ASSESSMENT OF GENDER ROLES AND ENVIRONMENTAL IMPACTS OF OIL CROP PRODUCTION IN LARE, NAKURU,

KENYA

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DECLARATION AND RECOMMENDATION

DECLARATION

I declare that this is my original work and has not been presented elsewhere for an award of degree, diploma or certificate in this or any other university.

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RECOMMENDATION

This thesis has been submitted for examination with our approval as University Supervisors.

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ABSTRACT

The oil crops sector had been identified as one of the entry points in the execution of the food reliance and a vehicle for poverty reduction by government of Kenya (MoA, 2008). As a result many studies and development projects aimed at promoting soybean and sunflower in Kenya have been undertaken since the 1990s. While a lot of studies have been based on low adoption of these crops, challenges like gender roles, access to and control of the farmland remain undocumented. To address this gap, this study focused on gender roles and the related potential environmental effects during oil crop production by small holder farmers, in Lare Division, Nakuru County, Kenya. The importance of disaggregating gender roles, access to information by gender and awareness of environmental and gender policies were analyzed. The research adopted an ex-post facto survey research approach. Purposive sampling was used to obtain a sample size of 180 small holder farmers from 330 households within the study area. Data collection instruments included questionnaires for primary, focus group discussions and secondary data were also reviewed. The results indicated that the activities and production of oil crop was a gender crop. Male farmers owned land and accessed information through trainings but were not involved in all activities of soybean and sunflower production. Gender roles adhere to traditional and cultural codes on pesticide application, it was done by male farmers with no protective gears despite having been trained on safe practices. The study established that 58% female and 13% male farmers were aware not of environmental and gender policies. The study concludes that there was exposure to pesticide within the households and water bodies by contamination which interfered with biodiversity and habitat. No female farmers were aware of any policies though 35% of the males were aware. This slow of awareness is likely to lead to poor practices that are likely to increase environmental risks. The study recommends that there is need to promote policies, programmes and projects that improve both men and women's access to and control over productive resources, inputs and services equally at grassroots' levels. There is a need to study the changes in the gender roles in agriculture in order to understand the cultural setup in different area. The understanding of such changes goes a long way in enhancing better projects planning and implementations.

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LIST OF ABBREVIATIONS AND ACRONYMS

AEZ	-	Agro-Ecological Zone
ASALs	-	Arid and Semi- Arid Lands
CDD	-	Crop Development Division
CSE	-	Centre for Science and Environment
ECOSOC	-	Economic Social Council (United Nations)
EPZ	-	Export Processing Zones
FAO	-	Food and Agricultural Organization
FGD	-	Focus Group Discussion
FPR	-	Farmer Participatory Research
FSK	-	Farming Systems of Kenya
GAD	-	Gender and Development
GAM	-	Gender Analysis Matrix
GDP	-	Gross Domestic Product
GED	-	Gender, Environment and Development
GOK	-	Government of Kenya
HCDA	-	Horticultural Crops Development Authority
HIID	-	Harvard Institution of International Management
ICA	-	International Cooperative Alliance
ICRA	-	International Cooperative research Alliance
IFPRI	-	International Food Policy Research Institute
ILO	-	International Labor Organization

IRN	-	International Research Network
JICA	-	Japan International Cooperation Agency
KARI	-	Kenya Agricultural Research Institute
KEPHIS	-	Kenya Plant Health Inspectorate Services
LHz	-	Lower Highland zone
MDGs	-	Millennium Development Goals
MM	-	Millimeters
MOA	-	Ministry of Agriculture
PPE	-	Protective Production Equipments
PRA	-	Participatory Rural Appraisal
RRA	-	Rural Rapid Appraisal
SbMV	-	Soybeans Mosaic Virus
SIDA	-	Swedish International Development Cooperation Agency
SPSS	-	Statistical Package for Social Sciences
UN	-	United Nations
UNEP	-	United Nations Environmental Programmes
UM	-	Upper Midland
USAID	-	United States Agency for International Development
VOPS	-	Vegetable Oil Protein System
WID	-	Women in Development

CHAPTER ONE

1.0. INTRODUCTION

1.1. Background Information

Oil crops are grown all over the world and in many economies; they play a crucial role in the agricultural sector. There are three groups of oil crops: Annuals which include soybean (*Glycine max*), sunflower (*Helianthus annus*), rapeseed (*Brassica napus*), groundnuts (*Arachis hypogea*), sesame (*Sesamum indicum*) and safflower (*Carthamus tinctorius*); Perennials: include oil palms (*Elaesis quanensis*), coconut (*Cocos nucifera*) and olives (*Olea europaea*) and by product crops like cotton and corn (Americanos, 1994). Among seed oils, soybeans and sunflower have had an extraordinary growth due to rising consumption of livestock products and concurrent rapid growth in meal demand; as well as the fact that they are cheap source of proteins especially in developing nations. Soybeans and sunflower account for more than 50% of the world oilseed output (Joshi, 2001).

As the world population continues to grow and is predicted to reach about nine billion in 2050, the demand for oil produce will continue to grow. FAO (2002) estimated that the future may see some drastic decline in the growth of aggregate world production by 1.5 percent per annum in the next three decades and 0.9% per annum in the subsequent 20 years to 2050. An increase in demand for bio-fuels could further increase pressure on inputs, prices of agricultural produce, land, and water. Governments, donors and development partners committed resources towards the development of the oilseed sub sector (MDG 2001). Currently, 40% of edible oil consumed within the region is imported as crude palm oil and blended with the locally produced oil seeds to be sold in the domestic and regional markets. There is an opportunity to increase domestic production to substitute palm importation. At the same time, it can also substitute the high animal feed imports (Andrew, 2003). There is also a high demand and potential for bio-fuels due to lack of sufficient energy or irregularity of energy supply for processing, lighting and production activities thus influencing livelihoods of over twenty million Kenyans and accounts for over 70% of oil production in the country (EPZ, 2005).

In Kenya, the development of the oil crop industry has been of considerable importance to the country's economy. Kenya is currently importing over 95% of her vegetable oil requirements at a cost of US $ 90 million annually (FAO, 2002). The consumption of edible oils has grown at about 13% per annum in recent years but production of oilseeds has been declining since the mid-1980s. At a population growth of about 3.4% per annum, it is estimated that Kenya will need approximately 250,000 metric tonnes edible oils, 200,000 tonnes of oilseed cake and an additional 500,000 tonnes for other (industrial) purposes by the turn of the century (MDGs, 2000). This demand can only be achieved by shifting to domestic production and processing of vegetable oils.

There is a strategy in the country focused on transforming subsistence agriculture to market-oriented farming (GoK, 2006). The oil crops sector had been identified as one of the entry points in the execution of the food reliance and a vehicle for poverty reduction (MoA, 2006). Oilseed contributed to food security; to the livestock sub sector through the seed cake as animal feed; to the energy sector through production of bio-fuels, energy that can in turn be used to support value addition in the oilseed sub sector through processing and packaging and can be used as forage for bees for improved production in the apiculture sub sector (KARI, 2008)

Sunflower and soy bean crops are widely adapted and they were among the major oil crops grown in Kenya mainly in the Rift valley and Southwest of Kenya. Kenya has suitable agro-ecological zones with potential for the cultivation of various oilseed crops and essential oil crops. In areas where meaningful research has been carried out (Okoko *et al*., 1998), it has been established that the presently low yields attained by farmers could be increased threefold if they adopted scientifically developed appropriate technologies. Prioritisation of oilseed crop research programmes would greatly facilitate and accelerate the generation of production technologies, especially so for those crops which hitherto have not been accorded priority as subjects for research (IRN, 2005).

In Nakuru County, oil crop production is undertaken mainly in areas with an altitude of less than 1200 meters above sea level, which are low lying zones. These areas include Lare, Rongai, Njoro, Molo and the adjacent areas. Oil crop in these areas produce for the local market which include the local vegetable oil manufacturers e.g. Bidco oil Company. Studies on

sunflower and soybean production in Kenya have shown that although sunflower and soybean have good potential for commercial production, there are still some challenges such as gender bias mainly on roles, low land acreages leading to shortage of seeds for processing, poor agronomic practices mainly on fertilizer usage, and also low production yields (KARI, 2008). Other production constraints include socio- economic, lack of policy and regulatory bodies and cultural issues, lack of extension services, and climatic changes (Okoko *et al*., 1998). However, to sustain production of sunflower and soybean, it was envisaged that gender roles and environmental impacts should established to document 'who' does 'what' and 'how' and to assess impacts of oil crop production to the environment. Other production constraints included socio- economic and cultural issues, lack of extension services and pesticide usage.

1.2. Statement of the Problem

Oil seed production is one of the economic activities selected by the Kenyan government to transform agriculture from subsistence to commercial farming level. KARI, MOA, FSK and Egerton University in collaboration undertook an integrated pilot study on soybeans and sunflower production project in Lare Division of Nakuru County, Kenya. The objective of the project was to address food security. Farmers were trained on production and management of sunflower and soybean crops. The requirement during training was that the oil crops be grown as a single plot crop (no intercropping). After implementation, the project soon fizzled out. The question was "why?" A needs assessment and concerns study was done (KARI, 2007). The findings from this study indicated that the trainings were done on a one sided gender (male farmers) only. Activity, access and control profiles were not addressed during project inception to ascertain who does what, how, by whom and when. Influencing factors and intervention from gender perspective was not done to identify external constraints and opportunities on environmental risks that would arise during project implementation. Therefore, this study sought to assess the gender roles and environmental impacts among small holder farmers during oil crop production in Lare Division, Nakuru County, Kenya. This study helped to understand different gender roles in oil crop production and the farming practices by different genders. The findings will hopefully give some useful insights on how these different gender roles were likely to affect the environment (negatively). By understanding these different gender roles and environmental impacts will create an entry point for future project implementations.

1.3. Objectives of the Study

1.3.1. Broad Objective

To assess gender roles and effects of oil crop production on the specific gender activities in Lare division, Nakuru County, Kenya.

1.3.2. Specific Objectives

i. To identify the oil crop production activities carried out by both male and female small holder famers.

ii. To determine gender roles construction in oil crop production.

iii. To identify and compare the potential environmental risks by gender of cultivating oil crop

iv. To establish awareness of environmental policies and gender in Kenya

1.4. Research Questions

I. Which activities are carried out by male and female farmers in oil crop production?

II. What factors determine the roles among men and women farmers in oil crop production?

III. Do women and men grow separate oil / crops on separate fields, simultaneously or in rotation?

IV. What is the ecological and human health risks associated with production of oil crop?

V. Do men and women suffer the same environmental and health risk hazards in the production of oil crop?

VI. Do farmers seek for extension services related to oil crop production?

VII. Are the oil crop farmers aware of the environmental policies addressing the use of pesticides in oil crop production?

1.5. Justification of the Study

A lot of literature shows that sunflower and soybean have a great potential in terms of food, income, nutrition and human health and soil health improvements through biological nitrogen fixation in the crop farming systems. But, no systematic study has investigated the actual impact of sunflower and soybean on the environment and different gender roles in sunflower and soybean production. The findings of this study will assist researchers and other stakeholders to understand specific genders' roles during oil crop production and how these specific gender roles impact the environment.

1.6. Scope of the study

The study concentrated on small-scale farmers who grew sunflower and soya beans in Lare division of Nakuru County. It looked at gender perspectives in terms gender roles, access and decisions made during oil crop production. Investigations were also done to find out how the environment was impacted during oil crop production in regard to activities done which were: socio- economic and regulatory bodies i.e. land use, labor, educational levels, health and policies.

1.7. Limitations and Assumptions of the study

i. That everybody involved in the study would co-operate during the study period

ii. That all the study areas would be accessible.

iii. That all the farmers interviewed would recall the farming practices of the previous year.

iv. All households were not homogeneous. To overcome this limitation, simple stratified sampling was used

v. That there would not be any adverse weather/ political/ climatic conditions that hinder the scheduled activities program.

1.8. Definition and Operationalization of Terms

Access – In this study it is the equal access to the factors of production by removing discriminatory provisions in the laws. Do small holder farmer (women and men) have equal access to available resources?

Control – in this study they are the farmers on how they make decisions over factors of production. Farmers were asked on whom controls the available resources like land and incomes generated from oil crop production.

Culture – In this study, it includes a community's reservoir of what defines them as a people which in most cases represents the best that has been known and thought. Through culture we are able to see society in its strengths and weaknesses and to see ourselves.

Environmental Impact- As for this study it was any change to the environment, whether adverse or beneficial, wholly or partially resulted from the production of oil crops and genders' contribution to the same. Farmers in the study area were using chemicals to protect their oil crops from diseases. What were the repercussions and how did they spray?

Environmental Right- In this study, every person has a right to a clean and healthy environment and a duty to safeguard and enhance the environment.

Ex-post facto – In this study it was the independent variable causing changes in the dependent variable. Female farmers in this study lacked access to information and trainings yet they did most of the farm activities while male farmers who were trained were not doing much hence hampering good land practices leading to negative land degradation.

Farmer- In this study it's the person who works on the land and keeps crops

Gender - is used to describe those characteristics of women and men, which are socially constructed, while **sex** refers to those which are biologically determined. People are born female or male but learn to be girls and boys who grow into women and men. This learned behavior makes up gender identity and determines gender roles.

Gender Analysis - Identifies analyses and informs action to address inequalities that arise from the different roles of women and men, or the unequal power relationships between them and the consequences of these inequalities on their lives, their health and well-being.

Gender Awareness- In this study it referred to conscious knowledge that communities are not homogenous and those benefits from development intervention do not accrue equally to all segments, sexes, and sectors of a community.

Gender Balance- In this study gender balance is the equal and active participation of women and men in all areas of decision-making, and in access to and control over resources and services

Gender Discrimination- In this study gender discrimination is any exclusion or restriction made on the basis of gender roles and relations that prevents a person from enjoying full human rights.

Gender Equality- is the absence of discrimination on the basis of a person's sex in opportunities, in the allocation of resources and benefits or in access to services.

Gender Equity- refers to fairness and justice in the distribution of benefits and responsibilities between women and men.

Gender perception- Is a term used to describe how individuals are classified as male, female, or transgendered. It may be used to describe group perceptions about gender as well as individual perceptions about one's own gender.

Gender Relations- The ways in which a culture or society defined rights, responsibilities, and the identities of men and women in relation to one another (between men and women).

Gender Roles- Are conditioned by household structure, access to resources, and duties assigned to individuals at household level on the basis of being male and female.

Gender Mainstreaming- for this study mainstreaming gender is the process of assessing the implications for small scale women and men farmers of any planned action, including legislation, policies or programmes, in any area and at all levels.

Household- For the purpose of the study, it referred to a group of people living under same roof, bounded by common kinship ties, recognized one authority and shared same food daily.

Male and Female Farmers- In this study, it referred to both men and women heading households and carried out agricultural activities on farming household including production of oil crops.

Oil crops- In this study, oil crops were those plants that produced oils and protein meals for livestock and human beings.

Socio-Economic- In this case study they were people having the same social, economic, or educational status, related to, or involved both economic and social factors.

Participation – In this study it is the making processes related to policymaking, planning and administration during sunflower and soya bean production.

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. Gender and the Environment

The current Gender, Environment and Development (GED) approach is not only concerned with women, but with the social construction of gender and the assignment of specific roles, responsibilities, and expectations to both women and men. According to the GED approach, gender roles distinguish and determine human relationships with the physical environment and sustainable development. Access to and effective control over natural resources of good quality, such as land, water and forests, are important indicators of gender position. The use and management of the resources are also differentiated by gender. Other critical factors are access to and control over other means of production, including income and credit; appropriate technology; training and education; housing; active participation and involvement; decision making power and social status; and freedom of organization. These critical factors differed between the sexes, and played a role at micro-, meso- and macro-levels of society (Dankelman and Davidson 1988).

2.2. Concept of Gender in Agriculture

Gender refers to socially constructed roles and relations between men and women. This includes the different responsibilities of women and men in a given culture or location. These roles vary within and between cultures, ethnicity and class and they change over time (Bhatta, 2001). In this context it is modest to incorporate the aspect of gender equity. Gender equity denotes the fairness of treatment of women and men, according to their respective needs. This may include equal treatment or treatment that is different but considered equivalent in terms of rights, benefits, obligations and opportunities. In the development context, a gender equity goal often requires built-in measures to compensate for the historical and social disadvantages of women (FAO, 1997).

Agriculture is a major component of incomes, especially in developing nations. Water, land, livestock, crops, and knowledge are essential for the livelihoods of most of the world's

families. Access to, control over, and management of these resources determines which activities are pursued, which goods may be produced, and whether the lives of rural families are enhanced or diminished (Jiggins, 1986). Gender determines who has access to these resources and what kind of access they have. Although women work in the fields, the homes, outside of the farm, and at the markets, their male counterparts often dictate decisions over the household and its economy (ICA-ILO, 2001)

At the household level, the ability to cope to changes in agricultural sector depends on control over land, money, credit and tools; low dependency ; good health and personal mobility; household entitlements and food security; secure housing in safe locations; and freedom from violence (Lambrou, *et al*. 2006). Moreover, gender biases in institutions often reproduce assumptions that it is men who are the farmers, as a result, new agricultural technologies – including the replacement of plant types and animal breeds with new varieties intended for higher drought or heat tolerance – are rarely available to women (Gurung, *et al* 2006). Women all over the world continue to struggle for their rights to own and inherit property. Human Rights watch details the disastrous effects of traditional and governmental institutions that deny women's rights to own property in Kenya. Women are key agricultural producers in Kenya, contributing 75-80% of all labor in food production and 50% in cash crop production but they receive only 7% of agricultural extension information (USAID, 2008)

Much of the agricultural work done by women in the developing world is subsistence agriculture (KARI, 2008); while their husbands often go to the cities or large-scale farms to find work, women are often left to produce and raise food for their children. Agriculture, especially subsistence agriculture, is a way of survival for many women. Their work, however, is often unrecognized. Despite a growing recognition of women's work and contributions to agriculture, women continue to have unequal access to necessities such as land, water, credit, supportive networks, and capital (Mbugua *et al*, 1997). As in many other places in the world, women in Kenya do not have access to resources such as machines, land, credit, and advice that are necessary to be as productive as men (Welch, 2000).

In regard to gender role in agriculture, Boserup (1970) classified it into two bases, the level of population density and the level of agricultural technology. On the basis of these

variables, the gender role in agricultural production varies from place to place. According to her, female role in agricultural production is dominant in African because the continent is sparsely populated and the agricultural technology is based on simple hand tools that are hoes, sickle, axe and iron tipped digging stick. As to Boserup, women, in Africa, carry out nearly all farming activities except tree felling. Africa is the region of female farming par-excellence. In many African tribes, nearly all the tasks connected with food production continue to be left to women..... Tree felling is always done by men, most often by young boys of 15 to 18 years (Boserup, 1970).

A study for the International Food Policy Research Institute (2007) pointed out, "If women were given the same resources as men, developing countries would see significant increases in agricultural productivity." Despite the fact that women do not own the land, they are still responsible for most of the labor done on the land. It is estimated that "75% of all agricultural labor in Africa is performed by women (IFPRI, 2007)." Men are doing less of the labor on the land that they own because they are seeking seasonal employment in cities. The result is a "feminization of agriculture," where women are now responsible for producing market produce and tending the cattle, in addition to producing food for consumption by the family, Olumakaiye M.F. *et al*, (2006). Yet because the husbands own the soil and the land, the income the women earn from their hard work is allocated to the men. This has left Kenyan women in a situation with few options for improvement (Welch, 2000).

In some cases women tend to work fewer hours on the farm than men while working about the same number of hours off the farm. However, the census did not calculate the hours of work women put in on the farm that was considered "unpaid labor". This unpaid family labor - taking care of children, making meals, doing housework - all takes time and are a necessary part of the operation of a farm and family. However, there is no economic value calculated for this time. The devaluation of women and the work that they do leads to their unequal participation in farming organization. This limits their influence on policy making which often leads to unjust legislation and restrictions on women's ownership and control over necessary resources. Consequently, the scenario keeps women within a second class, with less economic security and more vulnerability to the effects of poverty (Karen *et al*, 2008).

2.3 Gender Roles in Crop Production

Gender roles are clusters of socially and culturally defined and learned expectations about how people will behave in specific situations. In any society, gender roles are developed and transmitted through the process of socialization with the family members and other significant groups and individuals taking up the major roles of agents of socialization at various developmental stages. Women in Africa, generally play an important role in small scale traditional agricultural roduction(Afolabi,2008).Rural women have taken over the production and processing of arable crops and are responsible for as much as 80% of the staple food items. Women farmers are the principal labor force on smallholder farms and perform the largest share in land preparation, weeding, transporting, processing and marketing of agricultural products, they make up to 60-80% of the labor force (women in agriculture-WIA- development programme in Nigeria Rural women according to Olawoye (1988) constitute the ‘’the economically active population’’ but they are largely not considered productive because they usually work as unpaid family labor.

These social cultural roles are in most cases interchangeable between men and a woman, for example tending or working in the farms is seen as a female role. Female may purely be responsible for weeding while men’s responsibility may be to engage in heavy machinery such as tractors e.t.c. In most cases, men have exploited their female counterparts in the way they have taken the role of earning from the sacrifices of women with their little access to the same. The female are placed at the periphery in all this.

In Asia and Africa, women do much of the agricultural work, yet in these two societies, the culture dictates that the women do housework. In certain communities such as the Maasai and Somalis women are not allowed to attend certain important meetings where serious decisions are made or serious issues are discussed pertaining to development. It is the male domain strictly, and if they have to attend, they sit far away from the meeting venue. The division of farm tasks between women and men varies according to the enterprise, the farming system, the technology used, and the wealth of the household. Control over the benefits of production also varies between women and men, partly reflecting their labor input, but also reflecting the use of produce in the home or for sale, cultural norms regarding ‘women’s’ and ‘men’s’ enterprises,

and the dominance of men as the household head and, consequently, are entitled to the most important resources like land (Derman, 2005)

Generally, men are the key players in crop production, and are also the principal beneficiaries in terms of control over the income generated through the sale of produce. In contrast, there are very few enterprises in which women dominate both the workloads and the control of the benefits, although there are several enterprises in which women and men share both the workloads and the benefits. However, it is almost impossible to draw general conclusions about the division of labor and the share of the benefits between women and men because there are significant inter- and intra-regional variations, as well as variations reflecting the wealth of the household. Although the division of tasks varies between commodities and between locations, it is possible to make some broad generalizations (ILRI, 2010)

In crop production, men are typically responsible for the heavier manual tasks, such as land preparation and tillage with oxen; they also play a dominant role in seed selection, reflecting their better access to information and perform skilled jobs, such as broadcasting seed and fertilizer. In comparison to women, men are not usually responsible for threshing and winnowing cereal crops. Women are often involved with activities that require dexterity and attention to detail, such as raising seedlings in nurseries, transplanting and weeding. They are also involved with activities closely associated with their household responsibilities, such as storage, processing and value adding. When timeliness is of the essence, particularly weeding and harvesting, women and men work together with other household members (ILRI, 2010).

2.4 Gender Constraints in Agriculture

Rural women's general lack of land restricts their access to credit. Lack of access to credit in turn puts up barriers to their access to productive assets. Women's access to land, credit, productive assets, and technology and extension services is further constrained by prejudice against them at both the institution and social levels. This prevents them from having equal opportunities with men attending training courses and obtains information in agriculture (ICA-ILO, 2001)

In Kenya, women and consequently female headed households have significantly less access to certain resources than men and male headed households. In the past, it was the men who provided extension services. Few female worked as extension workers due to the nature of work, which demanded one to be away from home for extended period of the year (Young, 1994). Rural women also perceived male extension workers as people who came to talk to the fellow men folk. Also extension officials perpetuated the myth that the Kenyan farmer was a male (Young, 1994). This meant that, to a large extent, men remained the primary beneficiaries of their training programmes and indeed the design, timing and location of the training programmes rarely took account of women 's multiple roles in the community. Due to this, any innovations would be given to men; the expectation that men would pass information to women farmers has not always been the case. Women were condemned to continue with old ways of doing things and were labeled "ignorant" (ICA-ILO, 2001).

2.5. Oil Crop Production in Kenya

The ranges of oil crops in Kenya include sunflower, cotton-seed, soya, groundnuts, rapeseed, Bambara nuts, castor, and palm oil amongst others. Kenya is making efforts to satisfy the local and export demand for various vegetable oil crops. The total area covered by vegetable oil crops had increased from 120,667 hectares in 2002 to 127,997 hectares in 2003 (MoA, 2003). Vegetable oil is one of the key sub-sectors of agriculture, with soybean and palm oil being the leading sources in production of vegetable oil in the world respectively. Kenya has been undertaking continued research through the Vegetable Oil Protein System (VOPS). The objective of VOPS is to support an integrated, sustainable, applied research and extension program on the vegetable oil / protein system aimed at the removal of constraints to domestic oilseed production, processing and use of edible oils. At present, Kenya's domestic production of edible oils is estimated at 380,000 tonnes, only about one-third of its annual demand. The remainder is imported, at a cost of $140 million, making edible oil the country's second most important item after petroleum (CDD, 2003).

The area under vegetable oil crops has remained fairly steady over the years despite the irregular weather conditions. The key players in the vegetable oil industry in Kenya comprise processors who extract the oil from the seeds and also produce oil cake for use in animal feeds,

and refiners who convert crude oils into a form suitable for human consumption (MoA, 2003). For poor households, oil seeds, edible oils and the paste provide quick sources of cash income. They are also an important component of local diets and the seed cake can be used to promote the dairy sub-sector. Many governments in the region of Africa, Kenya included have put schemes in place to provide privatized extension service delivery systems to support private sector engagement in this sector. Within the value chain income disparity / equity and gender balance is still limited at producer levels and potential to increase margins or value is highly skewed (MoA, 2003).

2.6. Potential Environmental Health Hazards of Oil crop Production

The potential environmental impacts of the oil crop farming include impacts of the various stages of oil crop production, trade and processing of oil crops. Potential impacts of oil crop production, and the expansion of production, include effects on land-use (including deforestation, change in amenity value of land, change of habitats and impacts on biodiversity); direct effects of cropping on soils (soil erosion and fertility), water (use of water resources and impacts on run-off and drainage waters), and air (air quality and greenhouse gas production); and indirect effects of the production and supply of inputs to agriculture (pesticides and herbicides use). There is overwhelming evidence that some of these chemicals do pose a potential risk to humans and other life forms and unwanted side effects to the environment during agricultural farming (Forget, 1993; Igbedioh, 1991; Jeyaratnam, 1981). No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden is shouldered by farm workers in developing countries (WHO, 1990). The world-wide deaths and chronic diseases due to pesticide and herbicide poisoning is about 1 million per year (Environews Forum, 1999). The high risk groups exposed to pesticides and herbicides include sprayers, mixers, and agricultural farm workers. During chemical mixing and crop spraying, the possibility of hazards may be higher because the processes involved are not risk free (WHO, 1990).

Tracing the chain of cause and effect in environmental impacts during oil crop production is complex because environmental impacts may be both positive and negative; the outcome in

specific cases will depend on a complex of factors affecting oil crop production including the basic land resources available, production systems, technologies and inputs adopted, prevailing socio-economic and regulatory environments and many other factors (World Resources Institute, 1994). All types of land-use have potential environmental impacts; what is of concern in assessing the impacts of alternative uses are the relative or net impacts and trade-offs of losses and gains. Thus the impacts of increased demand for oil crop production may be the small net impacts of a slightly changed cropping system (e.g. where opportunities for expansion of cropped areas are limited), or the net impacts (gains and losses) of changed land-use where new cropland is opened up (FAO, 1993).

2.7. Oil Crop Production and the Environment

Vegetable oils have gained in importance during the past few decades resulting in the doubling of the world oil crop production in the last 25 years. Oil crops have been increasingly used as raw materials for food, livestock feed and non-food industrial applications. Rising demand is driving owners to clear tropical forest to plant oil palms (UNEP, 2000). For example, according to UNEP 2000, at the current rate of intrusion into Indonesian national parks, it is likely that many protected rain forests will be severely degraded by 2012 through illegal hunting and trade, logging, and forest fires, including those associated with the rapid spread of palm oil plantations. Thus, there is growing concern that this will be harmful to the environment in several ways namely: Significant greenhouse gas emissions. Deforestation, mainly in tropical areas, accounts for up to one-third of total anthropogenic CO_2 emissions; Habitat destruction, leading to the demise of critically endangered species (e.g. the Sumatran tiger, the Asian rhinoceros, and the Sumatran Orangutan.); Reduced biodiversity including damage to biodiversity hotspots; Destruction of cash crops, such as fruit and rubber trees in Sarawak, Sabah and Kalimantan and Borneo, that belong to indigenous peoples (the Dayak), despite their frequent objections (UNEP, 2000).

In Africa, the situation is very different compared to Indonesia or Malaysia. In its Human Development Report (2007-2008), the United Nations Development Program says production of palm oil in West-Africa is largely sustainable, mainly because it is undertaken on a smallholder level without resort to diversity-damaging monoculture. The United Nations Food and

Agriculture program is encouraging small farmers across Africa to grow palm oil, because the crop offers opportunities to improve livelihoods and incomes for the poor (UN, 2001).

2.8. Environmental Impacts of Agriculture

Agriculture is facing the challenge of feeding an increasing global population while natural resources are shrinking due to a combination of factors. Current practices such as tillage, water use, intercropping, crop rotation, grazing and extensive usage of pesticides affect the biodiversity of agricultural fields as well as the environment outside of fields (Tilman, 1999, 2002; Robinson and Sutherland, 2002; Butler et al. 2007, Quemada, 2009). By occupying 40% of the land surface, agriculture is currently a major land-use and is the main factor contributing to losses in biodiversity (FAO, 2007). Approximately 13 million hectares of biodiversity-rich forests are lost in developing countries annually (James, 2009). This situation will likely worsen in the near future as the global population must be fed and biofuel feedstock's additionally produced. The pressure to increase the area of land under cultivation will grow more and more important. Climate change also is "expected to accelerate many pressures on the wild environment, as long-established production systems become destabilized and a biotic stress (such as water shortages, salinity, aridity and heat) are increased" (FAO, 2007).

Pests cause a loss of 40% of agricultural production worldwide, despite strategies and measures carried out to control them (Pimentel, 1998). Insects alone destroy annually about 25% of food crops worldwide. For instance, the European corn borer (the larvae of Ostrinia nubilalis) can destroy up to 20% of a maize crop. In Africa, losses in agricultural production due to pests can reach 100% depending upon the agro-ecological zones (Abate et al., 2000). Thus, huge amounts of synthetic pesticides are used every year to control agricultural insects around the world. Those chemicals not only have serious impacts on the environment but also can cause harm to human health. Every year, thousands people are poisoned by agricultural pesticides worldwide, mostly in developing countries (Brodesser et al., 2006, CGIAR, 2008).

In intensively managed agricultural systems, large amounts of the herbicides are annually used by farmers to control weeds. Many groups of herbicides are available including the chlorophenoxy acid herbicides which are selective for the angiosperm plants, the triazines herbicides used mostly to protect corn, apple, grapes, wheat; the thiocarbamates which are

generally used as graminicides applied to soil before emergence of crops, to protect maize, rice, sorghum, sugar beets, soybean (Nagy et al., 1994); and the organic phosphorus herbicides including glyphosate, a non selective herbicide. Broadcast spraying of herbicides can have negative consequences on the environment through different pathways. Drift of the herbicide beyond the intended spray site, for instance, can cause offsite damage to susceptible vegetation. Herbicides also result in reduced habitats and food for non-target organisms such as birds and mammals, especially when these herbicides are applied in forestry.

It has been reported in the USA that the residual herbicides commonly used for corn and soybean production have been detected in rivers, streams, and reservoirs at concentrations exceeding the U.S. maximum contaminant levels or health advisory levels for drinking water (Martin et al., 2008). Among the herbicides, glyphosate is the one most widely used both in agriculture and forestry. Its values include a low toxicity to animals, a rapid adsorption to soil particles reducing movement in the environment and a low persistence due to a rapid degradation by soil microbes (Cerdiera and Duke, 2006). It has been used commercially in the United States for over 35 years (Combs and Hartnell, 2008). Glyphosate is a nonselective herbicide that kills annual and perennial plants including both weed and crop species (Duke et al. 2003, Brown, 2006, Combs and Hartnell, 2008).

Tillage or plowing can increase soil erosion and cause soil loss all around the world. These practices also demand fuel consumption, which contributes to the increased carbon dioxide emissions which are responsible for the greenhouse effect and global warming.

Reduced tillage has been shown to be environmentally beneficial by reducing soil erosion, increasing its moisture content and nutrient richness, and leading to favorable conditions for soil organisms and wildlife. Reduced tillage also contributes to decreases in the level of pollution by smoke and carbon dioxide release through reduced consumption of fuel (Fawcett and Towery, 2002; Dale et al., 2002).

Agriculture consumes approximately 70% of the world’s fresh water that is withdrawn for human use (FAO, 2007). This demand for water is expected to increase dramatically as the world population is growing and will reach 9.2 billion by 2050 (James, 2009). Among the environmental problems of agriculture, water-related problems occupy an important place. It can be said that water is the blood of an ecosystem. Water not only influences the plant's growth *per*

se but serves as an important medium of transfer for nutrients, etc., in soils. It influences the soils physical properties, both directly and indirectly due to biochemical processes. Environmental problems in agriculture have proven difficult to address due to the spatial heterogeneity and temporal variability intrinsic to agriculture.

Agriculture is largely a struggle against nature; both its sustainability and the prospects for improving environmental performance and farm income simultaneously are thus inherently limited. Agriculture's high degree of variability makes direct regulation inefficient. Subsidies for improving environmental performance can have negative consequences and have proven ineffective in practice, due largely to bureaucratic culture. Water serves as a medium for transporting matter both inside and outside the given agro-ecosystem. The water-related environmental problems of agriculture are connected with mechanical treatment of soil and use of fertilizers, pesticides, and other chemicals, and are naturally closely related to irrigation. The components of the environment most damaged by agricultural practices are soil and waters pollution.

2.9. Gender Perceptions

Gender perception is a term used to describe how individuals are classified as male, female, or transgendered. Gender perception is the way in which a person is viewed as belonging to a gender. It may be used to describe group perceptions about gender as well as individual perceptions about one's own gender. There is a gender perception between productive and reproductive side of women's work and lives. The general view that is widely held is that women have no or little productive abilities and hence their main work is reproductive in nature. Reproduction encompasses the care and maintenance of the household and its members such as cooking, cleaning, childbearing, mostly regarded as female work. This perception has relegated women to spectator in meaningful agricultural development. The labor invested in the family maintenance, including child bearing and rearing, house work, care of the ill and the elderly, has been considered to belong to the private domain and outside the purview of development example, agricultural activities aimed at enhancing better outputs. In most societies, gender power relations favor men and as a result, different values are given to men's tasks.

2.10. Gender mainstreaming

Gender mainstreaming was established as a major global strategy for the promotion of gender equality in the Beijing platform for action from fourth United Nations, world conference on women in Beijing in 1995. The ECOSOC, (1997/2), defines gender mainstreaming as the process of assessing the implications for men and women of any planned actions including legislation policies or programmes in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated.

The ultimate goal is to achieve gender equality. Gender mainstreaming entails bringing the perceptions, experience, knowledge and interests of women as well as men to bear on policy-making, planning and decision-making. Mainstreaming should situate gender equality issues at the center of analysis and policy decisions, medium term plans, programme budgets and institutional structures and processes. This requires explicit systematic attention to relevant gender perspectives in all areas of the work of the United Nations. Mainstreaming can reveal a need for changes in goals, strategies and actions to ensure that both men and women can influence, participate in and benefit from development processes. This may lead to changes in organizational environments which are conductive to the promotion of gender equality. However, a number of persistent constraints remain to be addressed.

2.11. Gender Analysis Matrix (GAM)

The gender analysis matrix by Rani Parker (1993) identifies how a particular development intervention will affect women and men. It is a community-based technique to elicit and analyze gender differences and to challenge a community's assumptions about gender. The principles of the Gender Analysis Matrix are: all requisite knowledge for gender analysis exists among the people who live in the subject of the analysis; gender analysis does not require the technical expertise of those outside the community being analyzed, except as facilitators and gender analysis cannot be transformative unless the analysis is done by the people being analyzed. In household decision making, **w**omen are more sensitive than men to the inner 'pulse-

beat' of the community. They are able to sense what is going on behind the scenes; they often know more accurately what the genuine felt needs of the people are. They therefore needed to be included in decision making process (Batchelor, 1993). A United Nations report claims: The extent to which women were free to make decisions- may be the key to future not only of the poor countries but of richer ones too (UN, 1989).

As compared to men, women have limited access to labor market, less chance of getting a good-paying, secure job, lower wage earnings, fewer assets, lower education, narrow range of technical skills, and less access to land, capital and technology (UN, 1989). Women's reproductive and domestic responsibilities are generally perceived to be their primary function. Therefore, reinforced structural barriers to their land and productive assets; and restricted their time and mobility for productive work. Women face unequal access to productive resources and services although they were largely dependent on self-employment for which land, capital, and labor were critical, women's work tends to be undervalued-perceived as work that was of low importance (cite source).

2.12. Conceptual framework on Gender Roles and Environmental Impacts

This study was based on the theories of Harvard Analytical Framework also called Gender Analysis Framework. The framework helped the researcher to design more efficiently on the project and improve overall productivity. This was done by mapping the work and resources of men and women in a community and highlighting the main gender roles differences. The framework consists of a matrix for collecting data at the micro (community and households) levels (Livingstone (1992), (Peet 1998), (Yates and Fratkin 1999), (Schroeder 1985) and (Overholt *et al*., 1985).

The Harvard Analytical Framework has four main components. The Activity Profile: This tool identifies all relevant productive and reproductive tasks and answers the question: who does what? This includes gender, age, time spent and location of the activity. Access and Control profile identifies the resource used to carry out the work identified in the activity profile, and access to and control over their use by gender? These factors are considered because they present opportunities and constraints that shape gender relations, and determine different

opportunities and constraints for men and women. Influencing factors: This tool helps to identify external constraints and opportunities during planning any development interventions. It helps to anticipate what inputs will be needed to make the intervention successful from a gender perspective. Checklist for Project-Cycle Analysis consists of a series of questionswhich are designed to assist in examining a project proposal or an area of intervention from a gender perspective, using gender-disaggregated data and capturing the different effects of social change on men and women.

As stated above, the of the Harvard Analytical Framework helped the study to collate data about men and women farmers activities. In tool I, the small holder farmers in the project area (Lare Division), the gender division of labor was represented in the table form on gender participation. The researcher also examined the details of who does what by gender? Which men / women? Where? When? How long? Also men and women's access to and control over resources and benefits data were collected. These tools were used to indicate and understand who had access to resources and control over their use. Benefits realized from household (and community) on oil crop production and use of resources were also identified and decision making analyzed. Through this framework, this study was expected that the relationship between independent and dependent variables will be mediated and moderated by intervening variables.

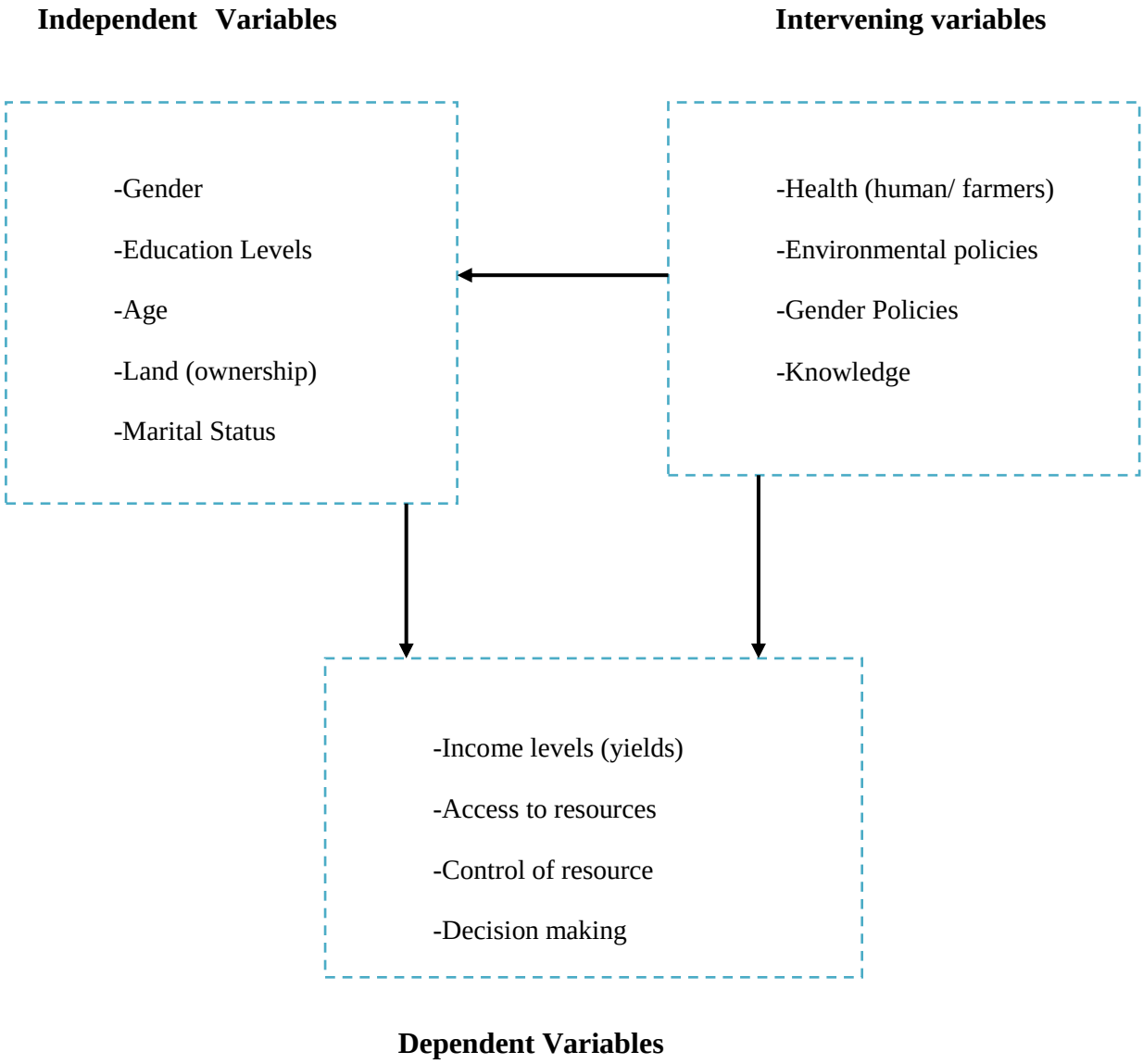

Figure 1: Conceptual Framework

CHAPTER THREE

3.0 METHODOLOGY

3.1. Gender Responsive Study Design

In Lare Division, there are a total of 330 farmers, both male and female farmers (MoA, Nakuru County, 2006) who practice both subsistence and sunflower and soybean farming in the area. Among these crops, oil crops are intercropped within other crops like maize with sunflower and soy bean as guard rows. Within households, farmers are involved in this production and thus gender differentiation was necessary. It is this context it was necessary to include a mixed gender field enumerators who consisted of both male and female interviewers (3 form each gender) who were to have access to either male or female respondents. Since 'women' and 'men' small holder farmers were not homogenous categories, we had to probe and examine how gender roles was cross-cut by many other forms of social difference: gender, socio-economic status, decision making authority, and constraints- because the difference in household activities led to important insights about the perception of oil crop production and environmental impacts. To ensure that we worked with people from the range of social groups relevant to the topic at hand, respondents selected included small holder farmers who were or had practiced oil crop production. These categories were identified through discussions with key informants and extension officers from Ministry of Agriculture (Njoro District) in the area. Therefore, it was important to implement gender responsive research designs to understand these factors.

3.2 Study Area

The study was conducted in Lare division of Njoro District in Nakuru County, Kenya. The county has a population of 1.7 million (2009 census) and is the largest in Kenya (MOA-Nakuru District, 2006). Lare division is characterized into four agro-ecological zones (AEZ). The average annual rainfall ranges between 600 to 1000mm and is quite erratic and unevenly distributed. This has greatly influenced the crop performance in the area. The average monthly minimum and maximum temperature ranges from either 22 to 26 (degrees) or 8 to 10 (degrees) respectively .The major soils in Lare are developed on the ashes and pumice from recent

volcanoes (Jaetzold and Schimidt 1983). The farmers in Lare practice subsistence farming where most of their acreage of farm holding is between 1.5 to 5 acres of land. Since the area is endowed with bimodal rainfall distribution i.e. the long rainy season (March to June) and the short rainy season (August to November), the cropping pattern is intercropping (especially maize with common bean/ sunflower/ soybean), which is increasing with increase in land scarcity due to population pressure in the area.

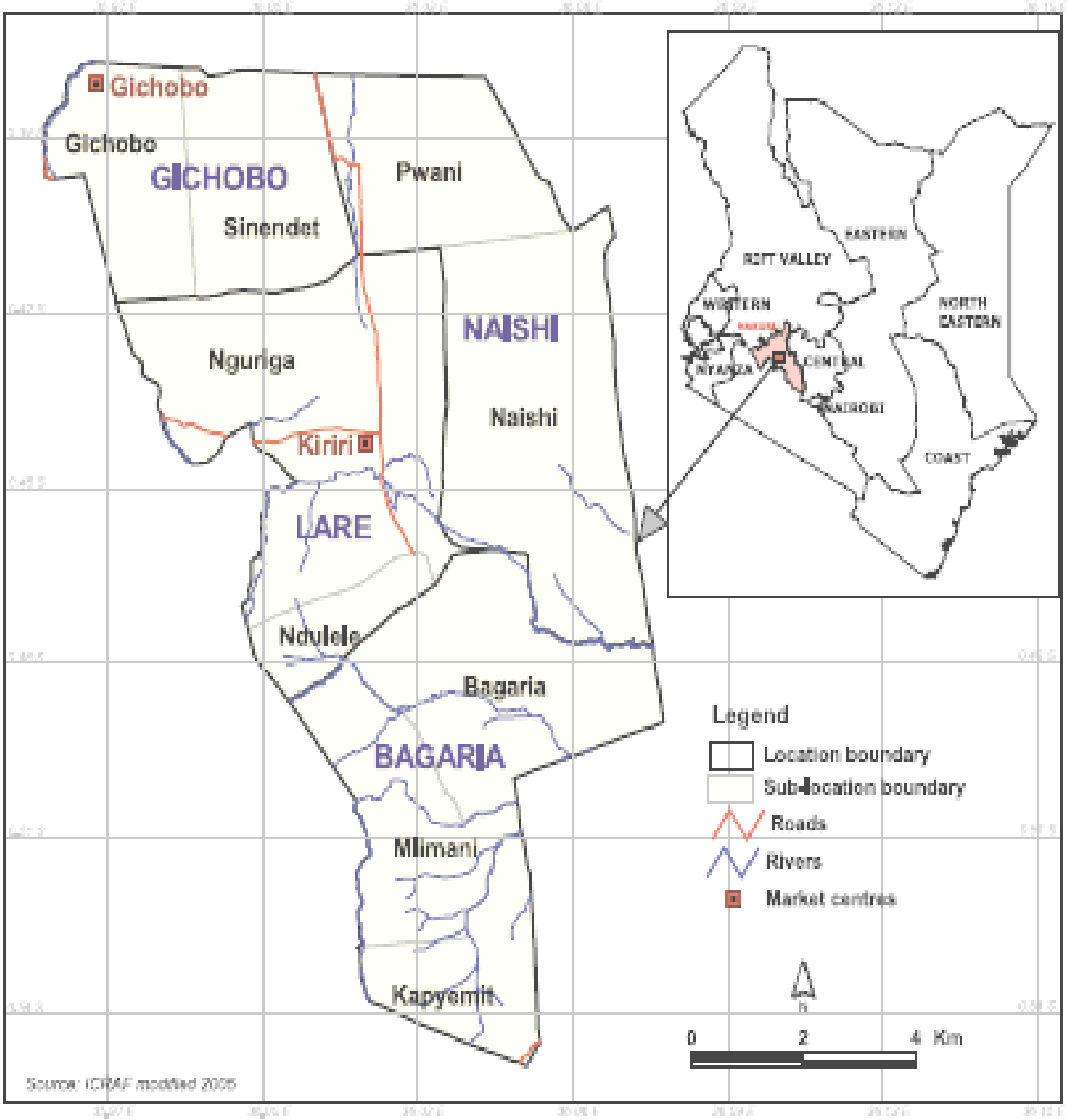

Figure 2: Map of Kenya showing Lare Division

Source: ICRAF, 2006

3.3. Research Design

The study was designed as an *ex post-facto* survey. It was ex post-facto because levels of oil crop production and potential environmental impacts were studied knowing that farmers produced oil crops and there was potential environmental impact from these activities. This was appropriate because sampling was done only once from the specific population. Any possible chance differences emanating from the sampled population was minimized through randomization while selecting the sample (Frankel *et al.* 2000).

This study also combined comparative, exploratory and descriptive research skills. In comparative research, the implicit or explicit differences was examined i.e. gender differences whereas exploratory and descriptive research skills were employed to examine the phenomenon from many points of views- looking for new ideas and insights which explained what was happening and how the variables were related. The study was done in the four sub-divisions in Lare Division namely Bagaria, Lare, Naishi and Gichobo. The questionnaires and interview contents were developed, pre-tested and validated using a pilot Study in Rongai before they were used in data collection. This was conducted between July and September, 2012 in Lare Division, Nakuru County.

The study took into account the overall key of Harvard's Analytical Framework on adequate data collection at the individual and household level, and that adapted well to agricultural and other rural production systems. Data was collected on men's and women's activities which were identified as "productive" types, and was then considered according to how those activities reflected "access to" and "control over" income and resources, thereby "highlighting the incentives and constraints under which men and women worked in order to anticipate how projects impacted their productive activities as well as the responsibilities of other household members (Rao, 1991)." The researcher collected data on three components: an activity profile, gender relationships, and access and control profile that looked at resources and benefits, and their influencing factors like resource use and inputs. The researcher conceptualized that, in order to attain sustainable environmental management at all levels, gender roles concerns and institutional frameworks influenced farmers' access to productive assets, technology and marketing channels, all of which in turn affected productivity efficiency of the respective gender.

3.4. Sampling Procedure

The sampling frame was based on the 2008/2009 data of the Ministry of Agriculture, Njoro District, Nakuru County (MOA 2008). According to this data, the division of Lare has a total of 330 households (practicing oil crops). The first step was to determine the optimal sample size of the study area. This was estimated to be 180 households when applying the following formula by Yamane (1967) as adopted by Cochran, (1977), updated by Bartlet Kortlett and Higgins (Bartlet and Higgins, 2001). The study used the following formula to calculate sample size.

$$n = \frac{N}{1+N(e^2)}$$

Where;

n =designates the sample size the research uses;

N= designates total number of population size practicing oil crops (330)

e =designates the level of precision or margin (sampling error) 5 % (0.05);

1=designates the probability of the event occurring.

$$n = \frac{330}{1+330(0.05^2)}$$

$$n = \frac{330}{1+330(0.0025)}$$

n = 180

Normally the required minimum sample size is 30 but 5 more household are added to cater for any spoilt questionnaire (Mugenda *et al*. 1999). In this study, a sample size of 180 households was sampled from a total of 330 households. The variable used for stratification was gender of farmers (male or female) in order to get the required size of respondents in the sample as long as each household had practiced sunflower or soybean farming previously.

3.5. Data Collection

The secondary data was collected from various County Agricultural and Development Profiles and Value chain reports (KARI, MOA and other literature studies). Six enumerators (technical officers from KARI), extension officers (Lare) and the researcher did the data collection. Those selected as enumerators had a good educational background with knowledge on field data collection. They were needed to understand the objectives of the study, with good communication skills and were able to confer in local language with respondents. These selected enumerators were familiar with local terms, customs and farming practices and were open minded, tactful and flexible.

The enumerators were trained by me. We went through the questionnaire together and had ample time to visit the area of survey prior to survey. We talked about time to be spent within each respondent, who was to be interviewed; the questionnaire layout, consistency and interviewing techniques (probing). To facilitate the training further, the researcher, assistant and enumerators did two households together to array any fears or questions that may arise. The researcher did checks in the field.

3.6. Method of study in Lare Division

Descriptive method was used for this study. The research utilized mainly qualitative methods to clarify concepts, characteristics, descriptions and counts to demonstrate implications of the issue under question. Data presented in the study were obtained from primary and secondary sources. Primary data was collected directly from respondents using questionnaires and interviews and group discussion with focus groups. Secondary data was collected through review of related literatures. The qualitative research mainly focused on the role of both men and women farmers practicing oil crop in the study area. Information was attained through interviews and focus group discussions by using interview and discussion guides. Secondary data were collected from Njoro District and Lare Division Agricultural Offices. The discussion was undertaken to collect information from relevant bodies involved on actual implementation of the role of men and women farmers during sunflower and soybean production and potential environmental impacts during these activities.

3.7. Data Analysis

A data template for the household questionnaire was built using Statistical Package for Social Studies (SPSS 2007). The template was split into sections to ease data entry and also minimize errors. The baseline data was analyzed by tabulating the descriptive statistics (mean, mode, standard deviation and any measures of associations, and frequencies (percentage occurrence, and minimum and maximum levels of occurrence). The following table 1 summarizes the procedure used for data analysis.

Table 1: Research Questions, Variables and Statistical Tools to be used

Research Questions	Variables to be collected	Data Analysis Tools
Which activities are carried out by male and female farmers in oil crop production?	- Land clearing - Land preparation - Choice of seeds - Sowing - Choice of fertilizers - Application of fertilizers - Weeding - Choice of pesticides - Application of pesticides - Harvesting - Threshing - Transporting - Post harvesting - Marketing	Descriptive statistics
What factors determine the roles among men and women farmers in oil crop production?	- Age - Educational level - Gender - Culture - Socio- economic	Descriptive statistics
Do women and men grow separate oil / crops on separate fields, simultaneously or in rotation?	- Land Ownership - Decision Making	Descriptive statistics
What is the ecological and human health risks associated with production of oil crop?	- List the associated health risks during oil crop production	Descriptive statistics
Do men and women suffer the same environmental and health risk hazards in the production of oil crop?	- List the associated health risks of using pesticides	Descriptive statistics
Do farmers seek for extension services related to oil crop production?	- Extension services required - Knowledge required to be impacted on farmers	Descriptive statistics
Are the oil crop farmers aware of the environmental policies addressing the use of pesticides in oil crop production?	- Policies known - Awareness trainings	Descriptive statistics

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1. Activities carried out in oil crop production by gender

A total of 180 households were surveyed within the study area. The respondents' frequency distribution revealed there were 48% male farmers and 52% female farmers and the gender distribution of respondents was about equal for male and female respondents during the survey. In this study, the gender activities analysis showed that the relationship between male and female farmers during oil crop production was not gender-neutral, thus affected both genders differently. In Lare Division, women farmers (n=93) contribute 90% of the labor for oil crop production, as compared to male labor (n=87) who contribute 10% labor. The results further showed that women farmers are an important source of labor during oil crop production. What is clear from the interviewed respondents (n-180) is that oil crop production in Lare has become a predominantly female enterprise as a consequence of its labor demanding during production. This qualified early study by UN, (1989) who found that women constitute the majority of smallholder farmers, providing most of the labor and managing a large part of the farming activities on a daily basis.

Men and women gender labor activities were analyzed based on different agricultural activities. This included: land clearing, tilling, planting, weeding, harvesting, threshing and selling of the sunflower and soya bean crops. The results showed that activities such as field preparation, selling and supervising are mostly done by men (48%) while tilling, planting, harvesting, and threshing is mostly done by women (52%). The analysis based on the division of production activities undertaken by men and women farmers in soybean and sunflower production distinguished different alternative patterns of household heads. In the first pattern on households with male household head respondents, sunflower and soybean was considered as a man's cash crop. About 40% of the female respondents indicated that they had their separate sunflower and soybean plots from other crops. Further the results showed that in households with both spouses, sunflower and soybean production was a family enterprise (28% of women and 23% of men) but in this pattern, men and women performed complimentary activities on the

same oil crop plots. For instance, men provided labor for land preparation and making holes, while women were responsible for planting and weeding.

This pattern of gender roles compliments documentation in other areas of Africa (Burton & White, 1984) who found that at processing stage women are crucial in quality assurance processes like sorting, drying and packaging while men are involved in more demanding activities like marketing and technical areas of formulation and supervision. Guyer *et al*. (1988) notes that women's work is dominated by the 'symbolism of bending" meaning that women tend to be more involved in activities that necessitate bending, such as planting allocation, weeding, threshing and winnowing. This fact hold true in our study area where all female respondents did activities of planting, weeding, harvesting, threshing and winnowing. In this study, the researcher found that women farmers compared to men farmers, contributes twice as much labor in sunflower and soybean production. This supports findings by Hunt (1997) who found that African women farmers provide between 60% and 80% of labor input in agricultural production as compared to men farmers (10% to 20%).

The average number of years of farming experience was about 33 for both male and female. The average number of years of experience in soybean and sunflower production was 23 years for women and 14 years for men. 52% of women had been growing sunflower and soybean since the introduction in earlier 1990s while male farmers (48%) were on and off. This results further showed that the average age clusters of respondents (n=180) was between the age bracket of between 46 and 55 years. This age factor was a determinant on farming experiences possessed by either male or female farmers and were pointers to the opportunities that farmers have both to minimize or resist the negative impact of environmental problems on their farms; and to develop methods for using and managing available resources that ensure protection and uphold a sustainable process (Gurung, *et al* 2006). This qualifies a study by FAO, (2000) who found that age is an important socio- economic factor in terms of its influence upon land ownership and decision making at the household level, especially with regard to issues concerning crop production (FAO, 2000).

In the sample area, 48 % (n=87) of male farmers acquired their land through inheritance while none of the sampled female farmers 52% (n=93) own or acquired their land through

inheritance. It is argued that insecure land tenure influences how different genders use natural resources or adopts environmentally sustainable farming practices (Young, 1994). FAO, (2010) also argue that when tenure is not secure, women have little incentive to invest in soil conservation and are also significantly less likely to plant trees for food and fuel-wood in areas where future access is uncertain. On land cultivation, 97 % of male respondents cultivated one acre of land within the range of 1 – 5 acres with a mean size of 3.4 acres while, all the female farmers fell within the range of 1 – 2 acres with a mean size of 1.6 acres. The survey results indicated that women (52%) are generally involved in the management, maintenance and conservation of land resources for collective and community consumption. Men (48%) tend to plant permanent trees like coffee, fruit trees and wood lots on their pieces of land due to land security. This qualified early study by KARI (2008) who found out land ownership and use was gender based resource.

Table 2: Land Tenure by Gender

Gender	**Frequency**		**Percentage**
	Owned	**Hired**	
Male	174	5	96.7%
Female	6	2	3.3%
Total	**N=180**	**-**	**100**

The findings of the study showed that in Lare division, agriculture is regarded as one of the risky ventures (n=180). In this study, results show that farmers make individual decisions on the type of crop they grow, inputs used, markets where they sell their produces, and management of available resources like land. Decision making, thus, plays a vital role in the day to-day life of Lare farmers and their families. Lare farmers have to consider a number of factors before arriving at any decision regarding farm and non-farm activities. Because, the present decision has its roots in the past and reflects upon the future decision (Rio De Janeiro, 1992). In this study, women (n=93) did not make individual decisions regarding oil crop production without the consent of either their spouses or any adult male in the family. The absence of women (52%)

in decision making within households pointed to gender based constraints that prevented them from making positive decisions regarding oil crop production. UN, (1990) found failure to take account of women's activities and to include both gender in the decision making process can lead to policies that criminalize women's activities without changing their behavior. The findings of the study indicated that land, labor availability and finances are considered as the major factors influencing decision making in sunflower and soya bean activities by 54% of the farmers. Only 46% of the total respondents (men and women) considered type of crop as the factor influencing their decision making in any agricultural activities.

The results further indicated that regarding farm activities, male farmers (n=87) took more of self-decisions than consultative decisions or decisions by their spouses in case of choice of crop and varieties choice; cropping protections manures, fertilizers and their use; plant protection chemicals and their use; marketing of crop produce, and land usage. The probable reason for this respondents said was traditionally "land" issues are a male right and domain therefore male farmers' still feel that the performance of taking such crucial decisions regarding land lies with themselves. These results showed that being involved in a process is not the same as having a voice or ability to influence and thus farmer's daily interaction and decisions on environment use was gender specific.

The respondents were further asked how many times they sought extensions' advice on environmental risks. Only 68% of the respondents agreed that they always sought for advice on environmental risks while 32% said that they usually received advice during public gatherings. This qualified early findings by MOA, 2006 (Nakuru County) that the technical advice sought for by small scale farmers applied more directly to the production activities of the family farm and to the action needed to improve or sustain the farming production and reduce environmental risks. On finding out about gender technology accessibility, 42 % of the male farmers were aware of new technology with 19 % of the female farmers aware. Only 6% of male farmers had no knowledge at all about new technologies while 33% of female had no knowledge at all. This indicated that a higher percentage of Lare women farmers were not accessing extension for farming information. Findings show that application of new technologies on any farming

systems often meant that the farmer had to acquire new skills of crop production e.g. technical skills to operate unfamiliar equipment, acquisition of new farm inputs, the skill to assess the economic aspects of technical advice given, or farm management skills, and allocating the use of farm resources and equipment (World bank, 2008).

The results further showed that oil crop production activities was associated with level of education of either male or female household head. The results indicates that 26% of women and 10% of men had no formal education, while 8% of women and 22% of men had attended primary school and above.

Table 3: Education level of respondents by Gender

Level of education	Gender	Frequency	Percentage
No formal education	Male	18	10
	Female	46	26
Primary	Male	40	22
	Female	14	8
Secondary	Male	37	20
	Female	12	7
Tertiary	Male	11	6
	Female	2	1
Total		**n=180**	**100**

These levels of education showed those male and female respondents who attained primary level of education and above were engaging more labor towards producing sunflower and soya bean. According to Teich *et al.* (1990), improved communication and higher levels of education make people more adaptable to new ideas and new social reforms required by technology towards any agricultural enterprise.

4.2. Construction of Gender Roles by Cultural Setups

In Lare Division, gender roles adhere to traditional and cultural codes. A division inhabited by over 95% Kikuyu tribe; tradition and culture are upheld tightly. Women farmers (n=93) do the heavy work of tending crops, fetching and carrying water and fuel wood, in addition to household chores and childcare. They operate under serious time constraints, thus limiting their efficiency and the ability to respond to changing economic opportunities. Lare women (52%) are responsible for production of all or most food crops and many are left to run family farms alone while their husbands (48%) migrate in search of paid employment. These results were found from focus groups discussions within the division (Naishi, Lare, Bagaria and Gichobo sub- divisions). For example, results from one focus group discussion in Naishi sub-division (n=18 women) indicated that women farmers are constrained by existing socio-cultural norms through which they are perceived as inferior or second class citizens. From the discussion, women farmers indicated that culture was used to justify the subordinate position of women in the household. The disincentives thus created undermine women's interest and motivation to invest and work on the land and instead, seek other options that directly benefit them.

Division of labor and responsibilities of males and females is a social reality in all households interviewed (n=180). This compliments Olawoye (2001) who found that the subject of gender roles concentrates attention on the obligations, privileges and duties assigned to men and women in society and the relationships between them. From the study findings, 28% of male respondents said most of the farm work was done by their spouses (women). Out of 20% men who said they shared farm work with their spouses, 52% of female respondents said they do most of the farm work alone. This supports findings from the 1990s (Quisumbing 1995) and (Peterman, (2009) who have documented gender inequalities in agricultural roles that disadvantage women as agricultural producers. Given the important role women play in agricultural production around the world, focusing on the unique challenges women face and the resources they lack is key to gender inequality.

Results further shows that the roles of men farmers towards oil crop production differ from those of women farmers. While all men farmers were involved in land clearing, transportation and marketing of oil crop produce, all women farmers were doing the back breaking work like planting, weeding, harvesting, threshing and post- harvesting of oil crops. This compliments findings by World Bank (2008), who found that traditionally, the roles of men and women in farming differ in Africa. Men clear the land and women undertake most of the remaining farming activities, particularly planting by hand, weeding and processing. Women's roles have tended to be homestead-based, for biological and cultural reasons. Men and women have also been responsible for their own inputs and have controlled the output. In sub-Saharan Africa, men traditionally owned land, but plots of land have been cultivated or managed jointly or separately by men and women (GID, 2008).

The findings show during oil crop production, females farmers participate in all phases of oil crop production, although roles including decision-making and control over resources and incomes vary greatly from household to household. The female respondents further said that whether or not they control income accrued from oil crops, often they participate in the labor force required for oil crop production. This compliments a study by FAO, (2000) found out that the distribution of responsibilities and roles between men and women are socially determined, and in some rural societies, commercial agricultural production is mainly a male responsibility. Men usually own and trade any produce from their farms and are responsible for making decisions regarding farming roles in their households. This compliments a study by Quisumbing *et al.* (1995) who found that gender roles can vary considerably depending on the geographical area, culture, social and economic factors.

Source: Researcher Survey, 2012

Figure 3: Female farmers weeding, harvesting, de-husking and sun-drying sunflower

In Lare Division, traditionally, land may be allocated through lineage or village heads which is a model which still persists despite increasing private or state ownership of land. In patria lineal lineages, women have access to land through male relatives. This supports findings by FAO, (2010) who found that when allocations are made by village heads, a lot depends on their perception of different individuals' need for land. To the extent that women are perceived to be less capable of farming, their allocations are smaller. Overall, women's access to land in African societies is quite restricted, even in cases where the law protects women's rights to land, traditional customs inhibit their access and control over land. However, there are customs that constrain women's access to land. Single-women can gain access to land through their fathers, brothers or uncles. But, upon marriage in patriarchal communities women's access to land held by these relatives is lost, as they are expected to have access to land through their husbands. Generally, women tend to have smaller land holdings and less fertile plots.

Further results found culture in the study area dictated access and control of resources within households and the community and were regulated through different systems and arrangements. This supports a study by Olawoye J.E (1985) who found that whether these systems are formal or informal, statutory or customary, restrictive or open, they all play a major role in household and community setups. History, values and beliefs are reflected in the way societies organize their systems of agricultural production and natural resource management. They determine the extent to which farmers and other rural community members have the right and power to secure the resources they need to ensure food security and income. They also have an important influence on the political climate in which resources are managed and regulated.

Culturally, single-women can gain access to land through their fathers, brothers or uncles. But, upon marriage in patriarchal communities women's access to land held by these relatives is lost, as they are expected to have access to land through their husbands (FAO, 2010). Generally, women tend to have smaller land holdings and less fertile plots. Control over land is an important factor which explains the large differences in investments on land made by men and women. From the group discussions (Bagaria sub-division), women participants hinted that for example a woman may have obtained land through her husband but, may be hesitant to invest in better technology if she perceives her marriage to be unstable, because if a marriage is dissolved

the land reverts to the lineage and woman has only a limited claim on the land. Instead this encourages poor land management skills and less production yields.

Culture in Lare division discouraged extension program to target women farmers. This was because women's participation is constrained by practices like the expectation that woman needs husband's approval for any legal transaction. Because most interviewed women were married too young immediately after circumcision, where they had to drop out of school, many were not educated (n=46). Lack of education and higher levels of illiteracy among women was another constraint to women receiving extension services. Women continue to be educated at an inferior rate to their counterparts, increasing their reliance upon men. Further results indicated that women (n=93) are limited from owning, acquiring, and controlling property throughout Kenya, regardless of social class, religion, or ethnic group. This supports another research in Kenya (KARI, 2008) which shows that agricultural extension programs always tend to ignore plots which are individually managed by women. They would provide assistance to plots which are managed by men and women or only men. An agricultural extension program or input provision policy insensitive to gender roles in agriculture will intensify and increase absolute women's work. If women attempt to assert property rights over men or in-laws, they are often ostracized by their families and communities. This practice of disinheritance seems to be on the rise, particularly in areas hit hard by poverty.

Another cultural factor that reduces a woman's efficiency and productivity on her plot is lack of access to credit. Credit is important for securing fertilizer, improved varieties of seeds and other technology on farms. Most Lare women (52%) farmers are not able to obtain credit without a male guarantor or without husband's assistance. The disparity between who farms and who receives inputs, credit etc. is due to institutional barriers and social constraints (Yates and Fratkin 1999). The perception that women produce crops for subsistence and not for the market, women's less secure land tenure and provision of credit through organizations geared towards men affect provision of credit to women farmers. A study on Kenya, Zimbabwe, Malawi, Zambia and Sierra Leone (Saito *et al*., 1994) found that women received only 10% of the credit for smallholder farmers and 1% of total credit to agriculture. Thus, an agriculture development

policy intended to create an all-round development in rural Africa needs to be sensitive to needs of women in these subsistence societies.

Evidence from Lare Division (n=180) shows that majority of women are involved in producing oil crops still they do not have control over income. Mainly because the rural households and marketing institutions work within a wider framework of patriarchal systems that are tilted in favor of men's control of major household resources. Galdwin and McMillan (1989) address the question that whether a turnaround is possible in Africa without helping women farmers. They are particularly pointing towards women farmers' access to inputs and women being targeted by policies for agricultural and economic reforms. The lack of visibility of women's contribution and participation in agriculture stems from the patriarchal norms that make women's contribution in the household or in subsistence sector– "non-economic or non-market activity". Further results showed that, the decision makers regard women as home producers or assistants in farms and not as farmers and economic agents.

Table 4: Comparison of gender roles in oil crop and other crops production

Activity	Other Oil Crops		Oil Crops		
	Coconut and Palm Oil		*Sunflower & Soybean*		
	Males	**Females**	**Male**	**Female**	**Shared Activities**
Land Clearing/burning/slashing	xx	xx	xx	xx	Joint
Land preparation	x	xx	x	xx	F
Planting	xx	xx	x	xx	F
Fertilizing land	xx	x	x	xx	F
Weeding	x	xx	0	xx	F
Bird scaring	0	0	0	xxC	F/C
Harvesting	xx	x	0	xx	F
Transportation	xx	x	xx	xx	Joint
Threshing	0	0	0	xxC	F
Processing	xx	xx	x	xx	F/M
Post harvesting	x	xx	0	xx	F
Marketing	xx	0	xx	0	M

Key: x = low participation; xx = primary responsibility; C = children; 0= no participation

The above table clearly shows that women farmers are not involved in marketing of any oil crop yields. This alienation from incentives of sale of yields will lead to poor management and unwillingness by women who are the farm workers not to practice positive land management leading to negative environmental risks.

4.3. Environmental Risks during Oil Crop Production

In Lare division, the potential environmental risks were related to the land resources, ownership, control and decision making and gender roles during sunflower and soybean production. Findings show that the environmental risks caused by crop production depend on a range of factors i.e. the nature of the natural resource base (soils and water), prevailing cropping systems and intensity, available technologies, inputs and socio-economic condition (Smith *et al*, 1995). Study results indicated that women farmers' (n=93) relationship to the environment revolves around their central concern with family and food security. Environmental degradation has a direct impact on women's workloads, and yet restricted access to inputs; resources and capital often force women to overexploit the immediate available natural resources base. Despite this, Lare women are both the best-equipped and the worst-equipped to manage the environment; the best because they have the necessary "born with expertise" and the worst because they lack the power of information to intervene.

Further study results found that all the respondents went for expansion of new crop farms for (sunflower and soy bean) which were either animal grazing fields, next to river banks (riparian Zones) or along the community rural roads which entailed increased runoffs or water bodies contamination. This compliments studies by FAO, (2002) who found that an important factor affecting potential environmental risks was the extent and intensity of cultivation of marginal lands (i.e. land with some features which limit crop yield and which may be more susceptible to damage by inappropriate cultivation). Because of these, land expansion was putting a lot of pressure on the available diminishing farming lands (MOA- Nakuru, 2006). Other studies by Fargione *et al*. (2008) found that converting rainforest, savannahs or grasslands to the growing of bio-fuel crops releases 17 to 420 times more CO^2 than the reductions that occur when these bio-fuels replace fossil fuels. This scores the fact that growing sunflower and soy bean on riparian zones or road sides with fertilizers and chemical application will have the most negative environmental impact (World Bank, 2008).

Sunflower and soybean farming in Lare Division tend to be produced in the more intensive inter- cropping systems. The study finding showed that the nature and degree of

environmental risks of cropping varies between different farms in regard to the gender roles involved. This supports a study by FAO (2003) who found key elements of changes in cropping systems that will influence the types of environmental risks incurred are increases in cropping intensity (increased frequency of cropping) and attempts to increase unit area (by increased crop husbandry). Crops typically grown in more fragile environments may generate greater impacts than others (FAO, 1992) e.g. maize grown in semi-arid areas is prone to soil erosion.

Results in this study showed that all farmers practice intercropping of soybean and sunflower with cereal crops like maize because of their crop residues. Farmers indicated that after intercropping maize with sunflower or soybeans, yield are higher and they do not need to weed twice as pure stand crop requires. A study by Clark, *et al*. (1985), found that when soil is replaced by a single species grown year after year, some trace elements are depleted if not replaced by fertilization. The organic content of the soil also diminishes unless crop residues or other organic materials are supplied in sufficient quantities to replace that consumed over time. When declining soil fertility results in the cleared new land, women's access to fertile land is constrained because women farmers are not legal owners of tenure (KARI, 2008). On fertilizer use, 86% farmers were not using any fertilizer while 14% farmers used fertilizer when planting sunflower and soya bean with maize or as a pure stand. Other studies FAO, (2000) found limited access to natural resources can leave small holder farmers especially women with little choice but to engage in harmful environmental practices like farming close to river banks and houses. As environmental risks increases, more natural resources are needed for basic subsistence production, and other daily farming activities.

Study findings showed that both male and female farmers exploit the environment differently for purposes of growing oil crops. The results show that all women and men farmers have their own knowledge about environmental risks and practices though not modern with the current methods, and they know about different farming practices according to their farming activities. This compliments findings by Harcourt, (1994) who found that understanding the different knowledge of women and men in different socio-economic circumstances helps to determine appropriate and sustainable environmental interventions. Also Brundtland Commission (1987) found out that understanding women’s and men’s individual decisions and

their relationships to the environment plays an important role in developing solutions for more sustainable use of the environment and reducing potential environmental risks.

Findings show in farming systems, farmers' health is connected to use of natural resource base and chemical inputs like pesticide and fertilizer (WHO, 1990). Chemical inputs used to increase agricultural productivity, such as inorganic fertilizers and pesticides have been associated with many negative direct and indirect human health impacts (Pimental, 1995). Pesticides can contaminate soil, water, turf, and other vegetation and can have effects on the health of workers who are in contact with them (WHO, 1990). All interviewed during the study cited use of pesticides to control pests, weeds and diseases attacking their crops. While the farmer uses the pesticide ignorantly to kill insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants (Copplestone, 1982). The trend toward intensive crop production in modern farming has led to increased potential for damage by pests and diseases. Predators that would be present in a mixed biological community are not supported by large fields of a single crop; so farmers, instead, rely on chemical measures for crop protection (WHO, 1990).

The results showed that farmers apply pesticides twice or thrice on a sunflower or soybean crop farm. In Lare Division, most chemical application is done by male farmers. The results indicated that farmers' pesticide applications may start before planting when the soils are treated with pesticide to kill grass or weeds. Then, several applications follow when the sunflower and soya bean has germinated and formed leaves. The findings showed that Lare farmers use a variety of chemicals. "Given the costs associated with spraying, farmers combine several products together in mixtures know locally as 'cocktails', applying all on a single pass through the filed. The researcher went further to find out the methods of spraying and the use of protective gears. All respondents (male and female farmers) said they used hand knapsack sprayers done by either the farmer himself / herself; farm worker or a member of his or her family. On enquiring further if they use protective gears during spraying they indicated normally applications are done without the use of any professional protection, with exception of rubber boots. Rubber boots are considered the usual working footwear for farming activities. However

farmers' use certain clothing which is considered protective, which the protective gears used were mainly old, worn out clothes and had no face masks.

Interviewed respondents indicated that the current problems during pesticide use include the fact that many women (52%), men (48%) agricultural workers are unaware of all of the adverse effects of pesticide use. Even where they are aware of the problems few understand about specific adverse effects and most described ill-effects in general or vague terms. In Lare division, pesticides are stored in the home in areas easily accessible to many family members including young children. Ninety per cent, of the respondents said that once they use chemicals for weed control, a new and vigorous host of weeds germinate and they are not able to weed it manually. This forces them to re-spray again. This compliment a study by Pimental, et al. (1978) found out that one drawback to pesticide usage is that pesticides generally kill not only the pest of concern, but also a wide range of other organisms, including beneficial insects and other pest predators. Once the effect of the pesticide wears off, the pest species is likely to recover more rapidly than its predators because of differences in the available food supply. Previously unimportant species may also become significant crop pests when their natural predators are killed by pesticide applications.

Findings showed that men (48%) were often pesticide applicators and cannot read labels and follow instructions though they have been trained on best management practices. During focus group discussions, the results showed that most pesticide applicators do not use protective clothing because it is unsuitable for the climate, unavailable or too expensive. A study by WHO/UNEP, (1990) found that many pesticides are applied by farmers wearing inadequate or unsuitable clothing, which was frequently worn for extensive periods after being contaminated by pesticides and thus encouraging chemical exposure. One female farmer said; field workers eat in the same plot where they work, even when they are applying pesticides. The majority of them do not wash their hands, because water is not always available and some get so hungry that they just want to eat as fast as possible. It is not rare that some farmers smoke when applying pesticides.

Some farmers wash the pesticide backpack sprayer close to the field, in nearby water streams, but many wash the backpack sprayer at home. The backpack sprayer is washed with the water that is stored in the house. Afterwards, the backpack sprayer is left to dry in places like a on top of the fence, grass lawn section and an entrance to the main door of the house or in a storeroom together with other household items (such as firewood). Sometimes it is left dripping in a corner of a room with maize for chicken, and close to the children's bed. Further results indicated that another common place they leave the wet backpack sprayer was on top of the roof where when it rains, they collect the same roof water. On being asked whether they wash after spraying, many respondents (80%) said that it is more common that after pesticide applications farmers wash themselves with the water stored in the house, or wipe themselves with wet cloth. Few said that they really take a long shower. In separate conversations with a female respondent with a spouse, she said that: *"My husband usually does not take a shower after pesticide applications. He either goes to the market place to sit with his fellow men after work or he goes to check on the animals after eating. This is where he take a bath at the community stream (river). If he comes back, he takes a very fast shower because of the cold or water is not enough. And this is done within the family bathroom outside the house. He hangs the clothes at the line in the bedroom and awaits another spray day. Therefore I believe that he has lost his sense of smell, because he is not able to smell pesticides residues in his clothes or body anymore!"*

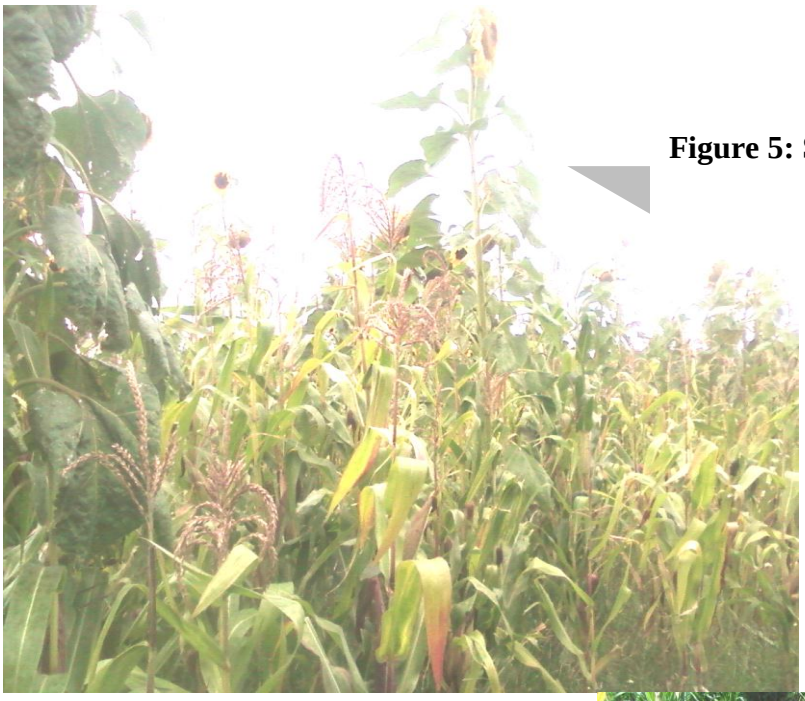

Figure 5: Sunflower intercropped with Maize

Fig Figure 5: Pure Soy bean crop

Source: Authors Survey, 2012

Agriculture tends to be excluded from many national labor laws and is not subject to any comprehensive international standard. Where regulations exist, they are often sporadically applied due to inadequate legal provisions, low levels of unionization and insufficient labor inspection. Agenda 21 clearly outlined an agenda for sustainable agriculture that includes reduced reliance on pesticides through a variety of steps which would reduce exposures, including enhanced reliance on integrated pest management. Studies of women in Asia by (Moore, 1998) have found that they often are unaware of the existence of protective equipment. In many agricultural settings there are no washing facilities in the field where workers spray pesticides, and workers seldom wash even when pesticides spill on their skin. In Africa there are reports that rural women often reuse pesticide containers for storing or transporting their crops (Miriam Sow Global Campaigner, 1994).

On enquiring how soon they re-enter their fields after spraying, 32% male and 40 % female said they don't leave the field but continue working while 6% male and 2% female said they go home for that day and resume work the following day. Only 8% female and 44% male were quite well aware of the potential health hazards of the different pesticides used in their respective areas while 14% female and 30% male were aware of only some of these hazards. The rest 3% female and 1% male were not at all aware of any hazards associated with pesticide poisoning. A majority of the respondents 55% male and 30% female were aware of the most effective ways of preventing work related pesticide poisoning while (10% female and 5% male) were not aware. All the respondents reported that they had dealt with agricultural pesticides in the course of farming work and had not been involved in training on agricultural pesticide use.

Pesticides are often toxic chemicals and represent risks to users. While it is known that most farm workers are routinely exposed to pesticides, relatively few studies have analyzed specific farm activities to pinpoint the extent of exposure by gender (Pingali *et al*, 1995). In this study the findings shows that risks and uncertainty are part of the every day live of both men and women of Lare division. During oil crop production all households (n=180) are involved and usages of pesticides not only generate occupational risks to persons who apply them in the field but to all those in contact with the applicator. Further results showed that all family members

came into contact with pesticides involuntarily. This compliments WHO, (1990) who found that pesticides are intricately linked with rural lives and domestic activities. This study found that it was not possible to count with data on gradual health effects of pesticides, but respondents (100%) admitted to having health problems after inhaling pesticides.

Results showed that a higher percentage of women farmers (52%) were ignorant of risks poised by pesticide contamination. Earlier studies by Moore (1998) found that when women are exposed to pesticides, so too are children through women's breast milk contamination and because women play an important role in raising children. Women are also often the ones responsible when other family members are impacted by illnesses due to pesticide exposure (WHO, 1990). Further recommendations by Agenda 21, says that there should be increased public awareness of sustainable agriculture in women's groups, which governments should disseminate to farming households more information involving "reduced use of agricultural chemicals" and train both women's and men's' groups, farmers and extension agents in alternative non chemical ways of controlling pests that are of significance. Economic considerations must be taken into account related to the costs to farmers' health problems due to exposures to pesticides both for themselves and the family as well as the issues of "women" as involuntary consumers of pesticide products (Agenda 21).

The researcher found out that Lare farmers lacked awareness of the potential health hazards and did not take elementary precautions. The researchers enquired further from the respondents if the labeling, advice and packaging of pesticides did have any influence on their usage. The respondents indicated that the advice was often written in a language that they did not understand and the toxicity was explained in a scientific language, with poor acronyms which was foreign to them (farmers). This compliments findings by Pimentel, (1995) who found out that the appropriate uses of the pesticide were usually not stated clearly and the dosages not specified, yet, guidelines on good labeling practices have been published by FAO (2000). Furthermore, comprehensive bodies of legislation to regulate the use and distribution of pesticides often do not yet exist. It is estimated that only 0.1 percent of applied pesticides reach the target pests, leaving the bulk of the pesticides (99.9 percent) to impact the environment (Pimentel, 1995). Therefore, these technical details were of no use when presented to illiterate

farmers or if entrusted to agricultural extension workers who may not understand them or have not been trained on usage methods while compounding the humans and the environment into health risks.

4.4. Awareness on Environmental and Gender Policies in Lare Division

The result showed that all female farmers were not aware of any environmental policies with 13% male farmers not aware. Further results showed that 35% male farmers were aware of environmental regulatory policies. Results from Lare division have shown that the underlying social norms and traditions that define the division of labor within household and the whole community tend to relegate women's productive activities to the household level, making them largely invisible to service institution. On enquiring further if they have had any environmental trainings, 65% farmers (both male and female) have not had any environmental policy trainings while 35% of the men farmers indicated they had been trained. This compliments World Bank (1991) finding that Environmental education, both formal and informal, is vital to changing people's attitude to appreciate environmental concerns. Formal education is important to increase awareness, improve extension services, sensitize people on environmental issues and build institutional capacities.

This supports quotes by Professor Wangari Mathai (2007) who said; "You cannot protect the environment unless you empower people, you inform them, and you help them understand that these resources are their own, that they must protect them". Both women and men need official channels to reflect their individual needs and to have a voice in environmental policy decisions. This marginalization of vulnerable groups especially women has had a negative impact on the implementation of environmental policies because as providers of food, women interact very closely with the environment. In Lare division, the empowerment of women farmers requires creating an environment in which they are able to access support services to boost their productivity, enhance the quality of their products, and identify and reach profitable markets.

While findings from the study indicated that there are no gender and environmental policies in place and that all female farmers (52%) are gender and environmental policies blind,

still these very female farmers were the main keepers of the environment. Because gender-responsive environmental policies and regulatory programs are those that seek to achieve positive environmental outcomes while explicitly taking into account both men's and women's opinions, needs, and interests (World bank, 1992). Such policies derive from social, health, and ecological research that provide a more comprehensive picture of the impact of humans on the environment, and the impacts of environmental change on people, World Bank (1992). Notable drivers of environmental degradation are high rates of population growth, inappropriate technology, unsustainable consumption and production patterns, and increased incidences of poverty and climate change (NEP, 2013). Gender plays an important role in the management of the environment. Different social groups and demographics are impacted differently by environmental challenges. They also play unique roles in managing the environment given their unique capabilities, experiences and knowledge relating to the environment. Access to and ownership of the environment should be enhanced for all gender (UNEP, 2000).

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

From these study findings, it can be concluded that:

There is exposure of all male and female small holder farmers and their household members to pesticide. There is also water contamination due to showering at the community stream and thus leading to interference of biodiversity and habitant.

It is found that sunflower and soybean is a female enterprise crop because women farmers carry out all farming activities while male farmers are involved in land clearing, transportation and marketing.

Land tenure and gender determined the roles played by men and women farmers during oil crop production. Male farmers (48%) made decisions on what land that needed to be planted while women (52%) did most of the chores in the farm.

Male farmers' (n=87) accessed information regarding best farming practices, while women farmers (n=93) did not. Female farmers were not trained, either was busy on farms or had no time to attend meetings which led to land degradation thus impacting the environment negatively due to lack of information

No female farmers ((52%) were aware about environmental and gender policies while 35% male farmers were aware. This slow of awareness is likely to lead to poor farming practices that are likely to increase environmental risks.

5.2. Recommendations

From the analysis of data gathered from all the 180 respondents in Lare division, the study recommends that:

There is need to promote policies, programmes and projects that improve both men and women's access to and control over productive resources, inputs and services equally at grassroots' levels. It is critical that commodity-specific gender analyses be carried out at the very beginning of any intervention since each commodity brings with it specific challenges and opportunities. This includes reaching out to both women and men individually, and recognizing their different roles and priorities in relation to the environment use. Therefore, programs directed to reduce health risks like pesticides strategies must consider the individual human gender dimensions that can avert future risks.

.There is a need to study the changes in the gender roles in agriculture in order to understand the cultural setup in different area. Culture is not static, and the dynamics of culture is ruled by a series of factors that may be economic and social in nature. The understanding of such changes goes a long way in enhancing better projects planning and implementations.

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Questionnaire No:…..……

Date:……..

APPENDIX I: Research Questionnaire for Farmers and Household heads

We are researchers currently studying at the University of Egerton, Njoro. We invite you to participate in our study which looks at assessment of gender roles in oil crop production and their potential environmental impacts. By participating in this study, you will help to increase our understanding of gender roles, oil crop production and environmental impacts in your area. We hope that the results of this study will help towards understanding at different gender roles and natural resource management in your area. Your participation in this study is voluntary and you have the right to refuse to participate in the research or refuse to answer any questions that you feel uncomfortable with. If you change your mind about participating during the course of the study, you have the right to withdraw at any time. If there is anything that is not clear or you need further information, you are free to ask. We hope you will allow us do some site observation in your farm.

Name of Enumerator: ……..……**Signature:** ……

Name of respondent: ……

Time Started……

SECTION A: FARMER'S CHARACTERISTICS (INTERVIEWEE)

1. Gender (Interviewee) i) Male ii) Female

2. Age of farmer (years) i) 18- 25

ii) 26- 35

iii) 36-45

iv) 46-55

v) Above 56

3. Farmer's level of education

i. Informal (did not attend any formal education),
ii. Primary,
iii. Secondary,
iv. Tertiary,
v. Other (please specify)……

4. Marital status

i. Married
ii. Single
iii. Widowed
iv. Divorced
v. Others (Specify)…….

5. Have you attended any agricultural training?

i. Yes ii. No

If yes, which ones?.....

SECTION B: GENDER ROLES IN OIL CROP PRODUCTION

B1. Please indicate the level of participation of each member of your household in carrying out the following oil crop production activities

Key

N – No Participation

L – Low Participation

M – Moderate Participation

H – High Participation

	Activity	Male Household Head	Female Household Head	Male Children	Female Children	Other Specify
1	Land preparation	N. L. M. H.	N. L. M. H.	N. L. M. H.	N. L. M. H.	N. L. M. H.
2	Planting					
3	Weeding					
4	Fertilizer Application					
5	Harvesting					
6	Sales / Marketing					
7	Pricing					
8	Others….					

B2. How much land is under oil crop cultivation in your farm/plot of land? .....acre / ha (Please specify in numbers form)

B3. Which type oil crops? (Specify) …..

i)……ii)……

iii)…….iv)……

B4. Other than oil crops, which crops do you grow in your plot? i) ……

ii)……...

iii)…….iv)……

B5. Please indicate who makes decision on the following oil crop production (sunflower and soya beans

	Activity	Male	Female	Both
1	Land preparation for oil crop production			
2	Which variety of oil crop to grow			
3	How much to plant			
4	When to plant oil crops			
5	When to weed oil crops			
6	When to apply fertilizer			
7	When to apply pesticides / chemicals			
8	When to harvesting			
9	When to sales / market and how much			
10	How much oil crops is for households			
11	Expenditure of income from oil crops			

SECTION C: GENDER DECISIONS

C1. To what extent do you agree with the following statements on how gender roles impact on oil crop production and the environment?

SD1- Strongly Disagree;

D2- Disagree;

N3- Not sure;

A4-Agree

SA5- Strongly Agree

Women

	Statement	SD1	D2	N3	A4	SA5
1.	Women farmers provide most of the required technologies in oil crop production					
2.	Women farmers make more of decision for land preparation than men farmers for oil crop production					
3.	Women farmers make more of harvesting decisions than men farmers					
4.	Women farmers make decision on the variety of the oil crops and how much to grow					
5.	Women farmers decide how much family finances go to oil crop production					
6.	Women farmers decide on which parcels of land should be planted oil crops					
7.	Women farmers decide on when to dispose off the oil crop produce					
8.	Women farmers make more decisions on the farm inputs to the be used on the land					

Men

Statement		SD1	D2	N3	A4	SA5
1.	Men farmers provide most of the required technologies in oil crop production					
2.	Men farmers make more of decision for land preparation than men farmers for oil crop production					
3.	Men farmers make more of harvesting decisions than women farmers					
4.	Men farmers make decision on the variety of the oil crops and how much to grow					
5.	Men farmers decide how much family finances go to oil crop production					
6.	Men farmers decide on which parcels of land should be planted oil crops					
7.	Men farmers decide on when to dispose off the oil crop produce					
8.	Men farmers make more decisions on the farm inputs to the be used on the land					

C2. Who decides on how much income from oil crops has to be ploughed back?

i) Men ii) Women iii) Both iv) Others (specify)……

SECTION D: ENVIRONMENTAL MANAGEMENT

D1. Do you apply fertilizer during sunflower/soya bean production?

i. Yes ii. No

D2. If yes, what role has these oil crops production played in environmental management?

.....

D3. Who in the household is more involved in environmental management to ensure its sustainability? i. Male ii. Female iii. Both iv. Children

D4. How do extension services help in oil crop production and environmental management?

Please explain……

.....

.D5. In your opinion, who has easy access to extension training on environmental management?

i. Male; ii. Female; iii. Both; iv. Children

D6. Do you have environmental suggestions after planting sunflower/soya bean crops?

i) Yes ii) No

D7. If yes, list them in priority

i)……ii)……iii)……

D8. If No, why?

i)……..

ii)…….

iii)……

D9. In your opinion, what are the opportunities for improvement of any farming or sunflower / soya bean farming? (Be Specific)

……

…… ……

D10. Have you noticed any long-term environmental changes (e.g. soil degradation, reduction of water volumes, drying of wells, e.t.c.) over the last 20 years?

i. Yes ii. No

D11. If yes, which two major ones have you noticed……....

……

D12. What environmental difference has the gender activities brought to your household since you started farming sunflower/soya bean?

i)……..

ii)…….

iii)……

D13. Have you noticed any long-term changes in climate (average temperature, average rainfall, rainfall distribution e.t.c) while practicing oil crop farming?

i. Yes ii. No

D14. If yes, what adaptation strategies have you been using and which ones have you been trained on?

...…….....

……

D15. On natural resource management, do you know about and practice any of the following on your farm?

i. Minimum tillage (*minimum soil disturbance while preparing land for planting or during weeding*

ii. Crop rotation

iii. Intercropping

iv. Mulching

v. Cover-cropping (*planting crops that cover the soil for reduced soil erosion and increased fertility*)

vi. Planting tree lots?

THANK YOU VERY MUCH FOR YOUR CO-OPERATION

TIME ENDED……..

APPENDIX II: Guiding questions for Researcher

Key areas of concern	Guiding questions
Project objectives and target group	- Do project objectives explicitly refer to men and women? - Does the project acknowledge and build upon women's and men's knowledge and skills in resource management? - Does the project acknowledge that women and men may have different needs and priorities for environmental management, resource use and conservation? - Have target groups and others directly or indirectly affected by the project identified their own environmental needs, concerns and priorities?
The gender division of labor	- Has sex disaggregated data been collected for each phase of the production cycle? *(e.g. the role of women in use and management of resources)* - Who is responsible for each production cycle? - How dependent are women and men on the resources which have been targeted by the project for oil crop production? *(e.g. labor, land)* - Will men's and women's traditional knowledge and practices be integrated into environmental practices initiated by the project?
Access and control of resources	- Has sex disaggregated data been collected about who has access to key natural resources targeted by the project? *(e.g. who has land use rights and tenure)* - Will women and men have adequate and equal access to information about proposed land use changes? - Will women or men have reduced access to resources to carry out their work roles and responsibilities?

	- Do women and men have different perceptions about natural resource uses and how they should be conserved and managed?
Access and control of the benefits and project impacts	- Will there be adverse effects on women's or men's capacity to continue to provide for basic daily needs or to earn income from natural resources? - Will the introduction of new environmental practices displace women or men from their current positions as heads of households? - Has the impact of new technology been discussed with women? *(E.g. new oil crop technology)?* - Will women's or men's workload increase as a result of sunflower and soya bean production? - If so, are the reasons for this clear and acceptable, and what remedial measures can be taken? - Will men and women have equal access to benefits? *(e.g. do women and men have equal access to land, finances or are women proscribed from gaining income from more lucrative products such as sell of oil crop produce)?*
Social, cultural and economic factors	- Are women/ men legally and/or traditionally recognized as managers of natural resources? - Are there men/women farmers active in environmental education or conservation in the target area?

***Note**: These questions will help the Researcher during data analysis to see if all the research objectives were met.*