- Farmers have to stick to tobacco production timelines - when to plant, when to apply insecticides and when to harvest tobacco
- Protective clothing provided by the company have to be worn when performing any tobacco production- related activity

The first rule has the potential to significantly reduce the impact of tobacco production on the health of farmers and the well-being of the environment. By sticking to the correct timelines, farmers are able to plan their timetables well, especially in terms of focusing more attention to planting food crops that would reduce food insecurity. More time would also be spent on managing the environment e.g. through reforestation activities. Furthermore, adhering to the timelines would significantly reduce the frequency at which agrochemicals are applied on tobacco crops. Although the tobacco production calendar has changed over the past decades, most tobacco farmers have stuck to their own timelines, increasing exposure to environmental and health risks. Some of the farmers who seem to be aware of the rules are still not keen on the set timelines.

As for the second rule, the PPEs are essential in reducing any health and physical risks to tobacco farmers when carrying out tobacco production-related activities. Most of the respondents were aware of the need to wear PPE but they acknowledged that they did not have them because they were expensive. Some of the respondents said that they felt uncomfortable wearing the PPE

especially the gloves hence they could not work efficiently. As shown in table 4.22, majority of tobacco farmers who have PPEs don't actually use them in tobacco-related activities.

Table 4.21 Ownership and usage of protective devices

		Do you use protective devices when carrying out tobacco related activities		Total
		YES	No	
Do you have personal protective equipment?	YES	36.7%	63.3%	100.0%
	NO	40.9%	59.1%	100.0%
Total		38.8%	61.2%	100.0%

Source: *Fieldwork data, 2014*

In summary, tobacco farmers are highly exposed to a number of risk factors that call for proper personal protection when attending to various tobacco-related activities. Although most of the tobacco farmers are aware of the risk factors, they agree that they do not use the PPEs. Furthermore, there exist a number of rules that are not often followed to the letter by tobacco farmers. According to tobacco companies' rules, farmers who do not follow these rules risk losing their contracts, farm inputs and tools. But according to respondents, tobacco companies do not always take action against farmers who violate the rules.

5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of key findings

This study focused on the impact of tobacco production on the environment and human health and safety. Although tobacco production plays a very important socio-economic role in Malakisi, the environmental and health and safety implications cannot be underestimated. Right from the time a tobacco nursery is prepared to the time the mature tobacco leaves are harvested and cured, the surrounding environment is exposed to various environmental risks resulting from unsustainable farming practices. Tobacco farming activities not only contribute to accelerated rates of deforestation but also degrade the environment and interfere with the state of the soil, water and air. The findings of this study indicate that the state of environment in Malakisi has changed overtime majorly due to increased deforestation and the pollution of streams and rivers from agrochemicals. The increasing number of tobacco farmers in Malakisi has substantially increased the demand for wood-fuel that is utilized in tobacco curing.

The preparation of tobacco nurseries and growing of tobacco along riverbanks and streams is an environmental hazard. This is because the loss of aquatic life in the local streams and rivers in Malakisi is majorly attributed to the excessive amount of fertilizers and other chemicals that are washed off from the nearby tobacco farms. The frequency at which agrochemicals are used on tobacco farms is much higher. The findings also indicate that the farmers' level of awareness on matters related to environmental sustainability is overshadowed by their drive for economic prosperity. This is evident in the extent at which environmental resources like trees and water are unsustainably utilized to maximize returns. For instance, tobacco companies' reforestation

programmes have not achieved much in terms of environmental conservation due to tobacco farmers' excessive demand for wood-fuel.

Tobacco production also exposes farmers to health and safety risks. The high magnitude and frequency at which agrochemicals and pesticides are used in tobacco production is an indication of their level of vulnerability to health-related illness. For instance, tobacco nurseries require sixteen separate applications. Tobacco farmers also spend more time in the farms attending to tobacco thus increasing the vulnerability and exposure to agrochemicals. Despite majority of the farmers being aware of the tobacco-related health and safety risks, only few of them use PPEs when carrying out tobacco-related activities. Majority of those who own PPEs don't actually use them due to the uncomfortable nature or unavailability of PPE when needed although they have them. Unlike other farmers, tobacco farmers are constantly exposed to various risk factors that increase their vulnerability to health-related complications.

The results also revealed that the farmer's level of education significantly influence the ownership and usage of PPEs. Majority of the farmers with lower levels of education do not use PPEs whereas the usage is high among those who have attained higher levels of education. The level of education is also directly proportional to the level of awareness on the impacts of tobacco production on the environment and health of farmers. For instance, majority of farmers who have no or insufficient education are not aware of the implications of various tobacco farming practices, majorly due to inability to read, understand and interpret the information provided.

Despite the environmental and health implications of tobacco production in Malakisi, there is less effort on the part of tobacco companies to minimize the risks. As tobacco companies continue to encourage tobacco farming by giving loans to farmers and access to markets, less attention is paid

to conservation measures that are sustainable. The farmers who are unaware of the health and safety implications seem to have a record of various tobacco-related complications and illnesses. Furthermore, there are no monitoring and evaluation plans in place to assess the effectiveness of various strategies like the tobacco companies' reforestation initiatives. For instance, the findings show that farmers seem to do not understand the reason behind the reforestation initiative as most of them seem to rely on the same trees for wood-fuel used in curing tobacco. The extremely reduced forest cover in Malakisi has had cascading effects in terms of biodiversity loss, soil and water degradation. This is because the polluted rivers and streams are a threat to aquatic life and the health of people who rely on the water for consumption. There is a likely risk of occurrence of climate-related extreme events like floods, drought. Furthermore, diseases are likely to occur as a result of deforestation and pollution of rivers and streams.

5.2 Conclusion

Tobacco production in Malakisi is causing degradation of the environment and the disruption of ecosystem due to increased deforestation for tobacco curing and other tobacco-related activities, and the intensive use of agrochemicals to increase production. Consequently, there has been a decline in the state of biodiversity and increased levels of farmers' exposure to agrochemicals. A number of measures instituted have not been sustainable due to the increasing demand for wood-fuel and the general lack of awareness on the implications of tobacco production-related practices on the environment and health of farmers. Article 18 of the FCTC addresses the need to protect the environment and the health of persons engaged in tobacco cultivation.

5.3 Recommendations

Little effort has been put in by stakeholders to ensure a safe and healthy working environment for those involved in the tobacco production process. The farmers' vulnerability is manifested in the lack of training on the use of agrochemicals, partly due to non-existent programmes that allow for knowledge transfer. The following are the recommendations that would help ensure a sustainable environment and minimal health and safety risks in the tobacco production process:

Tobacco farmers

- There is need to control the chemicals that flow to the rivers as a result of tobacco farming, because pesticides in the water pose a great threat to both human beings and the animals that use the water.
- The tobacco production rules to be strictly adhered to at all stages of production.
- To enhance conservation measures by cutting down less trees and planting more.
- Diversification of livelihoods to reduce the pressure that tobacco production has on the environment and human health.
- Use PPEs in all tobacco-related activities in order to reduce risk of exposure to agrochemicals.
- To dispose farm wastes (plastic bags, used containers and tobacco leaves) appropriately
- Tobacco farmers and residents in Malakisi should be informed and educated on health risks of tobacco production. They should also be advised on how to prevent tobacco-related illnesses.

Tobacco companies and the government

- Tobacco companies have the responsibility of ensuring that tobacco farming practices do not harm the environment and the health and safety of farmers.
- There is need for tobacco companies to invest in more co-operate social responsibility initiatives that are geared towards restoring the environment. The most ideal initiative would be to engage the citizenry in greening the environment by sponsoring them with free seedlings and
- Tobacco companies should endeavor to offer regular trainings to farmers on issues related to tobacco farming, the environment and their health. This should be followed up by more effective extension services to tobacco farms to monitor and evaluate individual farmers' practices.
- The tobacco companies need to set up penalties for those who violate the rules.
- There is need for agricultural institutions present in the tobacco growing zones to be proactive in sensitizing farmers on best practices. In Malakisi, for instance, there exists a number of Non-Governmental Organizations (NGOs), government offices, CBOs and other groups that would play a role in enhancing sound agricultural practices. The significance of these institutions varies depending on their specific roles. The government institutions like the Ministry of Health and the Ministry of Agriculture should provide an enabling environment for tobacco farmers to access information and relevant training that would minimize the impact of tobacco production.
- The government institutions have a unique role in terms of formulating and implementing policies that guide tobacco production. For a start, the provisions contained in the TCA are biased towards tobacco smoking and less attention has been given to the tobacco production process. There are no existing rules or guidelines for tobacco production hence

the need for government to step up efforts in regulating tobacco production activities. For instance, an effective regulation would include a fine so that both the farmers and the tobacco companies are asked to pay fine for contravening the regulations. This will go a long way in ensuring best practices in tobacco production and the sustainability of the environment and the health and safety of those involved.

5.4 Areas for further research

As the study has shown, there exists a gap in the formulation and implementation of policies that directly address diverse impacts of tobacco production. There is need for studies to be carried out on the extent to which tobacco production causes deforestation in terms of quantifying the amount of forest cover lost. There is need for an assessment to be carried out on soil, water and air to analyse the extent to which tobacco production degrades environmental resources. The analysis of the health impacts of tobacco production would help to further inform the contribution of tobacco production to health-related complications.

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APPENDICES

APPENDIX 1:QUESTIONNAIRE FOR TOBACCO FARMERS

Introduction

This survey seeks to analyze the environmental and the occupational health and safety implications of tobacco farming in Malakisi Division of Bungoma County. Your information on the subject and contribution to this study is very valuable since you are one of the tobacco farmers in this area. You are therefore requested to kindly participate in this study. You are assured of confidentiality in relation to your identity and personal information.

Questionnaire No.	
Date	
Village	
Name of interviewer	
Name of respondent	

1.0. General Information

- 1.1 Gender: Male Female
- 1.2 Household status: Head of household House wife Others (specify) _____
- 1.3 Age _____
- 1.4 Highest level of education of the head of household Primary 0-Level
 A-level College/University None
- 1.5 What is the size of the household size (Total number of persons) _____
- 1.6 (a) What is your main occupation (what takes up most of your time)? _____
-
- (b) For how long have you been involved in the main occupation?
 Less than one year 1-5 years 6-10 years Over 10 years
- 1.7 How do you rate the regularity of off-farm income in your household?
 Regular income Irregular/Occasional income No income

2.0 Land ownership

- 2.1 What is the legal entitlement of your land?
 Leased from an individual Freehold/inherited/purchased land Communal land
 Others (Specify) _____
- 2.2 What is the estimated total size of your land? _____ acres
- 2.3 Where does your household belong in terms of land enterprise diversity?
 Land available for woodlots, bush, fallow, Napier grass, etc.
 Land allocated to basics (maize, beans, vegetables, bananas etc.)
 Land allocated to basics, plus 1 or 2 other uses

3.0 Tobacco farming activities

- 3.1 (a) In which year did you start tobacco farming? _____
- (b) Which type of tobacco farmer are you?
 Contracted Non-contracted
- (c) Why do you prefer the status above?

3.2 What reason can you give for **currently** growing tobacco (**Tick appropriately**)

1) The ready market	
2) Availability of loans	
3) Favorable climatic conditions	
4) High financial benefits	
5) Availability of land	
7) Availability of cheap labour	
8) Culture/inheritance from the forefathers	
9) Good extension services offered by the tobacco companies	
10) Others (Specify)	

3.3 Do you know of any other household uses of tobacco? Yes No

If **Yes**, which ones?

Smoking Sniffing Chewing Pest control

Others (specify) _____

3.4 (a) What portion of your land is allocated to tobacco farming in acres? _____

(b) How has this portion of land allocated changed in terms of size?

Allocation	Tic
• Increasing over time	
• Decreasing over time	
• Constant over time	

3.5 Has land tenure system changed in this area due to tobacco production? Yes No

If **yes**, explain how.

3.6 (a) Do you own tobacco nursery or nurseries? Yes No

(b) If **No**, where do you acquire seedlings for your production?

Buy from neighboring farmers Buy from farmers' group (s)

From communally owned nursery Others (specify) _____

3.7 (a) Which of the farm inputs do you use in the production of tobacco (Tick where necessary and indicate the sources).

Tick	Farm input	Source
	Fertilizer	
	Fire wood	
	Fungicides	
	Furnace and pipes	
	Hessian bag	
	Labour	
	Pesticides	
	Pesticides	

	Seeds	
	Water can	
	Water pump	
	Others (specify)	

- 3.8 (a) Do you own a curing barn? Yes No
- (b) If **Yes**, where is the barn located?
 In homestead Near homestead Far from the homestead
- (c) If **No**, how do you cure your tobacco? Jointly (between two or more families)
 Communally Tobacco company's curing barn Others (Specify) _____
- (d) Which method of tobacco curing do you use?
 Flue curing Pit curing Fire curing Sun curing Air curing Others (Specify) _____
- (e) How long does one lot of tobacco averagely take in the curing barn?
 less than 2 days 2-4 days 5-7 days more than 1 week more than two weeks
- (f) In the last season, how many days did you take to cure all your tobacco? _____ Days
- (g) What problems do you experience during the curing process?
 Fire outbreak A lot of monitoring Eye problems smoke inhalation
 Tedious Others (specify) _____
- (h) What are the precautionary measures that you normally put in place to avoid the problems above
-

3.9 (a) Which of the following problems do you face in tobacco production?

Problem	Tick
Conflicts	
Drought	
Fire outbreaks	
Floods	
Hail stones	
Health problems	
Labour shortages	
Poor soil fertility	
Time constraints	
Pests & diseases	
Wild animals	
Others (specify)	

4.0 Rules governing tobacco production activities

- (a) Are you aware of any rules governing tobacco production? Yes No
 If **Yes**, explain which ones
-

- (b) Who sets the rules?
 Tobacco company Farmers' groups Government NGOs

Others (specify) _____

(c) What disciplinary measures are taken when a farmer fails to adhere to the and regulations set by the authority above?

5.0 Occupational and environmental hazards associated with tobacco production

5.1 (a) What is your current source of wood-fuel for tobacco curing?

Own farm Nearby bushes/hill Purchase from nearby market

Tobacco company's supply Others (specify) _____

(b) Name some of the indigenous trees/ natural forests that have disappeared in this area?

(c) What factors do you attribute to the disappearance of the indigenous trees in your land?

5.2 (a) Has the productivity of your land been interfered by tobacco production?

Yes No

Explain _____

(b) How do you rate the level of soil erosion in your farm?

Very serious Serious Minor Not a problem

Give reasons for your answer above

(c)) How do you rate the level of soil fertility in your farm?

Very high High Low Poor

Give reasons for your answer above

(d) Have tobacco production activities interfered with aquatic life in your area?

Yes No

Explain _____

5.3 (a) Are you aware of any risks or harmful effects associated with tobacco production? Yes No

(b) Do you use any personal protective equipment when carrying out tobacco production related activities?

Yes No

(c) If Yes, which devices do you use?

- Spray coat with hood Gumboots Nose masks Goggles
 Hand Gloves Others (specify) _____

(d) Who provides the personal protective equipment?

- Individual purchase Tobacco company Farmers' groups
 Others (specify) _____

(e) If no, give reasons why you don't use any protective device when carrying out tobacco production related activities?

- Uncomfortable to use Too expensive to obtain Not available when required
 Not necessary Others (specify) _____

5.4 (a) Have you experienced any tobacco related problems or complications? Yes No

(b) If Yes, which ones:

- Headaches Eye problems Chest problems Coughing Itching on skin
 Stomach problems Boils fever Dry throat Miscarriages Back problems
 Others (Specify) _____

(c) What are the most common diseases in your household ?

1. _____ 2. _____
3. _____ 4. _____

(d) Where do you first seek treatment when you or your household member falls sick?

- District hospital Local government dispensary Local private clinic Traditional Herbs or clinics None Others (specify) _____

5.5 Where do you store your tobacco after curing?

- Residential house A special store Kitchen In the curing barn
 Others (specify) _____

5.6 Where do you dump tobacco wastes?

- Within the homestead Near the river or stream In the farm
 Others (specify) _____

5.7 Has any of your family members suffered any form of injury as a result of tobacco production-related activities? Yes No

6.8 How do you assess the general health of your HH members

- Very Good Good Fair Poor Very Poor

Explain why

5.9 What is the main source of man-power for tobacco farming activities?

- Hired Men Women Children All
 Others (specify) _____

5.10 What assistance do you get from the following stakeholders concerning tobacco production activities?

Stakeholders	Name them	Form of Assistance
--------------	-----------	--------------------

• Tobacco companies		
• Government Agricultural Officers		
• Non-Governmental Organizations(NGOs)		
• Tobacco farming associations		
• Community Based Organizations (CBOs)		

6.0 Any comment/interesting case study/story on how farming has been useful or has negatively affected your life and family?

Thank you

APPENDIX 2:QUESTIONNAIRE FOR NON-TOBACCO FARMERS

Introduction

This survey seeks to analyze the environmental and the occupational health and safety implications of tobacco farming in Malakisi Division of Bungoma County. Your information on the subject and contribution to this study is very valuable since you are one of the non-tobacco farmers in this area. You are therefore requested to kindly participate in this study. You are assured of confidentiality in relation to your identity and personal information.

Questionnaire No.	
Date	
Village	
Name of interviewer	
Name of respondent	

1.0. General Information

- 1.1 Gender: Male Female
- 1.2 Household status: Head of household House wife Others (specify) _____
- 1.3 Age _____
- 1.4 Highest level of education of the head of household Primary 0-Level
 A-level College/University None
- 1.5 What is the size of the household size (Total number of persons)_____
- 1.6 (a) What is your main occupation (what takes up most of your time)?
-
- (b) For how long have you been involved in the main occupation?
 Less than one year 1-5 years 6-10 years Over 10 years
- 1.7 How do you rate the regularity of off-farm income in your household?
 Regular income Irregular/Occasional income No income

2.0 Land Tenure

- 2.1 (a) What is the legal entitlement of your land?
 Leased from an individual Freehold/inherited/purchased land Communal land
 Others (Specify) _____
- (b) What is the estimated total size of your land? _____ acres
- (c) Where does your household belong in terms of land enterprise diversity?
 Land available for woodlots, bush, fallow, Napier grass, etc.
 Land allocated to basics (maize, beans, vegetables, bananas etc.)
 Land allocated to basics, plus 1 or 2 other uses

3.0 Tobacco Growing

- 3.1 (a) Have you ever grown tobacco?[Yes No
- (b) If **yes**, which of the factors influenced you to start tobacco production?

Reason	Tick
Anticipated ready market	
Availability of land	
Culture/inheritance	
Incentives from Tobacco Companies	

Influence from other tobacco farmers	
Promotion from Government Agricultural officers	
There was no other cash crop by then	

(c) If No, give reasons why

Religion/denomination lack of farm inputs Inadequate land Tobacco related health Issues Labour-intensiveness Others (specify) _____

(d) Do you know of any other household uses of tobacco? Yes No

If Yes, which ones?

Smoking Sniffing Chewing Pest control

Others (specify) _____

3.2 (a) For how long were you involved in tobacco production in terms of months or years?

(b) Why did you abandon tobacco production?

Health related issues Unavailability of land Labour intensiveness

Religion Low returns Others (specify) _____

3.3 Have tobacco production activities changed land tenure system in this area? Yes No

If yes, explain

3.4 (a) What is the current source of wood-fuel for your household?

Own farm Nearby bushes/hills/rivers and streams

Purchased from nearby markets Others (specify) _____

(b) Name some of the indigenous trees/ natural forests that have disappeared in this area over time? _____

(c) What factors do you attribute to the disappearance of the indigenous trees in this area?

3.5 (a) If former tobacco farmer, did tobacco production interfere with the productivity of your land? Yes No

Explain how _____

(b) How do you rate the soil erosion situation in your farm?

Very serious Serious problem Minor problem Not a problem

Give reasons for your answer

(c) How do you rate the level of soil fertility in your farm?

Very high high low poor

Give reasons for your answer.

3.6 How do you assess the general health of your household members

Very Good Good Fair Poor Very Poor

Explain:

4.0 Any comment/interesting case study/story on how farming has been useful or has negatively affected your life and family?

Thank you

APPENDIX 3: FOCUS GROUP DISCUSSION GUIDE

- Thinking back in the past decades, what are the major agricultural events that have occurred in the area? When was tobacco introduced and which companies are involved in contracting tobacco farmers?
- What has been the trend in the number of tobacco farming since its inception? Has the number been increasing or decreasing?
- Give reasons for the trends in the number of tobacco farmers over time
- Briefly describe the stages involved in tobacco production and the impacts each have on the environment and health and safety of tobacco farmers/workers
- How do you compare tobacco production activities with those of other crops
- What rules and regulations govern the tobacco production process and what are the penalties that exist?
- How knowledgeable are you on issues related to environmental sustainability and health and safety?
- What are some of the suggestions you would make that address tobacco production related issues?

Thank you.