

**EFFECTS OF AGRICULTURAL ACTIVITIES OF
RURAL WOMEN ON THE SOIL, WATER BODIES AND
THE VEGETATION IN SOTA IN THE GREATER
ACCRA REGION**

BY

GRACE SETORWU FLEISCHER



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ABSTRACT

This research was an attempt to investigate the effects of agricultural activities of rural women on the soil, water bodies and vegetation in Sota, in the Greater Accra Region.

The aim of the research was to collect and analyze data on the effect of agricultural practices of female farmers in Sota on the soil, water bodies and vegetation; their level of awareness of major environmental issues, factors which influence behavioural changes of the female farmer with regards to the sustenance of the environment and to make suggestions for environmental protection and sustenance.

The research was carried out at Sota in the Dangme West District of the Greater Accra Region of Ghana. The simple random sampling technique was used in selecting 110 female farmers, but only 101 were available for the study. Personal interviews were conducted with respondents in their homes and/or farms.

The Statistical Package for Social Sciences (SPSS) was used to analyze the data.

The findings revealed that most of the respondents undertook activities which affect the environment negatively. These included slashing and burning (86.1%), felling of trees and selling of fuel wood and charcoal (58.5%) and use of agro-chemicals (55.4%), which destroyed beneficial insects, affected the vegetation and soil and reduced productivity.

Regarding the level of awareness of major environmental issues it was revealed that 67.3% of the respondents stated that agricultural activities do not have negative effects on the environment.

Based on the findings, it was concluded that agricultural activities of female farmers in Sota in the Dangme West District affect the soil, water bodies and vegetation.

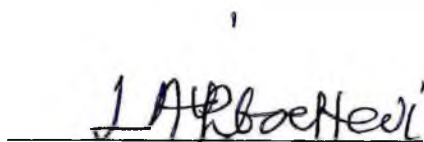
It is recommended that education on environmental issues should be intensified to help solve these problems.



DECLARATION

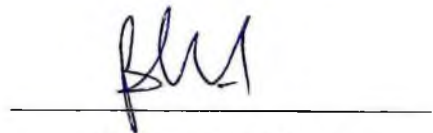
I do hereby declare that except for other people's work cited which have been duly acknowledged, this thesis is a result of my own original research, and that this thesis, either in whole or in part, has not been presented elsewhere for another degree.


GRACE SETORWU FLEISCHER
(STUDENT)

DR. L. A. P. HEVI-YIBOE

SUPERVISOR



DR. P. B. ATENGDEM

CO-SUPERVISOR

DEDICATION

*This work is dedicated to My Beloved Late husband, Pastor Prof. J. E. Fleischer
for his love, dedication, prayers
and encouragement
that made me what I am;
and
our lovely children, Nii Amartey, Elijah and Naa Ameley for their prayers, support,
understanding and love.*

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LIST OF ABBREVIATIONS

BIFAD	Board for International Food and Agricultural Development
DWDA	Dangme West District Assembly
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organisation of the United Nations
FRA	Forest Resources Assessment
IFAD	International Fund for Agricultural Development
ILO	International Labour Organization
IPM	Integrated Pest Management
MFNR	Ministry of Forest and National Resources
MoFA	Ministry of Food and Agriculture
NCWD	National Council on Women and Development
UN	United Nations
USA	United State of America

CHAPTER 1

BACKGROUND TO THE STUDY

1.1 Introduction

Agriculture plays a central role in the economies of most developing countries. It is a crucial sector for increasing export earnings, generating employment and improving food security (Alexandratos, 1995). In fact modernizing agriculture is necessary to sustain the increasing population of the world.

Over 1 billion people in the developing countries are poor, with a substantial majority of them living in rural areas (Alexandratos, 1995). The development of agriculture can play a direct role in rural poverty alleviation since the majority of rural poor depend on agricultural activity for providing the main source of their income and employment. Agriculture also contributes indirectly to alleviate rural poverty by influences that it has on the non-farm rural economy.

Agriculture, therefore, plays an important role in the lives of the people of most developing countries especially in sub-saharan Africa where women engage in various agricultural practices mostly as a means of livelihood. Nevertheless, poor economic conditions, poverty and diminishing resources cause most women to exploit their environment negatively to be able to survive (Alexandratos, 1995).

Issues related to agriculture and environment have become topical in recent years, because of changing climates, desertification and soil erosion resulting from the impact of agricultural practices on the environment. Furthermore, overpopulation puts additional pressures on agricultural resources and the environment, promoting conversion of more lands to agricultural use and human settlements (Alexandratos,

1995). Indeed, desertification in most sub-Saharan African countries has reached alarming proportions. It is estimated that 30% of the world's land surface area is affected (Alexandratos, 1995). Experience and observations have shown that in some developing countries including Ghana, many farmers engage in some agricultural activities, which impact negatively on the environment (Goudie, 1989; Montgomery, 1992). Montgomery (1992) pointed out that increased clearing of forest for fuel wood followed by deterioration of the exposed soil reduces the estimated carrying capacity of the land. Furthermore, he explained that part of the concern over deforestation associated with hard wood related to loss of habitat and possible extinction of unique plant species.

Some agricultural practices that promote erosion leave behind barren laterite soils. Although some places with laterite soils can achieve agricultural success, this normally happens when frequent floods deposit fresh nutrient rich soil over the depleted laterite (Goudie, 1983). Such human agricultural activities which affect the environment, are encouraged by economic pressures in households, in both rural and urban areas, particularly in developing countries. A good example is the felling of trees for fuel wood and charcoal, mostly by women (Carr, 1991). There is therefore an obvious need for both theoretical and empirical investigations on the level of awareness of major environmental issues by women who engage in such agricultural practices and its effect on the environment. Important among others are the factors which influence behavioural changes of such farmers.

This research was conducted with the view of addressing some pertinent issues concerning the close association between agriculture and the environment with particular reference to women who practice agriculture in Sota in the Dangme West District of Greater Accra Region of Ghana.

1.2 Study Area

This research was carried out at Sota a village located in the northern part of the Dangme West District of the Greater Accra region of Ghana. The District is situated in the south eastern part of Ghana and has a total land area of 1442 km² making it the largest in the Greater Accra Region. The land size represents 41.5% of the Regional land area. Sota is located 5 km off the Dodowa-Afiénya road and the nearest big town “Dodowa” is located 5 km away. Houses in the village are constructed mainly from mud and sandcrete with thatch or corrugated iron roofing. The population of the District in 2000 was 96,014. Males make up 48.4% of the population and females 51.8% (Dangme West District Assembly, 1996). The average household size of the District is 6.3 persons.

Sota is in the Sub-Saharan climatic region of Ghana with an absolute maximum temperature of 40°C. The district is within the coastal savannah zone. The vegetation is sub-Saharan type with short grass interspersed with shrubs and short trees. The average yearly rainfall is 762.5 – 1,220 millimeters, increasing from the coast to the north. The major rain season is between April and July and the minor between September and November. Most parts of the District is underlined by igneous rocks and the soil type is predominantly black clays classified as Akuse series (DWDA, 1996). On the outskirts of Sota is river Dodowa, the main source of water supply to the village. This river normally has a large volume of water in the rainy season leading to periodic flooding but reduces in volume in the dry season. The major occupation is farming, involving mainly vegetables maize and cassava.

1.3 Statement of the problem

The involvement of women in agriculture *per se* is not a new phenomenon especially in rural areas where traditionally, women play major roles in the agricultural sector. What is new about women's involvement in agriculture is the way it is organised and carried out in recent times. Several factors such as the use of improved methods of agriculture influence this state of affairs. In fact, agriculture in most rural areas has raised controversial issues as some of the improved methods such as the use of inorganic fertilizers have disadvantages. Nevertheless, the improved agricultural methods have brought about significant changes in most rural communities. For example, much of the returns from women's agricultural activities supplement that of their husbands, thus making an immense contribution towards the upkeep of their households (Ardayio-Schandorf, 1987). Some of the changes however lead to problems associated with the environment and agriculture itself, thereby intensifying the increasing debate on the close association between agriculture and the human environment (Goudie, 1989).

In Ghana, agriculture provides the means of survival in most rural communities. In the Dangme West District of the Greater Accra Region of Ghana, where Sota is located, the major role played by agriculture in the economy has been established (DWDA, 1996). Much of the agricultural activities in Sota is carried out by women, who have experienced low agricultural output with other rural communities in Ghana.

The fear of diminishing returns in agricultural output in the Dangme West District has led to renewed concern about the effects of deforestation, soil erosion, overgrazing, degradation of water resources and water pollution in the area. There is

therefore the need to collect relevant information especially under the present circumstances where there is very limited data available. This is especially necessary since in the absence of facts, misconceptions and misinformation abound to complicate the situation. Both the Ministry of Food and Agriculture (MOFA, 1993) report and the Dangme West District Assembly five year plan (DWDA, 1996) indicate problems involving women's accessibility to land and finance which necessitate extensive use of fuelwood and charcoal with associated deforestation.

It is against this background that this research sought to investigate the effect of agricultural practices of the women of Sota in the Dangme West District of the Greater Accra region of Ghana on the environment.

1.4 Objectives

The general objective of the study is to determine the effect of agricultural practices of female farmers of Sota on the environment.

The specific objectives for the research are:

- 1) To determine the effect of agricultural practices of female farmers in Sota on the soil, water bodies and vegetation.
- 2) To assess the women's level of awareness of major environmental issues.
- 3) To identify factors which influence behavioural changes of the female farmer with regards to the sustenance of the environment.
- 4) To make suggestions for environmental protection and sustenance.

1.5 Significance of the study

- 1) The study would create awareness of the effect some agricultural activities have on the soil, water bodies, and the vegetation.
- 2) The research would provide the needed information on the effect of agricultural practices on the environment, which can be used by the relevant bodies such as Ministry of Food and Agriculture (MOFA) and the Environmental Protection Agency (EPA). The information would be helpful in the organization of training sessions for farmers.
- 3) The research results could be used in educating female farmers on proper agricultural practices, which would help prevent degradation of the environment and enhance their health.
- 4) The findings would lead to improved farming practices, which will result in higher yields and improved income for the female farmers in Sota.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In broad terms agriculture involves the cultivation of crops and the raising of livestock. The term agriculture was derived from the Latin word *agricultura* which means “cultivation of land”. However, today the term refers to the cultivation of the soil, the production of crops and the raising of livestock, poultry and fish useful to humans (Awuku, Brese, Ofose and Baiden, 1991). The major divisions of agriculture, therefore, are Crop science and Animal science as well as Soil science, agricultural economics, agricultural extension and agricultural mechanization. However, for purposes of relevance, issues related to agriculture and environment will be emphasized in this review.

Agriculture is the world's oldest and largest industry (Goudie, 1989). In his discussion on criteria for designing sustainable agricultural systems, Okigbo (1990) explained that agriculture is "the science, art and business enterprise in which the farmer manipulates environmental resources and orchestrates several inputs in amounts, quality, sequences and timing in order to bring about or create environmental conditions that favour the production of plant and/or animal products needed for food. This means that incorporation of more environmentally and socially sensitive ideas in agriculture are not only necessary for production but also needed for ecological sustainability of the production system.

It has been argued that agricultural resources are not only an input into food production but also the major economic asset on which a good part of the population in the developing countries depend for employment and income (Alexandratos,

1995). The imbalance between population and agricultural resources is not so much the need to produce more food for people, but rather the fact that populations dependent on agriculture for a living continues to grow (Alexandratos, 1995). Indeed, efforts of a growing number of poor people to make a living out of dwindling agricultural resources are sometimes associated with degradation and reduction of the productive potential of these resources. However, it would be incorrect to assume that degradation of agricultural resource is exclusively poverty-related (Alexandratos, 1995). This is because resource degradation is also associated with agricultural practices in other areas which are not poor.

Sustainable agriculture has been defined in three main ways:

- (1) the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the natural resource base and avoiding environmental degradation (Dover and Talbot, 1987);
- (2) use of farming practices and systems which maintain or enhance the economic viability of agricultural production, the natural resource base, and other ecosystems which are influenced by agricultural activities (SAC, 1991);
- (3) a system synonymous with alternative agriculture, which is any system of food or fibre production that systematically pursues various goals, including the following:
 - a) Maintaining production over time in the face of social and economic pressures.
 - b) Conserving and protecting natural resources and allowing for long term economic growth by managing all exploited resources for sustainable yield (BIFAD, 1988).

- c) More thorough incorporation of natural processes such as nutrient cycles, nitrogen fixation, and pest-predators relationships into the agricultural production process.
- d) Reduction in the use of off-farm inputs with the greatest potential to harm the environment or the health of farmers and consumers.
- e) Greater productive use of the biological and genetic potential of plant and animal species.
- f) Improvement of the match between cropping patterns and the productive potential and physical limitations of agricultural lands to ensure long term sustainability of current production levels.
- g) Profitable and efficient production with emphasis on improved farm management and conservation of soil, water, energy and biological resources (ILO, 1991).

According to Dover and Talbot (1987), although sustainability in agriculture means different things to different people, on the basis of ecological principles, sustainable agricultural systems are those whose productivity can continue indefinitely without undue degradation of other ecosystems. Thus sustainable agriculture generally retains the important characteristics to maintain production over time.

2.2 Global land use and planning

In his discussion on agriculture and rural poverty, Alexandratos (1995) pointed out that continued population growth in the presence of rural poverty, and

conditions of equality of access to land, tends to push the rural poor to expand agriculture into ecologically fragile areas. In his view, this causes deforestation and exploitation of the land in ways which damage its productive potential. The ultimate effect of this, is continued poverty of the population concerned (Alexandratos, 1995). Similarly, Goudie (1989), stated that as population pressure increases there is insufficient land available for such an extensive use of land and so the fallow period becomes reduced with long term implications for soil fertility. However, population pressure is not the only cause of such an extensive use of land. Commercial ranching and logging also plays a part.

Forest reserves constitute a major form of land use and have a number of highly important functions. They provide services, which contribute to the well-being of people, they have a major role in the environment and their products are vital in the economy and daily living of people (Alexandratos, 1995). Forests, as the major natural occupants of land, have been subject to clearance for agriculture, pasture and human settlements. This clearance, including cutting of wood for fuel, construction and industry have been in most instances without consideration of the need to ensure sustained delivery of products and services of the forests for the future. With the growth of population and wealth, the demand for land for agriculture as well as for forest products and services is increasing (Alexandratos, 1995).

In a Food and Agriculture Organization (FAO) forest resources assessment in 1990, the world's forest area was estimated to be 3.4 billion ha (FRA, 1993). An average of some 0.7 ha per head of population. In this assessment, forests were defined as ecological systems with a minimum of 10 percent coverage of trees. The FAO forest resource assessment, 1990 produced data on the forest land of 69 tropical

countries of the developing world. It was projected that 85 million ha of forest will be converted to agriculture in 20 years out of the total of 1,720 million ha of land with agriculture potential that is not in crop production use at present. If all the additional land for agriculture were to come from the forest areas, it would imply an annual rate of deforestation of 4.2 million ha, or 0.25% of the total forest area of these 69 countries. This compares with the 15 million ha (0.8% per annum) of annual deforestation estimated for 1980s (Alexandratos, 1995). Even though this later figure includes deforestation from all causes, including formal expansion of grazing and informal unrecorded agriculture which uses much more land than considered necessary to achieve the crop production increases. It also includes deforestation from logging of areas, not yet reforested by natural growth and from fuelwood gathering operations. As long as expansion of grazing, informal agriculture, over cutting for fuelwood and unsustainable logging continue, it must be expected that deforestation will continue at a much greater rate than needed for expansion of formal agriculture.

2.3 Land use and planning in Ghana

The 1962 Lands Act empowered the Central Government of Ghana to acquire any lands in the country in the public interest. In principle, therefore, land is accessible to the state for the promotion of state agricultural enterprises. Such as block-farming or plantations. In practice, however, the vast majority of land is vested in traditional land-owning groups, essentially lineage. This land is also referred to as “stool land” The heads and office-bearers of these lineage are customarily regarded as the custodians of group lands and are traditionally, not allowed to give out any of that land without group consent. Any adult member of the group, male or female, is in principle allowed to farm any portion of the group-land not already claimed by

other members of the group and establish his or her right to that land by being the first to clear it (Benneh, 1988).

According to Amissah, Kasanga and Edmundson (1990), the overall impression of land use and management in Ghana is one of the lack of coordinated policy and planning. The lack of integrated policy and planning lies at the heart of the land management problems at the national, regional, district and farm levels in Ghana. The land user is seldom guided regarding the environmental effects of his activities. The effect of this situation is the inability to attain production objectives and also the threatened ecological status of land and the environment. Halm and Asiamah (1984) emphasized that proper farm planning is essential to the development of sustainable agricultural systems in Ghana. However, there is generally inadequate data on farm planning and this inadequacy among others seems to have hampered effective planning of land use (Halm and Asiamah, 1984). As a result, agricultural land in Ghana is under-used, over-used or mis-used. Land degradation in Ghana results from this situation and is widespread all over the country (Halm and Asiamah, 1984).

Soil degradation, in particular is the cause of stagnating or declining yields in parts of many countries, especially on profile lands from which the poorest farmers attempt to earn a living (World Bank, 1992). Erosion is the most visible symptom of this degradation. Data on soil conditions are of low quality, but crude estimates suggest that in some countries, the losses in productive potential attributable to soil depletion may amount to 0.5-1.5 percent of GDP annually. Erosion can also damage economic infrastructure such as dams. Even when erosion is insignificant, soils may suffer from nutrient, physical, and biological depletion. Water logging and salinization are serious problems in some irrigated areas and are often the result of policies and infrastructure that inadequately recognize the growing scarcity of water.

The increasing conflict over the use of water means that in the future, additional growth in agriculture productivity will have to make do with more efficient irrigation and, in some regions, less water overall (World Bank, 1992).

2.4 Agriculture and the Environment

The environment may be considered as all factors, both living and non-living, that affect an individual organism or population at any point in the life cycle. It is also used to denote a certain set of circumstances surrounding a particular occurrence (Goudie, 1989). The environment is an aggregate of complex sub-systems within which natural resources like soil, water, flora, fauna and air respond to conditions engendered by human activity (Goudie, 1989).

Human activities are part of what may be termed the human environment in which are found conditions and influences that affect the behaviour and development of individuals, communities and society at large. The human environment is made up of all the natural resources and the functional relationships between them, which results in the sustainability of the system. In addition, it includes man made goods and services as well as institutions upon which human survival and quality of life depends. By implication, issues related to environment are multi-disciplinary. Although natural disasters have considerable effect on the environment, certain human activities also affect the environment. This is because, wherever human beings settle for their activities, for example, agriculture, industry and recreation, they either have positive or negative effect on the environment. This can be attributed to the fact that human material needs and survivals are mostly derived through the exploitation of the environment (Goudie, 1989).

Issues related to agriculture and environment have been raised and extensively discussed by many researchers including Goudie (1989), Montgomery (1992) and Garbrah (1986). Garbrah (1986), indicated that the environment includes all the natural resources and the functional relationships between them which ensures sustainability of the system. He stated that it also includes the manmade goods and services and institutions on which, together with the natural resources, human survival and quality of life depends.

Generally, agriculture and environment are closely related. The effect of agriculture on the environment depends to a large extent on certain practices including clearing of the land, burning of debris, grazing of animals and improper land preparation methods, which may promote erosion. Obviously, planting along the slope instead of across it, and other cultural practices in farming activities also affects the environment. In most rural areas, absence of white-collar jobs compels people to engage mainly in agricultural activities, which are geared towards the survival of man and therefore have serious implications on the human environment, and their solutions have not yet been found.

In most poor rural communities, women have very little access to land. As a result, they keep cultivating the same plot of land over and over again, leading to the depletion of its nutrients, and possibly the promotion of massive erosion (Ardayfio-Schendorf, 1987). Rural women also have little finances for the cultivation of their lands, and may not be in a position to afford the cost of ploughing and harrowing (Berger, 1989). Most of them therefore resort to slashing and burning which is most suited for their simple farm implements such as hoes and cutlasses. Those rural folks who for one reason or the other plough and harrow their lands for planting, do not have much technical know how and therefore end up exposing the same piece of land

to the forces of erosion year after year. This is especially more serious due to inadequate land available to women farmers. Botkin and Keller (1995), emphasized that ploughing opens the land to erosion even more than removal of the original vegetation. Soil loosened by ploughing can be blown away when dry and washed away with rainwater.

2.5 The Status of Women in Agriculture

Women's status are defined differently in various countries; due to socio-cultural differences. This study would over view women's status at three main levels namely, (1) global level, (2) the Africa level and (3) the Ghana level.

In recent times, women have been in the center of development programmes in health, agriculture, nutrition, and education, especially in developing countries (Minnow, 1985). This is partly because of the realisation that for effective national development, the entire human resource, especially the rural poor, should be mobilised to participate actively as agents and beneficiaries. Women all over the world have played active part in the economic life, especially trade and production (income generation) and agriculture. In many countries, women play major roles bearing and raising children and over all household up keep, and maintenance of the extended family and the community. Anything that causes women to be incapacitated financially would therefore go a long way to affect the family and the entire nation.

Statistical Services (1992), introduced the concept of "Human Poverty" which focuses on the denial of opportunities and choices most basic to human development to lead a long, healthy, creative life and to enjoy a decent standard of living. According to World Bank (1990), the lower poverty line for Ghana in 1991/92 was

¢99,173.00 per person per year, placing most Ghanaian women below the poverty line.

1. Status of women globally

Until 1970, development policies virtually neglected the rural woman in the mainstream of development efforts (Minnow, 1985). However, following the declaration of 1975 as International Women's Year, women's placement and roles in modern society seem to be receiving world-wide attention (Ahmed, 1977). It is now clear that the woman's role transcends the boundaries of her traditional functions. Her numerous and valuable economic activities enable her to enjoy a great deal of economic independence and equality (Greenstreet, 1978).

Families and households are placed in the overall context of society and are recognised for their significant role as primary units in a complex ecosystem (Ardayfio-Schandorf, 1987). The family including women depends on many external systems and vice-versa. Since the family interacts both internally and externally with its environment it also has interrelationships with the various elements surrounding it, which is called the microenvironment. Savane (1981), found that in several parts of the world, women's work included not only the production of food but also in its transformation into edible material. Women's role of child care and agriculture therefore compete for mothers time and energy (Palmer, 1981). Studies by Savane (1981), showed that rural women's tasks represented 40 per cent of the work necessary to feed the family. Such work included digging or ploughing, sowing, planting, hoeing, weeding and protecting the crops against pests. Rural women also help with the harvest and transport of the produce from the fields to the village (Bortei-Doku, 1990). This serious involvement in agricultural activities in order to

feed the family has promoted women's activities, which negatively affect the environment.

The family is probably one institution that is capable of extracting long hours of unpaid labour from women. Housework and subsistence production for the family's consumption leave women little time for other activities, like education, health care, community work and political participation (Cebotarev, 1988). As a result of these, women tend to depend on their husbands or other males for support, social status, comfort, security or contact with the outside world. Division of labour in the domestic sphere between sexes tends to bring about a relationship of domination or even sometimes exploitation (Bukh, 1979; Dumor, 1983; Cutrufelli, 1983). Sexual division of labour causes women to produce the domestic unit and at the same time excludes them from social power (Young, 1988).

Unfortunately, women's domestic statuses are not considered as productive work. Men's tasks, on the other hand, are recognized as such. As a result of this, women worldwide are known to be breadwinners, but men become the recognised breadwinners, and are therefore accorded the right to claim the best food, care, rest and recreational services that can be provided by the family and community. Women, on the contrary are expected to conform to the image of a good wife or mother who should sacrifice greater part of life for her children and husband (Sen and Grown, 1987).

Another institution that is known to uphold women's subordinate status is marriage, which serves in some communities to give women increased mobility as they join their husbands. Smyth (1990), reported that Indonesian women are unable to take advantage of this mobility because they are not equipped for the labour market as a result of poor education, little work experience and home ties resulting from their

reproductive tasks. It is therefore not surprising that women's subordinate position in society remains highly visible almost universally, and can be observed both at the household level where women's activities are mainly centered, and at other levels of society (Beneria, 1982).

2. Status of women in Africa

In most parts of Africa, the marriage institution allows complete social control over access to the products of women's productive and reproductive efforts. Disruption of traditional extended family systems in African societies by colonialism facilitated the establishment of the nuclear family, which tends to change traditional division of labour among the sexes (Cutrufelli, 1983). This promoted man as the wage earner who is considered productive and the woman the unproductive member, economically dependent on the wage worker (Cutrufelli, 1983). In most African societies, including matrilineal societies men enjoy the right to inherit property and traditional offices. Furthermore, initiation ceremonies like female circumcision, and puberty rites, have a common purpose of instilling an attitude of submission to men into women (Cutrufelli, 1983).

Although women are generally relegated to subordinate positions in African societies, they still contribute significantly towards the development of the continent (Adu, 1999). Women are the backbone in food production. The food chain—from the farm to the dining table—starts and ends mostly with women. Women play a vital role in tilling of the land, sowing, harvesting, processing, preserving, marketing and cooking. Also, other household chores such as caring for the rest of the family, fetching water, firewood and washing are mostly undertaken by women (Adu, 1999). According to the Food and Agriculture Organization (FAO, 1993), women in sub-

Saharan Africa produce and market up to 80 percent of all food grown locally. As more men than women migrate to the urban centres to look for jobs, the brunt of food production falls mainly on the women. In Africa, women comprise about 47% of the total agricultural labour forces (Adu, 1999).

Whilst acknowledging the immense contributions by women in food production, it is also apt to highlight the problems they face. There is the need to assist women and make their work less burdensome.

3. Status of women in Ghana

The 1984 census of Ghana defined women as females who are 21 years and above with or without children (Statistical Services, 1987). The age has, however, since been reviewed to 18 years in a more recent census in 2000 (Statistical Services, 2000).

In Ghana, women form the greater proportion of the population. They are about 60 per cent of the national population of about 19 million (Gustave, 1998). Women in the developing world, spend most of their time working than men (United Nations, 1993). The gap between the hours worked by women compared to men is estimated to be greater in Africa than elsewhere in the world, except Asia and the Pacific regions. United Nations (1993) indicated that a greater proportion of women involved in farm activities and self-employment in developing countries are unpaid than anywhere else in the world.

The debate on the relationship between rural women and the environment in developing countries focuses on the roles women can play in both conserving and improving the environment. Nevertheless, more desperate search for fuel wood for domestic use by women is increasing their role in environmental degradation such as

deforestation (Carr, 1979). In many cases, therefore, women are seen as key actors and are targeted in practical development interventions aimed at protecting the environment (Awumbila and Momsen, 1995).

Women in Ghana share a common experience of subordination with all other women in the world. In all the ethnic groups in the country women are not considered the equals of men (Brown, 1994). Women in both patrilineal and matrilineal communities are always considered to be in need of male protection and are thus placed under the authority of an adult male (father, husband, brother, uncle or sometimes their own sons) (Nukunya, 1969). Manuh (1984), Tsikata (1989) and Dolphyne (1990), identified sexual division of labour, marriage (bride wealth), child marriage, polygamy, widowhood rites/ widow inheritance and ownership of the means of production (land and capital) as factors responsible for the maintenance and manifestation of women's status in Ghanaian society.

According to Bukh (1979), Ghanaian women have to fight two major battles, first against the strenuous demands of their productive activities and second against the difficulties in their access to strategic resources. Opong and Abu (1987), defined women's status in Ghana by seven different roles. These are, maternal, domestic, conjugal, occupational, kin, individual and community. Women in Ghana therefore play a major role in food production, household income generation, bearing and raising of children, over all household upkeep and maintenance of the extended family and community. Thus apart from their role as mothers, the women also make important contributions to the labour market and play a vital role in food chain activities.

In Ghana, according to 1995 figures, women form 50% of the adult labour force in agriculture, 17% of workers in industry and 33% in the services (Statistical

Services, 2000). In areas such as the Shai Hills in the Dangme West District, migration of men have left farming almost entirely in the hands of women, even though the universal problem amongst women farmers is access to capital (Adu, 1999).

2.6 Involvement of women in agriculture

2.6.1 World activities

In addition to processing and preparation of food, which is almost exclusively the responsibility of women, they also engage in a wide range of food conservation activities. They build storehouses for the grain and dried vegetables, and also engage in extraction of palm oil and drying and pickling of fish. Women also engage in planting and milling of the grain and the processing of yams, bananas and plantains (Savane, 1981). Carr (1991), pointed out that Nepal women take on agricultural activities to provide for the family in addition to their household work and as a result of this they contribute about 53 percent of the household monetary income. In developed countries, women engage in less agricultural work as compared to their counterparts in Africa.

2.6.2 Africa activities

Several communications, including FAO and UN (1985) and Leslie (1988) have indicated that in Africa, the woman's farming day begins early and ends late. She rises before dawn and walks to the field. In the busy seasons, she spends some 9 to 10 hours hoeing, planting, weeding or harvesting. She brings heavy loads of food and fuel wood home from the farm, walks long distances for water, carrying a pot which may weigh 20 kilograms or more. She grinds and pounds grains, cleans the

house and cooks while nursing her infant. She washes the dishes and clothes, minds the children and generally cares for the household. She processes and stores food and markets excess produce, often walking long distances with heavy loads in difficult terrain to reach the uncertain market centres where she often sells at give away prices. She must also attend to the family's social obligations such as marriage ceremonies, outdoorings and funerals. She becomes pregnant may have to provide fully for herself and her children. During much of the year, she may labour for 15 to 16 hours each day. The African rural woman works this way until she delivers her baby, frequently resuming work within a day or two after delivery (ILO, 1991).

Studies by Savane (1981), showed that women's tasks represented 40 percent of the work necessary to feed the family. The study found that women engaged in fishing for small species of fish or for shellfish in some coastal areas, in addition to routine work such as digging or ploughing, sowing, planting, hoeing, weeding and protecting the crops against pests. In some parts of Africa, the fish was dried and smoked. Fishing activities sometimes kept women occupied for the whole year, depending on the area and on the returns obtained (Savane, 1981; Carr, 1991). Savane (1981), again found that apart from the nomadic people rearing cattle and sheep, the women in addition to domestic tasks, devoted themselves to livestock rearing. In the home, the processing and preparation of food was the responsibility almost exclusively of the women (Savane, 1981).

Available evidence by the World Bank (1990), from rural areas in Kenya, pointed out that majority of Kenyan women (9 out of 10) lived in rural areas. Horenstein (1989) noted that 96 percent of rural women in Kenya worked on the farm. It was estimated that tasks like food preparation and nutrition took up one third of the day, whilst farming, marketing, caring for animals and water and fuelwood

collection took up the remainder of the day. In Malawi, both subsistence farming and processing of food for family consumption is in women's hands. It is estimated that 52 percent of Malawi's population of 7 million are women, 93 percent of whom live in rural areas. Of these, 50 – 85 percent were involved full time in their own holdings in subsistence agriculture and marginal cash cropping (Clerk, 1975; Spring, Smith and Kayuni, 1983; Carr, 1991). Kydd and Christiansen (1982) found that 69.3 percent of those working full time on their own farm holdings were women, and that the amount of women's work was determined more by the type of crop than by whether marriage was monogamous or polygamous. Most importantly, the Malawi National Sample Survey of Agriculture, undertaken in 1980-81 (Carr, 1991), estimated that as many as 28.8 percent of the rural households were headed by women who were divorced, separated, widowed, unmarried, married to polygamous husbands, or married to husbands who were away from home (within the country or abroad) in search of employment. Clerk (1975), also discovered that the proportion of agricultural work carried out by women in Malawi was twice that done by men in villages. About 54 percent of the major staple crop maize, is cultivated by women who are also involved in traditionally considered "male" crops; such as tobacco, tea and cotton (Carr, 1991).

The high incidence of female-headed households in rural areas may have far-reaching consequences for agricultural development efforts. In all these households, women undertake the central decisions regarding how to allocate land, labour and other resources between competing needs in an attempt to optimize family welfare (Carr, 1991). Moreover, in a number of male-headed households, the women again make most of the decisions connected with farming activities. This is mostly because the men are preoccupied with non-farm activities such as wage employment in

fishing, trading and self-employment in various trades. Although men may from time to time assist in various farming operations, the majority of the tasks associated with food production remain in the realm of the women. In Malawi, women can be considered as the main stay of agriculture (Carr, 1991). However, in the cultivation of rice, primary land tillage or ploughing and leveling with oxen is considered men's work (Carr, 1991). Although, both Malawian men and women plant, apply fertilizer and weed, harvesting and threshing are mostly done by women, with occasional support from men.

2.6.3 Ghana activities

Ardayfio-Schandorf and Kwafo-Akoto (1990), categorized women's work in Ghana mainly under Agriculture and environment, which are linked and any attempt by Ghanaian women to abuse one of these would definitely have a negative effect on the other. These main areas cover various aspects of work engaged throughout their life cycle from production to reproduction of the family unit.

According to Bukh (1979), Ghanaian women carried out more than one trade at the same time. These women would often work on the farm, be involved in petty trading, process crops for home consumption and sale, or street vending food. All this in an attempt to bring some money into the home to either supplement what their male counterparts provide or as their sole means (Nti, Inkumsah and Fleischer, 1999).

A few studies carried out in Ghana generally indicated that women worked long and hard at various tasks, especially in agricultural activities (Bukh, 1979). This supports Brown (1994), who agreed with various researchers that workloads for Ghanaian women tend to be heavier than their male counterparts because they are mainly involved in the production of the bulk of the nation's agricultural products.

Brown (1994) further noted that this cuts across most socio-economic groupings in Ghana. He observed that women's workloads were increased by their household responsibilities. These included food processing, cooking, child care, fetching water and fuel wood.

Similar findings in the Northern part of Ghana showed that women spent a great amount of their time on the collection of water and fuel wood (Awumbila and Momsen, 1995). Leslie (1988) also found that Ghanaian women apart from their roles as mothers were involved in food production and other economic activities. These activities included farming (cash cropping and subsistence) and trading. She noticed that presently, women are engaged in income-generating activities. According to her, these women contributed substantially to the household income, with many being the sole breadwinners.

2.7 Culture and its effect on environment

Historically, agricultural management included rich symbolic and ritual systems that often scurried to regulate land use practices, and to encode the agrarian knowledge of non-literate peoples (Ellen, 1993; Conklin, 1957). The existence of agrarian cults and ritual has been documented for many societies, including those of Western Europe. Indeed, these cults were an essential focus of the Catholic Inquisition. Medieval social historians (Posey, 1999), have shown how rural ceremonies were branded as witchcraft and how such activities became the focus for intense persecution. Most surprisingly, as the post-inquisition Spanish and Portuguese explorers set sail and European conquest spread over the globe for "God, gold and glory" part of their larger product included evangelical activities that often altered the symbolic and ritual bases of agriculture in non-Western societies.

Forest and culture have intertwined throughout human history. Forest landscapes are formed and are strongly characterized by cultural beliefs, while management systems and cultures are materially and spiritually built upon the physical world of the forest. Just as people have acted upon and altered forests throughout history, so has forests profoundly influenced human consciousness and culture (Posey, 1996). As a result of the long histories of co-development between forest ecosystems and local cultures, cultural and biological diversity are intimately connected and cannot effectively be separated from each other. Programmes designed to achieve the conservation of biodiversity, therefore, must be undertaken with a full grasp of the cultural context within which forests exist.

“Culture”, as it broadly relates to forests, includes what Balee (1994) referred to as a “mental economy”. It includes not only traditional ecological knowledge, such as that on relations between species of flora and fauna, edible versus inedible foods, and forest management systems, but also shared notions of kinship, marriage, taboos cosmology and ritual. Traditional forest management relies on a complex of ecological and a variety of habitats to maximize the range of products and services that forests can provide. Every culture has narratives or beliefs which answer in different ways fundamental questions about how we came to be, and articulate how and where people originated, by the community, and how people should behave towards one another and their environment (Elder and Wong, 1994).

Balee (1994), defined management of forests as the human manipulation of inorganic and organic components of the environment that brings about a net environmental diversity greater than that of so-called pristine conditions, with no human presence. Traditional systems of management have shaped forests throughout the world and many so called ‘natural’ forests in fact represent arrested successional

forest once managed by people. For example, Posey (1999) described “natural” ecological systems throughout the region of the Amazonian Kayapo Indians, which actually represent cultural landscapes that are products of human manipulation. Posey (1999), highlighted evidence supporting an extremely complex process which is the result of long experience of traditional forest use. In this example, *Ficus natalensis* and *F. thonningi* bark were harvested in Bugunda using elaborate protocols that included the tying of banana leaves to the de-barked tree; followed by the application of cow-dung and subsequent beating of the bark to make cloth.

Integral traditional forest management involve the use of elaborate taboos, myths, folklore and other culturally-controlled systems which bring coherence and share community values to resources use and management. Today under pressure from urbanization, cash economies and other socio-economic, political and cultural changes many of these systems are breaking down, to the detriment of forests and valuable species. But in many areas these forms of management and control remain strong. In the eastern Amazon, for example hunters who are greedy, or do not heed the wishes of the giant cobra, giant sloth, and the curupria, will become lost, or otherwise suffer some punishment. These creatures require respect for the forest, and what might be called “sustainable” approaches to the harvesting of game and plants (Posey, 1999). Interdicts, totems and sacred areas based on religions, beliefs, and implemented by religious chiefs are widely used throughout West Africa to control the use and management of forests and resources. For example, in Benin the panther is venerated by the Houegbonou clan, who can neither kill nor eat it. The Howedas people adore, protect and breed pythons. Fon and Torris people identify monkeys with twins which leads to the protection of some monkey habitats. *Ihlorophora*

(Milicia) excelsa-iroko is a sacred tree protected and revered throughout West and Central Africa (Posey, 1999).

On the Western edge of the Gola Forest Reserve, the largest element in a complex of four surviving areas of high rainforest on the Sierra Leonean side of the border with Liberia, villagers have a taboo against bringing the wood of *Musanga cecropioides* into the village for use as fuel wood. Posey (1999) described this as a good example of the true understanding of biodynamic processes sometimes encoded in mythic knowledge. In the Yoruba land of Nigeria, trespassing on the devil's land (such as earmarked forests and dark and fearful places) would incur the wrath of the bush spirits. No one farms in such forest or bush as ill befalls any one who go against this warning and clears the forest to plant his farm.

Traditional management systems of forests offer valuable insights to foresters (Posey, 1999). The processes, that foresters utilize as part of silvicultural systems has indeed benefited from management techniques employed by forest peoples for millennia. Silvicultural systems include repairing patches created by deforestation and tree fall gaps, timing the creation of these gaps to promote desirable species; managing succession, including the seduction and protection of desirable species and the weeding out of undesirable ones as well as managing regeneration to promote fruit trees and other tree species to attract wildlife. Also, included, are manipulation of the scale and timing of agricultural and fallow phases to minimize pests and maintain soil fertility by planting forest grooves on steep slopes and along streams to prevent soil erosion and protect watershed. Birds, bats, and other animals, may be used to 'plant' forest grooves, and enrichment of forests, by transplanting propagules and seedlings of rare or non-native seedlings.

Gadgil and Berkes (1991) and others have suggested that traditional management systems form the basis of sustainable ecosystem and biodiversity conservation. Traditional knowledge of species use and the management of forest products and ecosystems, provide numerous economic benefits for local communities, as well as promoting wider applications in regional and international economies.

2.8 Effects of agriculture on the environment

The effects of agriculture on the environment will be discussed under the following headings: regional effects including Ghana and Africa, effects on the soil, water bodies and vegetation.

In his discussion on "How agriculture changes the environment", Garbrah (1986) communicated that most effects of agriculture on the environment are unavoidable because the production, processing, and distribution of food alter the environment. However, modern pesticides for example, have created a revolution in agriculture in the short term, but the long-term effects of some of these chemicals have proved extremely undesirable. The effects can be both positive and negative, and either primary or secondary. The primary effect, which is also referred to as on-site effect is an effect on the area where the agriculture takes place. For example, the use of an agro-chemical against a pest may end up killing useful insects like butterflies or bees on a farm. The secondary effect also called off-site effect is an effect on an environment away from the agricultural site, typically downstream and downwind (Goudie, 1989). A good example here is the introduction of new plant species to distant areas through the use of cow dung as manure.

The effects of agriculture on the environment can be divided into three, namely local, regional and global effects (Goudie, 1989). The local effects are those that occur at or near the site of the agricultural activity. They include erosion, loss of

soils and increases in the sedimentation downstream in local rivers. Regional effects resulting from combined effects of farming practices in the same large region include the creation of deserts, large-scale pollution, increases in sedimentation in major rivers and changes in the chemical fertility of soils over large areas (Goudie, 1989). Associated global effects, include climatic changes as well as potentially extensive changes in chemical cycles. All these result in major environmental problems such as deforestation, desertification, soil erosion, accumulation of toxic metals and organic compounds, degradation of water resources, salinization and water pollution, including eutrophication, which is the increase in the concentration of chemical elements required for living things (Goudie, 1989). Eutrophication of lakes as a result of human-induced processes, such as disposal of nutrient-rich sewage is called cultural eutrophication.

1. Regional effects of agriculture on the environment

Deserts occur naturally where there is too little water for substantial plant growth. The plants that eventually grow are too sparse and unproductive to create a soil rich in organic matter. Desert soils are mainly inorganic coarse and typically sandy. When rain does come, it often is heavy, and erosion is rapid and severe (Goudie, 1989).

The spread of deserts, called desertification or desertisation is a serious global problem. About 20% of the earth, involving 100 nations and 80 million people, is threatened with desertification. Some areas are easily converted to deserts when used for light grazing and crop production. In these areas, the rainfall is just barely enough to make the area more productive. The leading cause of desertification are bad farming practices, such as failure to use contour ploughing, or simply too intense

farming in a particular area, overgrazing, the conversion of range-lands to crop-lands in marginal areas where rainfall is not sufficient to support crops over the long term, and poor forestry practises, including cutting all the trees in an area marginal for tree growth. In northern China for example, areas that were once grasslands were converted to croplands. Both overgrazing and farming practices have led to the conversion of the lands to desert (Goudie 1989).

Desert like areas can be created anywhere by poisoning of the soil resulting from the application of persistent pesticides or other toxic organic chemicals or from industrial processes that lead to improper disposal of toxic chemicals. Excessive manuring and oil or chemical spills can all lead to degradation of soils, which promote reduced agricultural use of lands and sometimes force abandonment of the land. Worldwide, chemical degradation accounts for about 12% of all soil degradation (Goudie 1989).

Irrigation of soils in arid areas can also lead to the formation of deserts. When irrigation water evaporates, a residue of salt is left behind. Although these may have been in very low concentrations in the irrigation water, over time the salts can build up in the soil to the point at which they become toxic.

In recent years, fear has been expressed that human action may even be leading to the spread of desert-like conditions. Most people believe that this is due to a combination of increasing human and animal population levels which cause the effects of drought years to become progressively more severe, so that the vegetation is placed under severe stress by over-grazing and cultivation of marginal areas. Although deserts cover one-third of the earth's surface, they are generally hostile environment for man, and easily degraded. Some of the problems they present are, sand encroachment on roads, wind erosion of soil, dust storms, salinity, floods,

weathering of buildings, reduction of soil quality, earth quakes, disease transmission, climatic changes, extreme heat, and very low humidity. Although spectacular advantages in desert utilization may occur in some of the developed countries and the new oil-rich states of the Middle-East, much of the world's desert area will remain relatively untouched wilderness areas for decades to come (Alexandratos, 1995).

Litter from leaves is rapidly decomposed with the help of fungi and other micro-organisms, and its nutrients are rapidly returned by a dense shallow root network to the trees. Because many of the nutrients are tied up in the vegetation it can lead to a very serious impoverishment of the soil, especially in the rain forest (Botkin and Keller, 1995). Traditionally, farming systems involving slash-and-burns recognise this and the forest is, therefore, cleared by cutting and burning, and this releases nutrients to the soil. However, under conditions of rapid breakdown and leaching combined with high rainfall, the fertility does not last long and so the farmers move on, allowing the cleared area to become re-vegetated by secondary forest, which means there is an extended period of fallow.

Two important environmental and natural resource challenges face rural people and policy makers. These are; 1) prevention of resource degradation that may result from rapidly growing demands for food, fuel fiber, and from poor stewardship due to poverty, ignorance, and corruption, and 2) preservation of valuable natural forest; wet lands, coastal areas, and grasslands from being taken over for relatively low-value uses that are artificially encouraged by bad policies, inadequate markets and flawed institutions. Ninety percent of the doubling in food production over the past quarter century came from higher yields and only 10 percent from cultivating more land. Intensification, which may account for some future increases in production, will create environmental problems. Right policies are therefore needed.

Firstly, there is the need for those policies that enable farmers to do what is in their own interest, such as managing soils better. Secondly, there is the need for policies that provide incentives to stop behavior, which primarily hurt others.

2. Effects of agriculture on the environment in Ghana

Ghana is basically an agricultural country, with soil erosion as one of the most threatening problems (Laing, 1994). This is due to the frequent removal of vegetation cover through farming. Bare rock and coarse soil particles are washed free on the surface, creating run off flow patterns on the ground in the savannah and the forest zone, while some tree roots are washed free on the surface in the forest zone (Laing, 1994). Erosion has changed the quality of Ghanaian soils especially in terms of nutrient availability, moisture and temperature relationships. Topsoils and sub soils are mostly affected. Halm and Asiamah (1984), showed data on incidence of erosion and the rates of erosion from Bawku and Navrongo areas of the Upper East Region of Ghana. Erosion to the soil may be considered as a disease, and a good soil subjected to erosion soon degenerates into a barren and unproductive soil. The increasing population rate in Ghana, and the need for increased hectarage of land for farming may require increased mechanisation in agricultural land use. However, it should be emphasized that improper mechanization practices could have disastrous effects on land quality, causing accelerated erosion, sub-soil compaction, and reduced water infiltration.

Bush fires occur widely in Ghana but are more extensive in the savannas. Fires are usually started for varied purposes, but they may also be set unintentionally. The most noticeable effect of burning is the reduction in the composition and density

of the vegetation. Bush fires have become in recent years, the most degrading environmental factor in Ghana (Halm and Asiamah, 1984).

In Ghana, there is a general lack of data and studies on the effect of agro-chemicals on soil quality. From limited studies that have been conducted under laboratory and field conditions, evidence seems to suggest that the response of micro-organisms in the soil may vary according to the kind of pesticide, its concentration and the type of soil. It is also suspected that uncontrolled use of some fertilizers may lead to soil acidification and salinization in the drier parts of the country. One laboratory-based study at the Soil Science Department of the University of Ghana, Legon, showed that the effects of pesticides Kocide and Primagram on microbial population and respiration in two Ghanaian soils varied according to the kind of pesticides, their concentration and the type of soil used.

The traditional farming systems of slash and burn are a sustainable agricultural practice in areas of low population. However, the present high population and high growth rate have necessitated short fallow periods leading to adverse effects on the environment. Furthermore, tree felling has become common in Ghana, especially in the rural parts of the country where farmers cut down trees for sale as firewood (Awumbila and Momsen, 1995). This happens mainly in the dry season and during severe draught periods when farmers have little or no produce to sell to make a living. Tree felling goes a long way to eliminate very vital tree species, which would have been exploited for food or medicine by scientist (Goudie, 1989). Some major causes of deforestation in Ghana are; the conversion to subsistence agriculture and rough grazing not recognized by official agricultural land use statistics, persistent over-cutting for fuel wood and charcoal production which completely eliminates woody growth and commercial felling of timber. Construction

of logging roads for commercial felling provides access and frequently facilitates conversion of forestland to other uses. The pattern of deforestation and degradation indicates that the most intensive extension of forest clearing and forest degradation radiates out from centres of population and established agriculture enterprises (Alexandratos, 1995).

3. Effects of agricultural practices on the soil

Since the end of World War II, human food production activities have seriously damaged more than 1 billion hectares of land, about 10.5% of the world's best soil equal in area to China and India have been developed (Botkin and Keller, 1995). Overgrazing, deforestation and destructive crop practices have damaged approximately 9 million hectares of land in the world to the point that, recovery will be difficult.

Degradation of soils is estimated to effect 450 million ha of land worldwide of which about 12 million ha are in Asia (Alexandratos, 1995). Among the causes, deforestation and overgrazing, probably contribute 1/3 each with the bulk of the balance due mostly to mismanagement of arable lands. Soil, water and wind erosion accounts for just over 1 billion ha of total degradation with the balance due to chemical and physical degradation (Alexandratos, 1995). Both man-made and natural processes such as upward movement in the earth's crust cause soil degradation. Some degradation will continue to occur in the future, but the relationship between soil erosion and productivity loss is complex and more work is needed before firm conclusion can be drawn about the impact of soil erosion on yields (Alexandratos 1995).

Broadly, degradation in dry land areas is estimated to affect some 30% of the world's land surface. More recent thinking on desertification points to a growing consensus that the past estimates of area affected were greatly exaggerated. It is now recognised that dry lands are much more resilient to drought and to man's abuse than previously thought. However, further expansion of agriculture into fragile soils in dry land areas would contribute to increasing problems from this source.

Soils may be defined as earth materials modified over time by physical, chemical and biological process, which, in addition to supporting rooted plant life, are altered from the original parent material into a series of horizons (Olaitan and Lombin, 1984). Some investigations have shown that large amounts of these modified earth materials have been damaged. Olaitan and Lombin (1984), estimated that more than 1 billion ha (2.47 billion acres) of land about 10.5% of the world's best soil have been seriously damaged by human food production activities. This has happened because farming easily damages soils.

According to Amissah, Kassanga and Edmundson (1990) clearing the land of its natural vegetation, forest or grassland makes the soil lose its fertility. Garbrah (1986) holds similar views on the loss of soil fertility. In his view, in the past when populations were low, fallowing periods were long enough to allow sufficient regeneration. With increased population, fallowing periods have been shortened, and cropping is resumed before regeneration has advanced. In some cases, no fallowing takes place at all resulting in the impoverishment of the soil (Garbrah, 1986). In his view, some of this results from physical erosion. Once the protection of the vegetative cover is lost, the soil is exposed directly to water and wind, which removes the loosened soil. For example, in Ghana, farming on slopes in upland areas has accelerated soil erosion and resulted in general impoverishment of the land. In

addition, farmed soil also loses fertility when chemical elements are dissolved in water and transported away in streams and subsurface run off (Olaitan and Lombin (1984)

Obviously, all forms of agriculture lead to soil loss. However, the rate of loss varies with the crop and the methods of agriculture. Poisoning of soils can also result from the application of persistent pesticides or other toxic organic chemicals (Olaitan and Lombin, 1984). A possible strategy for preventing this is to minimizing the use of expensive and dangerous chemical pesticides by growing crops simultaneously to enhance the abundance of predators and parasites, which in turn prevent the build up of pests. The mixing of crop species can also delay the onset of diseases by reducing the spread of disease-carrying spore and by modifying environmental conditions to make them less favorable to the spread of certain pathogens (Posey, 1999).

When land is cleared of its natural vegetation, such as forest or grassland, the soil loses its fertility, some of this occurs by physical erosion. Once the protection of the vegetative cover is lost, the soil is exposed directly to water and wind, which removes the loosened soil. Farmed soils also lose fertility when chemical elements are dissolved in water and transported away in streams and subsurface runoff. The rate of loss in fertility is sometimes measured, as the time required for the soil to lose one-half of it's original store of chemical elements necessary for crops. The time over which a soil loses one-half of a chemical element varies. It is much faster in warmer and wetter climates, such as in tropical rain forest, than it is in colder or dryer climates, such as those where the natural vegetation is temperate grassland-zone.

In temperate climatic zones, there is a long history of use of the plough, which turns over the soil completely. There is however the need for careful use of the plough, where the same land is ploughed and planted year after year to limit erosion.

The practise of annual ploughing and planting makes possible intense use of land for high productivity of crops. In some places, such as the farmlands of the province of Venice, Italy, ploughing the soil and planting crops has been a way of life for several thousands of years and continues today with major changes in the soils (Goudie, 1989). Ploughing opens the land to erosion even more than removal of the original vegetation. Soil loosened by ploughing can be blown away when dry and washed away with rainwater (Goudie, 1989). Ploughed lands tend to lose the upper soil layers, where the most fertile organic matter is found. The less organic matter present in the soil, the more vulnerable the soil is to further erosion (Goudie, 1989).

All forms of agriculture lead to soil loss, but the rate varies with the crop and the methods of agriculture. In the United States, about one-third of the country's topsoil has been lost, resulting in 80 million hectares either totally ruined by soil erosion or made only marginally productive. And soil loss in the United States continues. Today 90% of the land used for row crops and small grains is farmed without soil conservation practices (Goudie, 1983).

In unprofessional traditional ploughing, the ploughed furrows make a path for water to flow, and if the furrows go downhill, then the water moves rapidly along them, increasing the erosion rate. In contour ploughing, the land is ploughed along the contour, perpendicular to the slope as much in the horizontal plane as possible. Ploughing along the contours can greatly reduce erosion loss owing to water runoff, and in recent past, has been the single most effective method for reducing soil erosion (Goudie, 1983).

In forest areas, the main cause of accelerated erosion is the replacement of natural forest cover by agricultural crops. Forest protects the underlying soil from the

direct effects of rainfall runoff. Tree roots bind the soil and the litter layer protects the ground from rain splash. The rate of erosion that will result when forest is removed will be high if the ground is left bare. Furthermore, the method of ploughing, the time of planting, the nature of the crop and the size of fields may all influence the severity of erosion. Soil erosion resulting from deforestation and agricultural practice is especially serious in tropical and semi-arid areas (Goudie, 1983). This trend may be reversed by changing agricultural practices including substitution of inorganic fertiliser for farmyard manure, reduction in the process of "claying" where by clay was added to peaty soils to stabilise them.

Protecting soils from nutrient depletion is an urgent priority in many parts of the world. Many options are available, including mulching, contour-based operations, intercropping, agro forestry, and animal husbandry (World Bank, 1992). These improvements can sharply reduce erosion and raise yields and incomes towards the alleviation of poverty.

One way of minimizing run-off is by careful and rational management of crop residues through mulching. Mulching may be defined as the application of a protective covering over the soil surface that is intended to minimize evaporation losses. In this practice, natural or artificial elements such as green manures, leaves, compost, straw, hay, saw dust, paper and plastics are applied in layers to the surface of soil around plants to conserve moisture. Other approaches often adopted to minimize run-off include the construction of terraces and contouring, strip cropping and ridging. Other advantages of mulching are that it intercepts solar radiation by reflecting the light and so keeps the soil temperature low. The presence of sorghum, maize and millet stalks and stubble on the soil surface improves infiltration because they reduce the impact of rain drops. Heavy rainfall can break up soil aggregates and

cause the average pore size in the surface soil to decrease and thereby adversely affect infiltration rate (Olaitan and Lombin, 1984).

4. Effect of agricultural practices on water bodies

Eroded soil ends up in our waterways. Rivers carry about 3.6 billion metric tons/year of sediments in the United States, 75% of which is from agricultural lands. Of this total, 2.7 billion metric tons/year is deposited in reservoirs, rivers and lakes. Downstream sedimentation is a serious environmental effect of modern agriculture. Polluted sediments transport toxins, which fill in otherwise productive waters destroying some fish. Nitrates, ammonia and other fertilisers carried by sediments, can cause eutrophication in downstream water resulting in the build up of algae that, reduces fish production. Polluted sediments can also transport toxins (Botkin and Keller, 1995). Sediment damage costs the United States about \$500 million/year in dredging expenses and costs attributed to reduction in the useful life of reservoirs (Botkin and Keller, 1995). All these result in the destruction of the ecology, for example the geese that lay the golden eggs may be destroyed (Ammisah, Kasanga, Edmundson, 1990). The interaction of living organisms with their environment is very much a two-way process: organisms affect and are in turn affected by their physical surroundings (Bell *et al*, 1975).

Much of the basic drainage pattern of the Mississippi River was established during the surface run off of the enormous volumes of melt-water. The sediments carried along with the same melt-water are partially responsible for the fertility of mid-western farmland. Infiltration of a portion of the melt-water resulted in ground water supplies tapped today for drinking water (Montgomery, 1992). In most cases, soils are washed away through erosion. This means that much of the eroded soil ends

up in water bodies. Large amounts of eroded soils are deposited in reservoirs, rivers and lakes every year. For this reason, downstream sedimentation has been viewed as one of the serious environmental effects of agriculture. Sediments fill in productive waters destroying some fishes. Sediment pollution not only causes water to be murky and unpleasant to look at, swim in, or drink but also reduces the light availability to underwater plants and food supplies to fish, thus reducing their population (Montgomery 1992).

Dams, boreholes, drilling deep to exploit ground water have a whole series of environmental consequences that may not have been anticipated. The weight of water in the reservoir may accelerate earthquake activity by depression. The earth crust seepage from the reservoir and from canals may cause a build-up of salinity, local climates may change, the diversion of river flow may change salinity in the sea, which in turn may affect their ice cover and affect world climate. Water-borne diseases may be more widely transmitted and the migration of fish may be disturbed (Goudie, 1989).

Some water pollution problems resulting from agricultural activities are problems of excess fertilizer. The three principal constituents of commercial fertilizers are nitrates, phosphates and potash. Montgomery, (1992) stated that when fertilizers are applied to or incorporated in the soil, they are not immediately taken up by plants. The compound must be soluble for plants to use them, but that means that they can also dissolve in surface and ground runoff water. These plant foods then contribute to eutrophication problems. Eutrophication of water is the presence of critical plant nutrients such as nitrates and phosphates, which encourages the growth of plants, including algae. This development is known as eutrophication of the water; the water itself is then described as eutrophic. (Montgomery, 1992) the exuberant

algae growth that often accompanies eutrophication has also been called “algal bloom” and often appears as slimy green scum on the water.

Algal growth proceeds in the photic (well-lighted) zone near the water surface until the plants are killed by cold or crowded out by other plants. The dead plants sink to the bottom where they become part of the organic matter in the water. Biochemical oxygen demand increased, as they decayed releasing nutrients into the water. The impact of fertilizer runoff is apparent from a recent study conducted by Montgomery (1992) in which he reported the levels of eutrophication in the lakes of eleven states. He reported that the highest proportion of eutrophic lakes were farm-belt states. In the worst case, Iowa, 100 percent of the 107 lakes tested were eutrophic; in the next worse case Ohio, 84 percent of 119 lakes were eutrophic.

Reduction in fertilizer applications to the minimum needed, perhaps coupled with the use of slow-release fertilizers, and would minimize the harmful effects. In many agricultural areas sediment pollution of lakes and streams is the most serious water quality problem. Farmland and forestland together are believed to account for about 75 percent of the 3 billion tons of sediments supplied annually, to US waterways. Of this total, bulk of sediments is derived from farmland; sediments yields from forestland are typically low. Many farmers are concerned that, if they adopt practices recommended to reduce soil erosion, such as shallower cultivation; they will merely have to increase their use of herbicides. Herbicides and pesticides are already a significant source of pollution in agriculture. Most such compounds now in use are complex organic compounds. US farmers use more than 500 million pounds of herbicides and pesticides each year, of which 90 percent are synthetic organic compounds. The use of these synthetic herbicides grew by over 40 percent just in the two –year period from 1979-1981.

5. Effects of agriculture on the vegetation

Forest (especially moist tropical forest), coastal and inland wetlands, coral reefs, and other ecosystems are being converted or degraded at rates that are high by historical standards (World Bank, 1992). Tropical forests have declined by one fifth in this century and the rate has accelerated. In the 1980s tropical deforestation occurred at a rate of 0.9 percent a year, with Asia's rate slightly higher (1.2 percent) and sub-Saharan Africa's lower (0.8 percent). The loss of forest has severe ecological and economic cost. It affects people's lives through the loss of watershed protection, local climate change, and loss of coastal protection and fishing grounds. African women have to walk further for fuel wood, indigenous forest dwellers in the Amazon have succumbed to settlers diseases, and 5,000 villagers in the Philippines were recently killed by flooding caused in part by the deforestation of hill sides (World Bank, 1992). Also, extinction of species is occurring at rates that are high by historical standards. Many more species are threatened because their habitats are being lost. Models that link species extinction to habitat loss suggest that rapid rises in the rate of extinction to levels approaching those of prehistoric times that resulted in mass extinctions may be difficult to avoid in the next century unless current rates of deforestation and other habitat loss are sharply reduced.

Rapid population growth often contributes to environmental damage. Traditional land and resource management systems may prevent over use of the land (World Bank, 1992). The world's population is now growing by about 1.7 percent a year. During the period 1990-2030 the World's population is likely to grow by 3.7 billion. Ninety percent of this increase will occur in developing countries (World Bank, 1992). Over the next four decades sub-Saharan African's population is

expected to rise from 500 million to 1.5 billion, Asia's from 3.1 billion to 5.5 billion, and Latin America's from 450 Million to 750 million (World Bank, 1992). Rapid population growth can exacerbate the mutually reinforcing effects of poverty and environmental damage. Because they lack resources and technology, land-hungry farmers resort to cultivating erosion-prone hillsides and tropical forest areas where crop yields on cleared fields usually drop sharply after just a few years.

According to World Bank (1992), the poor are both victims and agents of environmental change. Poor families often have to meet urgent short term needs, prompting them to "Mine" natural capital through, for examples, excessive cutting of trees for firewood and failure to replace soil nutrient. Agricultural stagnation in Sub-Saharan Africa is a particularly clear example of the mutually reinforcing nexus of poverty, population growth and environmental damage. Low agricultural productivity caused mainly by poor incentives and poor provision of services, has delayed the demographic transition and encouraged land degradation and deforestation, which in turn lowered productivity.

Africa's forest declined by 8 percent in the 1980's. Nevertheless; 80 percent of Africa's pasture and range areas show signs of damage and in such countries as Burundi, Kenya, Lesotho, Liberia, Mauritania, and Rwanda, fallow periods are often insufficient to restore soil fertility (World Bank, 1992).

The carrying capacity for cattle varies with the rainfall and the fertility of the soil. When the carrying capacity is exceeded, the land is overgrazed, leading to reduction in the growth of vegetation, which reduces the diversity of plant species. There could be dominance of plant species that are relatively undesirable to the livestock, and increase in the loss of soil by erosion as the plant cover is reduced. Trampling of the land by livestock, contributes significantly to land degradation. For

example, paths made as the cattle travel to the same water hole or stream develop into quills, which erode rapidly in the rainy season. Traditional herding practice and industrialised production of domestic animals have different effects on the environment (Goudie, 1989). In traditional herding practice, manure builds up in large mounds on the field, and with the rains, it pollutes local streams.

People have distributed cattle, sheep, goats, and horse, as well as other domestic animals around the world and this has changed the landscape (Goudie, 1989). The spread of cattle brought new animal disease and new weeds, which arrived on their hooves and in their manure (Goudie, 1989). The spread of domestic herbivores around the world is one of the major ways in which human beings have changed the environment through agriculture. As the human population increases, and when income and expectations rise, the demand for meat will increase, and there will be an increased demand for rangeland and pastureland in the next decades.

2.9 Agricultural activities of women and their effects on the environment

Agricultural sector programmes and policies, extension services as well as designers of agricultural tools and equipment, have generally ignored women farmer's needs and concerns and their important contribution to agricultural production and rural economy (Carr, 1991). Yet according to IFAD (the International Fund for Agricultural Development) in many African countries, women provide 90 percent of the hoeing and weeding in the field, 70 percent of the overall agricultural work, 80 percent of food storage and transportation from farm to village; and they do 100 percent of the processing for basic foodstuffs.

Women in developing countries play a major role in the production, processing, and marketing of food but, for the main part, they have been constrained from contributing fully to the development of this sector by the lack of access to

improved techniques, which do exist (Carr, 1991). Most of the farm activities and post-harvest operations are carried out using basic tools and equipment. Only in rare cases do we find women using improved tools and equipment for these tasks. Land cultivation is still mostly done by hand, predominately with the traditional hoe or the tanged hoe. Traditional agricultural methods have persisted partly because improved appropriate techniques are not readily available and partly because women generally lack the requisite knowledge to handle the few improved techniques that are available (Carr, 1991). In the absence of improved appropriate technologies, women spend a considerable proportion of their time in food production. The Malawi experience demonstrates that women generally spend more hours than men in farming operations and food processing, besides their involvement in various domestic activities.

In processing, the various operations are carried out by women using mostly indigenous techniques and equipment. In the case of rice, for example, bunches of panicles are threshed by beating them against the ground, a stone, a bamboo frame, or the edge of a wooden structure. For most staples the basic equipment used in processing food includes mortar, pestle, grinding stones, pots of various sizes and shapes, baskets and mats. Traditionally, drying of cereals, fish, flour, and vegetables is widespread. This usually means placing the produce on the ground in the open, in the house compounds and/or on roadsides for various lengths of time (Carr, 1991). This practice invites contamination and infestation by blowing fecal dust and parasite eggs, insects, chickens and other domestic animals. Fuel wood is the primary and most probably the only source of energy for most households in Malawi. However, fuel wood shortages are noticeable and felt in many parts of the country. Women now find it difficult to get firewood and men, too, find it hard to find good building poles. In some parts of the country the environmental consequences of the fuel wood

shortages are becoming dramatic. The effect of deforestation on erosion, climatic changes, and desertification are well known. Agricultural production is also affected by the demand for fuel wood substitutes. Some agricultural residues are used for burning at the expense of livestock feeding or soil fertility. Women and children have to walk very far to find fuel wood at the expense of their health and that of other household tasks.

The results of the Malawi Rural Energy Survey (MFNR, 1981) by the Energy Studies Unit found that 60 percent of women felt that fuel wood collection is difficult and the results of Malawi Smallholder Tree Planting Survey (MFNR, 1982) indicates that 82 percent of men feel that it is difficult to get building poles.

2.10 Strategies for sustainable environmental protection in agriculture

One popular suggestion to eliminate the need for firewood for household activities was the use of solar cookers. However, these are virtually non-existent because of their disadvantages. At present, one of the most practical ways of solving the problem of fetching firewood is by introducing and promoting stoves, which use wood and/or charcoal in a more efficient way. The Malawian government also created fuel wood project to tackle the problem of energy. In all, fuel wood represents 35 percent of the total primary energy consumed in Malawi, with agricultural residues 6 percent, petroleum products 5 percent, hydroelectric power 3 percent, and coal 1 percent. In 1983, wood consumption was 10.6 million m³ (round wood). Wood fuel users consumed that total in the following quantities and proportions; rural households 5.1 million m³ (60 percent), urban households 0.9 million m³ (11 percent), tobacco industry 2.0 million m³ (23 percent) and other agro-based/allied rural industries 0.5 million m³ (6 percent).

The strategies being adopted in the government's policy involve the planting of trees and establishment of woodlots and plantations, the protection, control, and management of existing natural forests, and energy-saving systems (Carr, 1991). As many as 175 retail nurseries have been established throughout the country, from which the public, institutions, government and non-governmental organizations can purchase both exotic and indigenous tree seedlings. There exists a National Tree Planting Day, which is aimed at education, training and promoting public awareness of the value of trees. It also sought to promote knowledge of methods employed in establishing, tending and protecting trees and woodlots. Smallholder tree planting shows that 39 percent of the Malawi populations have planted on average 40 trees per family during the past five years. (Carr, 1991).

The Malawi Charcoal Project is being executed by the Forestry Department and is funded by the World Bank. The project is looking into the establishment and operation of semi-industrial charcoal production schemes from waste wood generated within government forest plantations (Bratton, 1986). This has already been introduced on a pilot scale in the Viphya forest; one of the largest forest plantations in Africa and the single most important wood resource in Malawi. In addition to this project the Ministry of Forestry and Natural Resources has started the production of briquettes from saw dust for use as fuel. The Government of Ghana recognizes the fact that the strategies of re-forestation, forest conservation, and energy saving systems will however, have relatively little impact in meeting the sustainable needs of the people. If constraints such as land availability, land tenure, competing uses, lack of tradition of forest, inadequate forestry, extension systems, and the shortages of qualified manpower and finance are under control, it will promote the industry (Sigot, 1995).

The Ministry of Food and Agriculture in Ghana has therefore put in place the Agro-forestry Scheme where farmers are encouraged through the extension agents to grow more trees to replace those that have been cut down, and for future use as fuel use and other related areas (Sigot, 1995).

CHAPTER 3

METHODOLOGY

3.1 Introduction

A meeting of the Chief and opinion leaders of Sota was organized to inform the community about this cross-sectional study. Subsequently, a group meeting of women in the community was organized at which members were encouraged to ask questions in order to prepare them for a questionnaire aimed at collecting information on the effect of agricultural activities on the environment (soil, vegetation and water bodies). A focus group discussion with a group of 15 women was then organized to collect relevant socio-cultural information to facilitate the design of the questionnaire. Possible dates for interviews and administration of the questionnaire were discussed and decisions made.

The questionnaire was administered to selected respondents. The data collected was compiled and analyzed using the Statistical Package for Social Sciences (SPSS).

3.2 Study Population:

The study population was made up of all the 250 women from Sota in the Dangme West District of the Greater Accra region.

3.3 Sampling Techniques

A simple random sampling technique was used to select 110 female farmers following a meeting at which the study was explained to them. This randomised sampling technique gave all units of the target population of 250 women, an equal chance to be selected (Sarantakos, 1993).

The sampling process involved picking pieces of paper from a pool including some numbered from one to a hundred and ten, and ninety others, which were blank. Each female farmer picked one piece of paper and those who picked numbered papers were selected for the research. The pieces of paper were folded and shuffled before being picked.

3.4 Pretest

The interview schedule was pre-tested on a pre-test group numbering 15 female farmers who were selected from Matetse, a neighbouring village also in the Dangme West District. The findings showed that the questions were largely clear except for a question on occupations that required the inclusion of additional options namely, broom making and palm kernel oil production.

3.5 Data collection and analysis

Data was collected in Sota in the Dangme West District of the Greater Accra Region. This data was analysed using the statistical package for social sciences (SPSS)

3.5.1 Data collection

Personal interviews were conducted using an interview schedule (Appendix) in respondent's homes or farms. The questions, which were structured, open and closed ended were asked sequentially. They covered demographic information such as age, ethnic group, religion, and occupation of respondent and marital status, agricultural and environmental issues. The personal interview method was used

because most of the respondents could neither read nor write. It took about 10 minutes to administer the questions to each individual.

3.5.2 Data analysis

The raw data was coded and entered into a database using the Statistical Package for Social Sciences (SPSS). The computer based SPSS (version 10.0) was used for the data analysis. The data were tabulated using frequencies and percentages that were later used to interpret the results.

3.5.3 Limitations

All 110 female farmers who were selected for the study were not available for questioning. Only 101 were available for the study.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter discusses the results of data collected on the effect of agricultural activities on the soil, water bodies, and the vegetation in Sota. The results are presented under the following headings:

- Demographic information on respondents
- Critical issues of the Agricultural activities of respondents and the environment.
- Perception of respondents on effect of agricultural activities on the soil, water and vegetation
- Awareness of environmental issues by respondents

4.2 Demographic information of respondents

This section includes:

- Age distribution of respondents
- Marital status of the interviewed women in Sota
- Ethnicity of respondents
- Educational level of respondents
- Other enterprises respondents were engaged in apart from farming.

4.2.1 Age Distribution of Respondents

Table 4.1 summarises data on the age profile of the 101 female farmers. Their ages ranged between 20 and 79 years.

Table 4.1: AGE DISTRIBUTION OF RESPONDENTS

Age Range (Yrs)	Frequency	Percentages (%)	Cummulative (%)
20-24	15	14.8	14.8
25-29	12	11.9	26.7
30-34	15	14.8	41.6
35-39	13	12.9	54.4
40-44	7	6.9	61.3
45-49	11	10.9	72.2
50-54	11	10.9	83.1
55-59	3	3.0	86.1
60-64	4	4.0	90.1
65-69	3	3.0	93.1
70-74	6	5.8	98.9
75-79	1	1.0	99.9
TOTAL	101	100.0	

Source: Field survey 2001

Generally, the number of female farmers declined with increasing age. The age ranges 20-24 and 30-34 showed the highest frequency of 15 respondents each, whilst the highest age range gave the lowest frequency (1). However, the age range 40-44. Showed a relatively lower frequency (7). In all, the data showed that 42 (41.6%) of the women interviewed in Sota were aged below 34 years. More than half, (55) of the total number of respondents were below 40 years (54.6%).

4.2.2 Marital Status

The data on marital status revealed that the majority 80 (79.2%) of the respondents are currently married. Equal representation of 7 women (6.9%) were either never married or widowed. Just a few of the respondents 3 (3%) were divorced. Separation rate was also very low (4.0%), as shown in Table 4.2.

TABLE 4.2: MARITAL STATUS OF RESPONDENTS

Marital status	Frequency	Percentage
Never married	7	6.9
Married	80	79.2
Divorced	3	3.0
Widowed	7	6.9
Separated	4	4.0
TOTAL	101	100.0

Source: Field survey 2001

4.2.3 Ethnicity of Respondents

As shown in Table 4.3, (89.1%) 90 of the respondents were Dangmes. This is because the majority of them are natives of Sota. Ewe, Akan, and Ga constitute lower percentages of 8.9%, 1% and another 1% respectively. The Ewe, Akan, and Ga could be referred to as settler farmers.

TABLE 4.3: ETHNICITY OF RESPONDENTS

Ethnic Groups	Frequency	Percentage (%)
Dangme	90	89.1
Ewe	9	8.9
Akan	1	1.0
Ga	1	1.0
TOTAL	101	100.0

Source: Field survey 2001

4.2.4 Religion of Respondents

With respect to religion, Christians formed the majority, 89 (88.1%) of the total respondents, followed by Traditionalists 11 (10.9%) and Moslems 1 (1.0%) as shown in Table 4.4.

Religion	Frequency	Percentage (%)
Christianity	89	88.1
Islam	1	1.0
Traditional	11	10.9
TOTAL	101	100.0

Source: Field survey 2001

4.2.5 Educational Level of Respondents

Table 4.5 provides information on the educational level of female farmers of Sota.

TABLE 4.5: EDUCATIONAL LEVEL OF RESPONDENTS

Educational Level	Frequency	Percentage (%)
No formal education	46	45.6
Primary	36	35.6
Middle / JSS	19	18.8
TOTAL	101	100.0

Source: Field survey 2001

The data showed that respondents who had no formal education constituted (45.6%) 46 whilst those who had primary education were 36 (35.6%) so Middle/JSS education was the lowest with 19 (18.8%) as shown in Table 4.5. Even those who were educated had not gone beyond Junior Secondary School.

4.2.6 Other Enterprises Respondents were engaged in apart from farming

From the research conducted, it was realised that 24.8% of respondents were hewers of fuel wood, and charcoal makers, 33.7% of them were both traders, and hewers of fuel wood and charcoal makers, which indicated that those who were hewers of wood and charcoal makers form a total of 58.5% (more than half of the sample size) as shown in Table 4.6. This confirms the view of Awumbila and

Momsen (1995) that “in most developing countries, women perform a dominant role of gathering fuel wood and other forest products for household used and for sale”

TABLE 4.6: OTHER ENTERPRISES RESPONDENTS WERE ENGAGED IN APART FROM FARMING

Enterprise	Frequency	Percentage (%)
Trader	29	28.7
Fuel wood / Charcoal	25	24.8
Trader and fuel wood / charcoal	34	33.7
Only farming	13	12.8
TOTAL	101	100.0

Source: Field survey 2001

4.3. Critical Issues Of The Agricultural Activities Of Respondents And The Environment

This section includes the following:

- Relationship between ownership of land and the number of years farmed.
- Who prepares land and how long respondents have been farming.
- Methods of land preparation engaged in by female farmers at Sota
- How respondents learnt land preparation
- Reasons for continuous farming on a particular piece of land.
- Land acquisition and how livestock was raised
- Land acquisition and how poultry was raised
- Use of fertilizer by respondents
- Type of fertilizer used by respondents

- Irrigational practices of the respondents
- Agro forestry practices of respondents
- Use of agro-chemicals besides fertilizer
- Name of Agro-chemical used
- Knowledge about Integrated Pest Management (IPM)
- Aspect of Integrated Pest Management (IPM) practised

4.3.1 Relationship between ownership of land and the number of years farmed

Data analysis on influence of ownership of farmland on the number of years farmed revealed that out of 85 (84.2%) of respondents who had been farming for less than 20 years, 84 (98.8%) had their own farm lands, whilst 1 (1.2%) farmer had no farm land but farmed on her friend's land.

For those who farmed for 20 years and more, 15 (93.8%) had their own farm lands whilst 1 farmer (6.2%) had no farm land of her own but farmed on her husbands land, as shown in Table 4.7. The ownership of farmland did not appear to influence the number of years that an individual had farmed {Yates corrected Chi-square value 0.13, $P = 0.720$, $df = 1$ }.

TABLE 4.7: RELATIONSHIP BETWEEN OWNERSHIP OF FARMLAND AND NUMBER OF YEARS FARMED

Number of years respondent has been farming		Have farm land		
		Yes	No	Total
How long you have been farming	< 20 years	84 98.8%	1 1.2%	85 100%
	≥ 20 years	15 93.8%	1 6.2%	16 100%
Total	101	99 98.0%	2 2.0%	101 100.0%

Source: Field survey 2001

$$X^2 = 0.13, df = 1, P > 0.05, NS.$$

4.3.2 Who prepares land and how long respondents have been farming

Table 4.8 shows how female farmers in Sota prepared their lands in relation to the number of years they have been farming.

Out of 85 (84.2%) who have been farming for less than 20 years, 26 (30.6%) of them prepared the land themselves and 59 (59.4%) respondents had their lands prepared by hired labour.

Out of 16 (15.8%) respondents who farmed for 20 years or more, 5 (31.3%) prepared the land themselves, whilst 11 (68.7%) used hired labour. The data revealed that majority 69.3% of the female farmers interviewed depended on hired labour for land preparation, which is an indication, that land preparation may not be properly done even if farmers are educated and trained in this aspect of farming.

The chi-square test at 0.05 level of confidence shows that there is no significant difference between respondents who prepare land with respect to length of years {Chi-square $X^2 = 0.06, df = 1, P = 0.808$ }.

TABLE 4. 3.2: WHO PREPARES LAND AND HOW LONG RESPONDENTS HAVE BEEN FARMING

Number of years respondent has been farming		Who prepares land		
		Self	Hired labour	Total
How long you have been farming	< 20 years	26 30.6%	59 69.4%	85 100%
	≥ 20 years	5 31.3%	11 68.7%	16 100%
Total		31 30.7%	70 69.3%	101 100.0%

Source: Field survey 2001

$X^2 = 0.06$, $df = 1$, $P > 0.05$, NS.

4.3.3 Methods of Land Preparation engaged in by female farmers at Sota

Table 4.9 indicates the methods of land preparation engaged in by female farmers in Sota. Majority of them 87 (86.1%) slashed and burned their lands before planting, while 3 (3.0%) slashed only. Three (3.0%) female farmers ploughed and harrowed while 1 (1.0%) did hoeing and another 7 (6.9%) ploughed without harrowing.

TABLE 4.9: METHOD OF LAND PREPARATION BY FEMALE FARMERS AT SOTA

Land Preparation	Frequency	Percentage (%)
Slash and burn	87	86.1
Slash only	3	3.0
Hoeing	1	1.0
Ploughing	7	6.9
Ploughing and harrowing	3	3.0
Total	101	100.0

Source: Field survey 2001

4.3.4 How respondents learnt land preparation

The results in Table 4.10, show that 21 (20.8%) of the female farmers learnt how to prepare their land from their fathers, whilst 8 (7.9%) learnt it from their husbands. One farmer however learnt land preparation from both father and husband. This shows that some respondents learnt land preparation from their father, indicating that they might have been farmers from childhood. However 71 (69.3%) of respondents did not prepare land themselves but used hired labour.

TABLE 4.10: HOW RESPONDENTS LEARNT LAND PREPARATION

Source of Learning	Frequency	Percentage (%)
Father	21	20.8
Husband	8	7.9
Both father and husband	1	1.0
None	71	70.3
Total	101	100.0

Source: Field survey 2001

4.3.5 Reasons for continuous farming on a particular piece of land

Data collected on the number of years respondents farmed on the same piece of land showed that those who had farmed continuously on the same piece of land for less than 15 years (86) were more than those who had farmed for 15 years and more.

Respondents gave various reasons for farming on the same piece of land as shown in Table 4.11. For respondents who farmed less than 15 years on the same piece of land, 15 indicated that the land was very fertile whiles 8 said they farmed on this land because they had no money to lease new lands.

Five women however stated that, they farmed on the same piece of land because new lands were not available for lease. Fifty two (52) respondents indicated that they farmed on a particular piece of land for two reasons, because the land was fertile and also new lands were unavailable for lease. 6 female farmers also stated that apart from the fact that new lands were not available for them to farm, they also did not have money to lease new lands even if they were available.

Concerning respondents who farmed continuously on the same piece of land for 15 years or more, 2 stated that the land was fertile that is why they farmed continuously on it, while 4 respondents indicated that the land was good that is why they farmed on it over and over again and also new lands were unavailable. A farmer, however, stated that even though there was no money to lease new land, the land was also not available for lease.

TABLE 4.11: REASONS FOR CONTINUOUS FARMING ON A PARTICULAR PIECE OF LAND

Number of years farmers cultivated particular piece of land		Why continuous farming on same piece of land					Total
		Land is good	No money for land	Unavailability of new land	Unavailability of land and also land is good	Unavailability of new lands and also no money to lease new lands	
How long you have cultivated a particular piece of land	< 15 years	15	8	5	52	6	86
	≥ 15 years	2	0	0	4	1	25
Total		17	8	5	56	7	93

Source: Field Survey 2001

4.3.6 Land acquisition and how livestock was raised

Table 4.12 shows how lands were acquired by respondents in Sota and how this related to livestock production. This did not apply to 65 female farmers because they did not raise any livestock. For those who leased lands (52) 6 of them practised the semi-intensive system, whilst 6 practised free range system. The livestock raised were sheep, goats and cattle.

Six respondents who obtained land from their family head were into semi-intensive system and 11 of them practised free range system. No female farmer who acquired land from friends raised livestock on a semi-intensive basis, only one woman in this category raised livestock on a free range system.

Three respondents who farmed on their husband's land raise livestock using the semi-intensive system, whilst 1 woman in this category raised them using free range system. Two respondents who acquired land from other sources apart from those mentioned in text, practised either semi-intensive or free range. None of the respondents interviewed practised intensive livestock farming as shown in Table 4.12.

TABLE 4.12: LAND ACQUISITION AND HOW LIVESTOCK WAS RAISED

How livestock was raised		Semi-intensive	Free range	Raised no livestock	Total
How land was acquired	Lease	6	6	40	52
	Family head	6	11	16	33
	Friend	0	1	2	3
	Husband	3	1	4	8
	Other	1	1	3	5
Total		16	20	65	101

Source: Field survey 2001

4.3.7 Land acquisition and how poultry was raised

For poultry production in relation to land acquisition, more respondents were into free range system as compared to semi-intensive as shown in Table 4.13.

Of those who leased lands, 1 practised intensive system of farming, 10 semi-intensive and as many as 23 free range. For those who had land from family heads, none practised intensive, 7 were into semi-intensive and 13 into free range. All respondents who acquired lands from friends did not raise poultry. One woman who farmed on her husbands land raised poultry using the intensive system. Three farmers in this category also used semi-intensive system, and 2 raised poultry using the free range system. For those who acquired land from other sources except those mentioned in text, none raised poultry using semi-intensive whilst 3 practiced free range.

As many as 41 respondents raised poultry using the free range system about 50% of those into poultry production, 21 practiced semi-intensive and 2 the intensive system. Thirty seven (37) respondents did not raise poultry at all.

TABLE 4.13: LAND ACQUISITION AND HOW POULTRY WAS RAISED

How livestock was raised		Intensive	Semi-intensive	Free range	Raised no poultry	Total
How land was Acquired	Lease Family head	1	10	23	18	52
	head	0	7	13	13	33
	Friend	0	0	0	3	3
	Husband	1	2	2	2	8
	Other	0	3	3	1	5
Total		2	21	41	37	101

Source: Field survey 2001

4.3.8 Use of fertilizer by respondents

When respondents were interviewed as to whether they added any nutrient supplements to their soil, 69 (68.3%) indicated that they fertilized their soil, whilst 32 (31.7%) stated that they did not fertilize their soil. This is shown in Table 4.14.

TABLE 4.14: USE OF FERTILIZER BY RESPONDENTS

Use of fertilizer	Frequency	Percentage (%)
Yes	69	68.3
No	32	31.7
Total	101	100.0

Source: Field survey 2001

4.3.9 Type of fertilizer used by respondents

Out of 69 who used fertilizer, only 5 (7.2%) used organic fertilizer. Majority 64 (92.8%) used inorganic fertilizer as shown in Table 4.15.

TABLE 4.15: TYPE OF FERTILIZER USED BY RESPONDENTS

Type of Fertilizer	Frequency	Percentage (%)
Organic fertilizer	5	7.2
Inorganic fertilizer	64	92.8
Total	69	100.0

Source: Field survey 2001

4.3.10 Irrigational Practices of the Respondent

The data on the irrigational practices of the female farmers of Sota revealed that majority of them 65 (64.4%) depended solely on rainfall for their agricultural practices. Fifty-four (54.1%) of those who relied solely on rainfall practised mulching

on their farms to retain moisture. Likewise, 34 (33.6%) of the female farmers practised mulching (Table 4.16).

Only 2 (2.0%) respondents who practised complete irrigation also mulched their farms. Generally, a high number of the female farmers 87 (86.1%) in Sota practised mulching on their farms as shown in Table 4.16.

TABLE 4.16: IRRIGATIONAL PRACTICES OF THE FEMALE FARMERS OF SOTA AND WHETHER THEY PRACTISE MULCHING

Irrigational Practices	Frequency		Whether respondent practise mulching			
			Yes	%	No	%
Rain-fed only	65	64.4	54	54.1	11	10.8
Irrigation only	2	2.0	2	2.0	0	0.0
Both rain-fed and irrigation	34	33.6	31	30.1	3	3.0
Total	101	100.0	87	86.2	14	13.8

Source: Field survey 2001

4.3.11 Agro-Forestry Practices of Respondents

These aspects of the results show some effects that agricultural activities have on the vegetation. From the data collected, it was evident that most female farmers were engaged in enterprises that involved destruction of the vegetation. Eighty seven (86.1%) slashed and burned their lands during land preparation, (Table 4.17) and were also involved in firewood and charcoal enterprise as shown in Table 4.17. Few female farmers however grew trees to replace that which they destroyed.

The female farmers interviewed at Sota listed trees they cultivated as part of agro-forestry activities. Five different types of trees namely, cashew, acacia,

leucenea, mahogany, and mango were planted; Table 4.17. One respondent did not know the name of the tree she planted. The tree planted by the highest number of respondent was Leucenea. Five (35.7%) out of 14 planted leucenea.

In all, only 14 out of the 101 respondents planted trees. Majority 87 (86.0%) did not plant any tree at all.

TABLE 4.17: AGRO-FORESTRY PRACTICES OF RESPONDENTS

Trees Planted	Frequency	Percentage (%)
Cashew	1	7.1
Acacia	3	21.5
Leucenea	5	35.7
Mahogany	2	14.3
Mango	2	14.3
Tree name not known	1	7.1
Total	14	100.0

Source: Field survey 2001

4.3.12 Use of Agro-Chemicals besides fertilizer

Agro-chemicals are known to be very harmful when washed down stream into water, which serves as drinking source for both man and livestock (Goudie, 1989). This might be the case of Sota since most of the respondents' farms were said to be located close to some water bodies.

Most female farmers 55.4% in Sota used agro-chemicals besides fertilizer for their agricultural activities, such as pest control. This implies that more than half of the respondents rely on agro-chemical.

As shown in Table 4.18, 56, (55.4%) used agro-chemicals beside fertilizers, whilst 45 (44.6%) did not use it.

These could be very harmful because some of these agro-chemicals may be washed down stream into water, which serves as drinking source for both man and livestock. (Goudie, 1989).

TABLE 4.18: USE OF AGRO-CHEMICALS BESIDES FERTILIZER

Use of Agro-chemicals	Frequency	Percentage (%)
Yes	56	55.4
No	45	44.6
Total	101	100.0

Source: Field survey 2001

4.3.13 Type of Agro-Chemicals used by the women

The agro-chemicals, used by the women were Cropmax and Karate (Table 4.19). Some framers used a combination of Cropmax and karate. Three respondents (3.0%) used only Cropmax whilst 43 (42.6%) used Karate. Six (5.8%) used a combination of both Cropmax and Karate even though they also used them separately depending on the crop.

The question did not however apply to 45 (44.6%) of the farmers because they did not use any other agro-chemical besides fertilizers.

TABLE 4.19: TYPE OF AGRO-CHEMICALS USED BY WOMEN

Name of Agro-Chemicals Used	Frequency	Percentage (%)
Only Cropmax	3	5.4
Only Karate	43	56.8
Both Cropmax and Karate	10	17.8
Total	56	100.0

Source: Field survey 2001

4.3.14 Knowledge and Practise of Integrated Pest Management (IPM)

Most respondents to the study in Sota (68.3%) had knowledge about Integrated Pest Management (IPM). Only 32 (31.7%) had no knowledge at all about IPM as shown in Table 4.20.

This indicated that there was the awareness of the importance of using organic extracts for pest control rather than inorganic agro-chemicals. Even though 68.3% respondents knew about integrated pest management, which involves the use of organic substances, for pest control, only 54.5% did practise it.

TABLE 4.20: KNOWLEDGE ABOUT INTEGRATED PEST MANAGEMENT (IPM)

Knowledge of IPM	Frequency	Percentage (%)
Yes	69	68.3
No	32	31.7
Total	101	100.0

Source: Field survey 2001

4.4 **Perception Of Respondents On Effect Of Agricultural Activities On The Environment**

Respondents were interviewed on their perceptions about environmental issues such as bush burning, deforestation and soil fertility in relation to their agricultural activities. The results in this section has been categorised into either agree, disagree or uncertain.

4.4.1 Perception of respondents on tree cutting or deforestation in relation to land preparation

Perception of respondents about the clearing of trees during land preparation is summarised in Table 4.21. Eighty-four (83.2%) of the respondents indicated that good land preparation requires the removal of trees. In contrast, only 15 (14.9%) disagreed. Only a small number of respondents 2 (2.0%) were uncertain about the role trees play in good land preparation as shown in Table 4.21.

TABLE 4.21: PERCEPTION OF RESPONDENTS ON THE STATEMENT: TREES SHOULD BE CUT FOR GOOD LAND PREPARATION

Perception	Frequency	Percentage (%)
Agree	84	83.2
Disagree	15	14.8
Uncertain	2	2.0
Total	101	100.0

Source: Field survey 2001

4.4.2 Perception of respondents on deforestation in relation to rain fall pattern

Seventy eight (77.2%) of the respondents agreed that deforestation could reduce rainfall. On the other hand, 14 (13.9%) disagreed with the opinion that tree felling reduces rainfall. Nine (8.9%) respondents were however uncertain (Table 4.22).

TABLE 4.22: PERCEPTION OF RESPONDENTS ON THE STATEMENT: DEFORESTATION LEADS TO REDUCTION IN RAINFALL

Perception	Frequency	Percentage (%)
Agree	78	77.2
Disagree	14	13.9
Uncertain	9	8.9
Total	101	100.0

Source: Field survey 2001

Twelve (11.9%) agreed and 4 (4.0%) were uncertain. A majority of 85 (84.1%) however disagreed with this statement, as shown in Table 4.23. This shows that respondents believe that there is a link between deforestation and rainfall.

TABLE 4.23: PERCEPTION OF RESPONDENTS ON THE STATEMENT: TREES FELLING INCREASES RAINFALL

Perception	Frequency	Percentage (%)
Agree	12	11.9
Disagree	85	84.1
Uncertain	4	4.0
Total	101	100.0

Source: Field survey 2001

4.4.3 Perceptions of respondents on the statement: Many trees lower the fertility of the soil

The opinions of the women farmers at Sota on possible effect of their agricultural activities on soil fertility were investigated.

When asked for their opinion on the assumption that the presence of many trees lowers the fertility of the soil, 44 (43.6%) agreed while 45 (44.5%) disagreed. Twelve (11.9%) respondents were uncertain about this statement as indicated in Table 4.24.

TABLE 4.24: PERCEPTION OF RESPONDENTS ON THE STATEMENT: MANY TREES LOWER THE FERTILITY OF THE SOIL

Perception	Frequency	Percentage (%)
Agree	44	43.6
Disagree	45	44.5
Uncertain	12	11.9
Total	101	100.0

Source: Field survey 2001

4.4.4 Perceptions of female farmers in Sota on the use of cover crops for soil fertility

With regards to the possible effects of cover crops on soil fertility, Table 4.25 shows that an overwhelming majority 87 (86.2%) of the respondents agreed that cover crops enrich the soil. Five (5.0%) disagreed with the statements that cover crops enrich the soil. Nine (8.9%) respondents were however uncertain about the effect of cover crops on soil fertility as shown in Table 4.25.

TABLE 4.25: PERCEPTION OF RESPONDENTS ON THE STATEMENT: COVER CROPS ENRICH THE SOIL

Perception	Frequency	Percentage (%)
Agree	87	86.1
Disagree	5	5
Uncertain	9	8.9
Total	101	100.0

Source: Field survey 2001

4.4.5 Perception of respondents on the statement: Grass promotes soil erosion

As shown in Table 4.26, women of Sota gave their opinions about the statement “grass promotes soil erosion”, and a total of 16 (15.8%) agreed. On the other hand, a total of 80 (80.1%) of the respondents disagreed with the assertion that grass promotes soil erosion. Four (4.0%) respondents however were uncertain.

TABLE 4.26: PERCEPTION OF RESPONDENTS ON THE STATEMENT: GRASS PROMOTES SOIL EROSION

Perception	Frequency	Percentage (%)
Agree	16	15.9
Disagree	81	80.1
Uncertain	4	4.0
Total	101	100.0

Source: Field survey 2001

4.4.6 Perceptions of female farmers in Sota on whether mechanical tilling of soil causes more erosion than manual tilling

Table 4.27 summarizes respondents' views on the relative effects of mechanical and manual tilling on soil erosion. A total of 86 (85.2%) women farmers thought that mechanical tilling causes more soil erosion than manual tilling. A small number of respondents 8 (7.9%) thought otherwise and 7 respondents were uncertain as shown in Table 4.27.

TABLE 4.27: PERCEPTION OF RESPONDENTS ON THE STATEMENT: MECHANICAL TILLING CAUSES MORE SOIL EROSION THAN MANUAL TILLING

Perception	Frequency	Percentage (%)
Agree	86	85.1
Disagree	8	7.9
Uncertain	7	6.9
Total	101	100.0

Source: Field survey 2001

4.4.7 Causes of erosion

From the study, rainfall was assigned the major cause of erosion 57 (56.5%) followed by lack of mulch on the farm as a result of throwing plant residues away 29 (28.7%). Vehicles which go to farms to cart food stuffs ranked third as the cause of erosion 13 (12.8%) whilst improper ploughing was thought to be the least cause of erosion 2 (2.0%) Table 4.28.

TABLE 4.28: CAUSES OF EROSION

Causes of erosion	Frequency	Percentage (%)
Rainfall	57	56.5
Removal of plant residues	29	28.7
Vehicles	13	12.8
Improper ploughing	2	2.0
Total	101	100.0

Source: Field survey 2001

4.4.8 Perception of respondents on the effect of slash and burn on soil fertility

A total of 33 (32.7%) agreed that burning of crop residue is better than burying them as indicated in Table 4.29 and 4.30. One (1.0%) respondent was however uncertain, whilst 67 (66.3%) which forms the majority disagreed with the statement that burning crop residues is better than burying.

TABLE 4.29: PERCEPTION OF RESPONDENTS ON THE STATEMENT: BURNING CROP RESIDUE IS BETTER THAN BURYING

Perception	Frequency	Percentage (%)
Agree	33	32.7
Disagree	67	66.3
Uncertain	1	1.0
Total	101	100.0

Source: Field survey 2001

Concerning slash and burn, in relation to soil improvement, a total of 86 (85.2%) respondents indicated that slash and burn improves soil fertility. A total of 14 (13.8%) respondents disagreed, whilst 1 (1.0%) respondent was uncertain about the statement, burning crop residue is better than burying.

TABLE 4.30: PERCEPTION OF RESPONDENTS ON THE STATEMENT: SLASH AND BURN IMPROVES SOIL PRODUCTIVITY

Perception	Frequency	Percentage (%)
Agree	86	85.2
Disagree	14	13.8
Uncertain	1	1.0
Total	101	100

Source: Field survey 2001

4.4.9 Perception of respondents on the effect of the use of agro chemicals on water bodies

A total of 63 (62.4%) of the farmers agreed that inorganic fertilizers cause pollution of water bodies. As many as 23 (22.8%) were uncertain about whether inorganic fertilisers could cause pollution of water bodies, and a total of 15 (14.9%) disagreed with this statement as shown in Table 4.31.

TABLE 4.31: PERCEPTION OF RESPONDENTS ON THE STATEMENT: INORGANIC FERTILISER CAUSES POLLUTION OF WATER BODIES

Perception	Frequency	Percentage (%)
Agree	63	62.5
Disagree	15	14.8
Uncertain	23	22.8
Total	101	100.0

Source: Field survey 2001

Regarding respondents opinion about the acceptability of the use of chemicals in fishing, only 3 (3.0%) agreed that applying chemicals in fishing is a good practice (Table 4.32). No respondent was uncertain. An overwhelming number of 98 (97%) disagreed with the suggestion that applying chemicals in fishing is a good practice, as shown in Table 4.32.

TABLE 4.32: PERCEPTION OF RESPONDENTS ON THE STATEMENT: APPLYING CHEMICALS IN FISHING IS A GOOD PRACTICE

Perception	Frequency	Percentage (%)
Agree	3	3.0
Disagree	98	97
Uncertain	0	0.0
Total	101	100.0

Source: Field survey 2001

4.4.10 Perception of respondents about the effects of both organic and inorganic fertilisers on crops and the environment

The opinion of respondents was sought on the statement “vegetables produced with farm yard manure are not good for human consumption”. As many as 90 (89.0%) disagreed with this statement while 5 (5.0%) were uncertain. Six (6.0%) of the respondents agreed with the statement that vegetables produced with farmyard manure are not good for human consumption (Table 4.33).

TABLE 4.33: PERCEPTION OF RESPONDENTS ON THE STATEMENT: VEGETABLES PRODUCED WITH FARM YARD MANURE ARE NOT GOOD FOR HUMAN CONSUMPTION

Perception	Frequency	Percentage (%)
Agree	6	6.0
Disagree	90	89
Uncertain	5	5.0
Total	101	100.0

Source: Field survey 2001

4.4.11 Perception of Respondents on the statement: Inorganic Fertiliser Leaves Toxic Substances in the Soil

When female respondents in Sota were asked whether inorganic fertiliser leave toxic substances in the soil, a total of 50 (49.5%) agreed. A rather high percentage 34 (33.7%) were uncertain about the assertion that inorganic fertilisers leave toxic substances in the soil. Seventeen (16.8%) however disagreed with this statement as shown in Table 4.34

TABLE 4.34: PERCEPTION OF RESPONDENTS ON THE STATEMENT: INORGANIC FERTILISERS LEAVES TOXIC SUBSTANCES IN THE SOIL

Perception	Frequency	Percentage (%)
Agree	50	49.5
Uncertain	34	33.7
Disagree	17	16.8
Total	101	100.0

Another assertion put to the female farmers of Sota was “inorganic fertilizers are better than farm yard manure”, to which a total of 36 (35.7%) agreed. A total of 47 (46.5%) disagreed. As many as 18 (17.8%) were uncertain about the assertion that inorganic fertilisers are better than farm yard manure as indicated in Table 4.35.

TABLE 4.35: PERCEPTION OF RESPONDENTS ON THE STATEMENT: INORGANIC FERTILISERS ARE BETTER THAN FARM YARD MANURE

Perception	Frequency	Percentage (%)
Agree	36	35.7
Disagree	47	46.5
Uncertain	18	17.8
Total	101	100

Source: Field survey 2001

4.5 Awareness Of Environmental Issues By Respondents

The next section summarizes findings on level of awareness of major environmental issues of female farmers in Sota. The major issues considered here include:

- awareness of effect of smoke on the environment
- awareness of whether trees are part of the environment
- awareness of the importance of trees to man
- awareness of how to solve environmental problems

4.5.1 Awareness of effect of smoke on the environment

Table 4.5.1.1 summarises the opinions of the respondents about the assertion that “smoke causes air pollution” A total of 82 (80.2%) out of the 101 respondents interviewed agreed with the statement. Comparatively fewer respondents a total of 11 (10.9%) in all disagreed that smoke causes air pollution. 8 (7.9%) were however uncertain about this statement as indicated in Table 4.5.1.1.

TABLE 4.5.1.1: PERCEPTION OF RESPONDENTS ON THE STATEMENT: SMOKE CAUSES AIR POLLUTION

Perception	Frequency	Percentage (%)
Agree	82	81.2
Disagree	11	10.9
Uncertain	8	7.9
Total	101	100

Source: Field survey 2001

4.5.2 Awareness of whether trees are part of environment

Data on the opinion of respondents on the assertion that trees are not part of the environment are shown in Table 4.37. A total of 92 (91.1%) of them disagreed. A relatively small number 9 (8.9%) in all, however agreed that trees are not part of the environment. As shown in Table 4.37, none of the respondents was uncertain about the assertion.

TABLE 4.37: PERCEPTION OF RESPONDENTS ON THE STATEMENT: TREES ARE NOT PART OF THE ENVIRONMENT

Perception	Frequency	Percentage (%)
Agree	9	8.9
Uncertain	0	0.0
Disagree	92	91.1
Total	101	100.0

Source: Field survey 2001

4.5.3 Awareness of the importance of trees to man

The views of respondents were sought on possible environmental impact of the hypothetical situation when the last tree dies on earth, what happens, 87 (86.1%) indicated that there would be no rains when the last tree dies, whilst 3 (3.0%) stated that man would die as shown in Table 4.38. 11 (10.9%) however stated that there would be no rains and as a result man would die. In all 99 (98.0%) of the respondents thought it was important to plant trees.

TABLE 4.38: PERCEPTION ON POSSIBLE ENVIRONMENTAL IMPACT OF THE DEATH OF THE LAST TREE ON EARTH

Effects	Number	Important to plant trees		
		Yes	No	No Idea
There will be no rains	87 (86.1)	85 (84.2)	2 (2.0)	0 (0.0)
Man would die	3 (3.0)	3 (3.0)	0 (0.0)	0 (0.0)
There will be no rains and also man would die	11 (10.9)	11 (10.9)	0 (0.0)	0 (0.0)
Total	101 (100.0)	99 (98.0)	2 (2.0)	0 (0.0)

Source: Field survey 2001

4.5.4 Awareness of how to solve environmental problems

Female farmers in Sota were interviewed about how environmental problems in their area could be solved (Table 4.39). Fifty two (51.5%) of the respondents interviewed indicated that provision of good drinking water could solve environmental problems, while 48 (47.5%) stated that education on environmental issues would solve environmental problems as shown in Table 4.39. In response to the aspects of environmental education they needed, 51 (50.5%) stated that they would like to be educated on good agricultural practices, 20 (19.8%) were interested in pest management and 30 (29.7%) wanted education on environmental sanitation.

**TABLE 4.39: RESPONDENTS SUGGESTIONS ON HOW TO SOLVE
ENVIRONMENTAL PROBLEM**

Suggestions	Frequency	Percentage (%)
Provision of drinking water	52	51.5
Education on environmental issues	48	47.5
No idea	1	1.0
Total	101	100.0

Source: Field survey 2001

CHAPTER 5

DISCUSSION

5.1 Introduction

One of the main problems in the developing world is poverty (Statistical Services, 1992). This poverty situation promotes illiteracy, poor sanitation, inadequate nutrition, poor health, and negative exploitation of the environment. In most developing economies, agriculture plays an important role in poverty alleviation with women as major contributors. The work described in this thesis was therefore designed to investigate women's role in agriculture, and its effect on the environment in Sota, a rural village in the Dangme West District of the Greater Accra region of Ghana. The discussion is presented under the following headings:

- Demographic information
- Critical factors/ issues of the agricultural activities of respondents and the environment
- Level of Awareness of environmental issues of respondents
- Factors which influence behavioural changes of the female farmers with regards to the sustenance of the environment

5.2 Demographic information

This section includes:

- Age of respondents
- Marital status of respondents
- Ethnicity of women farmers of Sota
- Religious practices of respondents
- Educational level of respondents
- Occupation of respondents

The 1984 census in Ghana defined women as females who are 21 years and above, with or without children, whilst the 2000 census redefined the age to 18 years or more (Statistical Services, 2000).

5.2.1 Age of respondents

In this study, the age range of the women farmers interviewed at Sota was 20 – 79 years. The numbers of female respondents was shown to decline with age as revealed by analysis of populations which normally follow typical pyramidal structure (source: US census Bureau, International Data Base; <http://www.census.gov/cgi-bin/ipc/idbpys.pl>). The observation that majority (100%) of the women respondents in Sota were involved in agriculture was not surprising, as 93 percent of Malawian women for example, were reported to live in rural areas and up to 85% were involved full time in their own holdings in subsistence agriculture (Clerk, 1975; Carr, 1991). The finding in this study, that most respondents were younger women aged between 20 and 34 years contradicted popular thinking that younger women in rural areas drift to the cities to look for other jobs. This observation may be explained by the relatively short distance from Accra to Sota, which allowed the women to commute daily.

5.2.2 Marital status of respondents

In a study in Anlo Ghana, Nukunya (1969), reported that the majority of rural women were married, thereby supporting the data on marital status which revealed that the majority, 79.2% of the respondents in Sota are currently married. It was realized in this study however that just having children with a man without some or none of the marriage rites was in some cases referred to as marriage. In line with

reports by Nukunya (1991) the number of separated, divorced and widowed women were each highest among older women. This may be partly explained by the length of time for which they have been married.

5.2.3 Ethnicity of women farmers of Sota

The data revealed that the majority (89.1%) of respondents are Dangmes. This could be because Sota is a community in the Dangme speaking area of Ghana, and so has indigenous members of the community living there. Ewes, Akans and Gas constituted lower percentages 8.9%, 1% and 1% respectively, mainly because they were settler farmers.

5.2.4 Religious practices of respondents

Various institutions, including religion and education have been reported to influence women's status in societies (Hamilton, 1978; Beneria, 1982; Molyneux, 1988). With respect to religion, Christians formed a majority 88.1% of the total respondents in Sota, followed by Traditionalists 10.9% and Moslems 1.0%. In a study in northern Ghana Sigot (1995) identified major elements in the general traditional religious beliefs and practices which constituted the basis for preserving flora and fauna.

The low percentage of traditionalists in Sota however suggest that traditional religious beliefs and practices would have lesser influence on preservation of the flora and fauna.

5.2.5 Educational level of respondents

The data gathered from the women interviewed at Sota showed that the level of education of women farmers was low, 45.6% of them had no formal education

whilst the remaining 54.5% had some formal education. In this study, all respondents were found to be involved in crop farming which took much of their time. This is in agreement with Brown (1994), who reported that most Ghanaian women spent more time on farms than their male counterparts. Furthermore, less interest in the livestock industry may be related to the observation that, almost every household raised poultry or local birds on a free range or semi-intensive system.

5.2.6 Occupation of respondents

According to Bukh (1979), Ghanaian women carried out more than one trade at the same time. This is mainly an attempt to bring some money into the home to supplement what their male counterparts provided (Bukh, 1979). It was therefore not surprising that most of the respondents in this study were also engaged in other non-agricultural enterprises namely, charcoal/fuel wood hewers and traders.

Savane (1981) and Carr (1991) found that apart from the nomadic people rearing cattle and sheep, women in addition to domestic tasks, devoted themselves to livestock rearing. Very few poultry producers 2.0% practised intensive system and 41 (40.6%) of them raised their birds on free range. However, many more respondents 21 (20.8%) kept their birds under semi-intensive system. Livestock production was also mostly practiced under the semi-intensive system of farming.

5.3 **Critical factors/ issues of the agricultural activities of respondents and the environment**

This section discusses women's role in agriculture and the economy and its effect on the environment. It is presented under the following headings:

- Effect of agricultural activities on the soil

- Effect of agricultural activities on water bodies
- Knowledge of Integrated Pest Management (IPM)
- Mulching and irrigational practices
- Effect of agricultural activities on the vegetation

5.3.1 Effect of agricultural activities on the soil

Generally, the number of farmers in any community decreases as the age advances, due to the tedious nature of the work. The data on number of years the respondents farmed on their land showed that those who have been farming for shorter periods (< 20 years) were more than those who have been farming for longer periods (≥ 20 years). Interestingly, the majority of respondents indicated that they farmed continuously on the same piece of land because the land was very fertile. This reason may have been given, possibly because of replenishment of soil nutrients, which is further discussed below, or the farmers were not knowledgeable about the expected yields. Available literature revealed that, overuse of a particular piece of land leads to reduction in yield, whilst optimal land use is not attained and land is usually underused, over-used or misused (Halm and Asiamah, 1984). Nevertheless, it is important to note that some of the subjects attributed their continuous farming on the same piece of land to lack of funds for acquisition of new lands and unavailability of land. This situation is highly influenced by land lease policies, which are implemented through family heads and are not very well defined. In Ghana for instance men and women assert categorically that women do not have hereditary rights to land (Sigot, 1995). However, in practice, women have rights to their husbands farms.

In developing countries, access to land and security of tenure has been identified to constitute crucial constraints facing women farmers (NCWD, 1991).

Indeed, the National Council on Women and Development has identified inaccessibility of land and credit as major problems facing small-scale women farmers in Ghana. In this study, ownership of farmland did not appear to affect the number of years the respondents farmed. However, Africa's land has very limited agricultural capacity with only 19% being free from inherent limitation. Much of it is in the hands of a few men. From this study, rainfall was mentioned as the major cause of erosion (56.5%) followed by removal of plant residues (28.7%), and interestingly, vehicles (12.8%). Improper ploughing was assigned only 2% as the cause of erosion by the respondents. The role of rainfall in erosion is well established (Goudie, 1989). However, the relative impact of the various causes of erosion in any locality may differ. The opinion of the women farmers of Sota that rainfall is a major cause of erosion in the area therefore needs to be addressed. This is especially necessary, since soil erosion is one of the greatest environmental problems in the less developed countries. It is at least twice as severe as it is in the USA, and it continues to grow worse as the demand for food increases (Agyeman and Brookman – Amisshah, 1996).

Nevertheless, an overwhelming majority (86.2%) of them indicated that cover crops enrich the soil. Olaitan and Lombin (1984), reported that the roots of higher plants aid in binding the soil particles together, thereby forming a good structure, while the leaves fall and provide organic matter.

Goudie (1989), reported that ploughing opens the land to erosion even more than removal of the original vegetation. In this study, 85.1% of the respondents thought that mechanical tilling causes more soil erosion than manual tilling. However, mechanical tillage could be made relatively environmentally friendly using modern conservation tillage practices (Goudie, 1989).

Regarding their views about how to solve environmental problems in their area, 51.5% of female farmers in Sota indicated that provision of good drinking water was needed to solve environmental problems, while 47.5% stated that education on environmental issues was necessary. On the issue of water pollution, 62.4% of the women farmers correctly identified inorganic fertilizers as possible sources of contamination. However, quite a number of respondents 22.8% were uncertain about whether inorganic fertilizers could cause pollution of water bodies. This is particularly interesting to note and consider in any future educational efforts in the area, since the farmers (55.4%) used agrochemicals that could leave toxic substances in the soil.

5.3.2 Effect of agricultural activities on water bodies

The results of this study showed that the female farmers of Sota used both agrochemicals and irrigation. Brady (1990) emphasised that, agrochemicals move into the soil where some became a problem because they are not biodegradable and persist for many years. Despite the beneficial effects of pesticides, they also destroy some non-target organisms such as beneficial insects and some soil organisms (Brady, 1990). Moreover, some toxic agrochemical residues enter the food chain, for example, through concentration in soil organisms such as earthworms, which may be eaten by birds and fish. Montgomery (1992), pointed out that herbicides and pesticides are already a significant source of pollution in agriculture. Most such compounds including the ones in use in Sota (Karate, Cropmax and Sampi) are known to have toxic side effects on people, farm animals and other organisms. It is important therefore for the use of these chemicals in Sota to be monitored in order to avoid any serious effects.

The women also reported the use of fertilizers. Meanwhile, Halm and Asiamah (1984) indicated the suspicion that uncontrolled use of some fertilizers may lead to soil acidification and salinization in the drier parts of Ghana. It would therefore be appropriate to encourage the women farmers to use fertilizers in a recommended manner that limits their deleterious effects.

Toxic agro-chemicals in the soil could be very harmful because some of them could be washed down-stream into water, which serves as drinking source for both man and livestock (Goudie, 1989). Encouragingly, the farmers opinion about the acceptability of the use of chemicals in fishing was very good, as 97% of them disagreed with the use of chemicals in fishing.

5.3.2.1 Knowledge of Integrated Pest Management (IPM)

The observation in this study that a higher percentage 68.3% of the respondents knew about integrated pest management (IPM) and 54.5% practiced it, suggests that modern approaches to pest control involving IPM could easily be promoted in Sota. Changing agricultural practices may reverse any likely environmental degradation in Sota resulting from the use of agrochemicals. For example, inorganic fertilisers may be substituted for farmyard manure, and the practice of IPM adopted instead of the use of pesticides (Goudie, 1989).

5.3.2.2 Mulching and irrigational practices

As reported by Olaitan and Lombin (1984), mulching enhances crop productivity. The results of this study revealed that most of the female farmers 86.2% in Sota practiced mulching on their farms. However, the data on irrigational practices showed that the majority of them 64.4% depended solely on rainfall for water.

Interestingly, all the female farmers mulched their farms irrespective of whether they relied on rainfall, both rainfall and irrigation or total irrigation.

5.3.3 Effect of agricultural activities on the vegetation

From the results, majority of the female farmers (86.1%) in Sota prepared their land by slashing and burning before planting, while 3.0% slashed only. Generally, fewer farmers engaged in ploughing, hoeing and harrowing (10.9%) compared to those who practiced slashing and burning. The extensive use of slash and burn, which is reported to be primitive and unscientific (Morgan et al., 1995) is an indication that most of the women farmers in Sota apply improper methods, which impact greatly on the vegetation. The traditional farming systems of slash and burn are applicable to an extent (Morgan et al., 1995). This is because in practice, farmers cut down bush vegetation on small plots which are usually less than one hectare (2.5 acres) in area and the ashes of the burnt vegetation, which contains some nutrients are utilized as fertilizer. However, tree felling has become common in Ghana, especially in the rural parts of the country where farmers cut down trees for sale as firewood with environmental consequences (Awumbila and Momsen, 1995). The use of the slash and burn method promotes destruction of soil nutrients, texture and structure and causes soil erosion (Enger and Smith, 1992).

The result from this study showed that only 30.7% of the female farmers prepared the land themselves, compared to 69.3% who used hired labour. This suggested that the knowledge, attitudes and practices of hired individuals engaged in land clearing at Sota may significantly influence the state of the environment. Interestingly, of the 30.7% of the respondents who prepared the land themselves, the majority, 20.8% learnt from their fathers. This meant that most land preparation

practices may have been acquired during childhood. Nevertheless, 7.9% still learnt from their husbands, thereby suggesting that measures could be implemented in the area to facilitate technology transfer and sharing of modern environmentally friendly farming practices. Several trees including fast growing woody plants and fruit trees have been reported to be suitable for revegetation (Sigot, 1995). The female farmers interviewed at Sota listed trees (Cashew, Acacia, Leucenea, Mahogany and Mango) they cultivated as part of agro-forestry activities. Leucenea has been promoted by the Ministry of Food and Agriculture as woodlot for use as firewood. Also, mangoes and cashew are being promoted as cash crops, while Mahogany is an important timber species. Leucenea particularly was most frequently planted 35.7% possibly because of its fast growing nature and a high demand for firewood. Nevertheless, majority of the respondents 86.1% did not plant any trees at all, and 82.2% of them agreed that good land preparation require the removal of trees. It was therefore not surprising that 91.1% of the respondents agreed with the assertion that trees are not part of the environment.

Surprisingly, 43.6% of the women farmers in Sota agreed with the assumption that many trees lower the fertility of the soil, and an additional 11.9% were uncertain about the assumption.

5.4 Level of Awareness of environmental issues of respondents

This section is presented under the following heading:

- Environmental educational needs of respondents

As summarized in the results of this study (Table 4.38 and 4.39) the respondents provided information about their opinions on the role played by

vegetation in maintaining soil fertility. The observation that majority of the respondents (82.2%) were of the opinion that removal of trees during land preparation is good practice, suggests that they are not fully aware of the negative environmental consequences of slash and burn. Also, the fact that only a small percentage (2.0%) were uncertain about the role trees play in good land preparation, is an indication that most of the female farmers at Sota had strongly formed opinions about the subject. Some of the opinions of respondents on environmental issues, such as the preference of burying crop residue to burning by the majority (66.3%), and disagreement with the assertion that grass promotes soil erosion (80.1%), are likely to lead to practices that could improve soil fertility. Again the observation that only 1.0% of respondents were uncertain about the effects of burying or burning of crop residue on the soil confirms earlier suggestions that most respondents have already formed opinions. For example, 88.9% of respondents who disagreed with the assertion that grass promotes soil erosion. Majority of the female farmers (89.0%) in Sota disagreed with the statement that vegetables produced with farm yard manure are not good for human consumption, but 35.7% of them agreed that “inorganic fertilizers are better than farm yard manure”. This apparent preference for inorganic fertilizers may be influenced by the bulky nature of farm yard manure. Furthermore, the tendency for more rapid regeneration of weeds associated with the use of manure, especially cow dung, may be important.

The importance of trees in supporting life on earth as well as providing various forest products to promote development is very well established (Boon, 1997). The view of 86.1% of the women farmers of Sota that there would be no rains when the last tree dies on earth is therefore along the general line of thinking.

Prompted by this question, it should not be surprising that 98% of the respondents thought it was important to plant trees.

5.4.1 Environmental educational needs of respondents

Environmental education would be needed to change the attitudes and practices of the female farmers of Sota.

Any attempts to change their attitudes and practices, therefore, would require intensive environmental education. The opinion of the majority of respondents that they need education on environmental issues, however, suggest that the farmers would easily adopt to more modern practices that would promote a sustainable environment. Indeed, Boon and Hens (1997) indicated that the most demanding task in environmental management probably concerns educating and training to be capable of predicting the likely outcome of human activities on society and the environment itself. In this study, the views of the respondents about aspects of environmental education they would want (education on good agricultural practices, pest management and environmental sanitation) all appeared relevant.

5.5 Factors which influence behavioural changes of the female farmers with regards to the sustenance of the environment

According to Carr (1991), various factors influence the behavioural changes of female farmers with regards to the sustenance of the environment. This include activities like felling of trees for fuel wood and charcoal which are encouraged by economic pressures in households, in both rural and urban areas, particularly in developing countries. However, tree felling has become common in Ghana, especially in the rural parts of the country where farmers cut down trees for sale as firewood

with environmental consequences (Awumbila and Momsen, 1995). In this study, the involvement of the women farmers of Sota in tree felling activities was confirmed.

From the data collected it has been shown that agricultural activities of female farmers in Sota in the Dangme West District of the Greater Accra Region of Ghana may affect the soil, water bodies and vegetation. Further work is therefore necessary to determine the extent of environmental degradation in the area.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

This research was conducted to investigate the effects of agricultural activities of rural women on the soil, water bodies and vegetation in Sota, in the Dangme West District of the Greater Accra Region of Ghana.

Data was collected and analysed on the effect of agricultural practices of female farmers in Sota on the soil, water bodies and vegetation, their level of awareness of major environmental issues, factors which influence behavioural changes of the female farmers with regards to the sustenance of the environment and to make suggestions for environmental protection and sustenance.

The simple random sampling technique was used in selecting 110 female farmers, but 101 were available for the study. Personal interviews were conducted with respondents in their homes and/or farms. The statistical package for social sciences (SPSS) was used to analyse the data.

The data analyses revealed that most of the respondents undertook activities, which affected the environment negatively. For example, the practice of slash and burn affected the vegetation and caused deforestation, which in turn could affect the weather pattern in Sota and its environments. The fire used during slash and burn may also kill some soil microbes which promote soil fertility by working on plant material to break them down into humus.

The research also showed that as many as 64 (63.4%) of the respondents used inorganic fertilizers, which is an indication that there might be a large deposit of toxic substances retained in the soil, which is detrimental to crop growth.

It was also realised that even though 68.3% of the female farmers knew about (IPM) integrated pest management, only 54.5% did practiced it.

Many respondents instead of practising IPM it was realised used a lot of agro chemicals such as karate and cropmax. As many as 55.4% of respondents used agro chemicals. This could affect water bodies if chemicals are carried along in runoffs from streams.

Irrespective of the level of awareness of major environmental issues, it was revealed that 67.3% of the respondents thought that agricultural activities do not have negative effects on the environment.

Based on the findings it was concluded that agricultural activities of female farmers in Sota in the Dangme West District affect the soil, water bodies and vegetation. Activities such as slash and burn affected the vegetation, reduced soil fertility and promoted erosion, whilst the use of agrochemicals polluted water bodies.

6.2 Conclusion

From this work it was evident that the women farmers of Sota engaged in agricultural practices, such as Slash-and-burn, felling of trees for fuel wood and charcoal, and use of agro-chemicals, which could have degradative effects on the environment. The opinions of the female farmers on environmental issues concerning food production and environmental education, suggested that the practices they employed caused deforestation and erosion. It was also found out that the farmers

considered rainfall as a major cause of erosion with possible consequences on agriculture.

It was established that the women farmers had inadequate knowledge about most environmental issues, especially tree felling, use of agro-chemicals, and land preparation. The women farmers also engaged in domestic roles and executed household chores such as cooking with fuel wood, which may influence their behaviour towards sustenance of the environment.

6.3 Recommendations

Following the establishment that the women farmers of Sota in the Dangme West District of the Greater Accra Region of Ghana, engage in agricultural activities with possible environmental consequences, it is recommended that:

1. Further work is carried out to determine the extent of environmental degradation in Sota so that effective solutions may be found.
2. Further work is conducted to establish the role of poverty and sociocultural practices on the environment in Sota.
3. Efforts are made to promote environmental education and good agricultural practices, pest management and environmental sanitation as requested by the farmers.
4. The land tenure system operating in Sota is studied so as to identify feasible suggestions to encourage farmers to engage in long term agricultural ventures.
5. Relevant ministries such as MOFA and EPA intensify educational programmes for women farmers on environmental issues.

BIBLIOGRAPHY

- Adu, J. I. (1999): *Woman in Human Development*. Horizon Publication. Accra.
- Agyeman, V.K and Brookman-Amisshah, J. (1996): *Land Use In Ghana*. Forest Products Institute, Kumasi.
- Ahmed, M. (1997): *Women In Men's Occupation A study Of Women In Kumasi Magazine*. A Project Work Submitted To The Department Of Sociology, University Of Ghana, Legon. In Partial Fulfillment Of The Requirement For BA . (Hons) Degree In Sociology P.31
- Alexandratos N. (1995): *World Agriculture: Towards 2010*. An FAO study. FAO and John Wiley and Sons, New York, p 1-34.
- Amisshah, S.B., Kasanga, R.K., and Edmundson, A.R. (1990): *Land Management Systems In Ghana*. Land Administration Research Centre. University of Science and Technology, Kumasi.
- Ardayfio-Schandorf, E. (1987): *Ghana Environmental Action Plan*. Advent Press Accra, Ghana.
- Awuku, K.A., Brese, G.K., Ofori, G.K., and Baiden, S.O. (1991): *Senior Secondary School Agriculture And Environmental Studies*. Evans Brothers Limited, London.
- Awumbila, M. and Momsen, J.H. (1995): *Gender and The Environment: Women's Time Use As A Measure of Environmental Change*. Elsevier Science Ltd; Great Britain.
- Balee, W. (1994): *Footprints of the forest. Ka'apor Ethnobotany. The historical ecology of plant utilization by an Amazonian people*. Colombia University press. New York.

- Bell, M K., Browsers, E.A., Chalmer, N.R., Ridge, I., Turner, C., and Varley M.E (1975): *Energy Flow Through Ecosystems* , Open University Press, Pp 61.
- Beneria, L. (1982): "Introduction". In Beneria, Lourdes ed. *Women and Development: The Sexual Division of Labour In Rural Societies*. New York: Praseger.
- Benneh, G. (1988): *Women Access to Land and Agricultural Production in Ghana*. University of Ghana Press, Accra pg.8-9.
- Berger, M. (1989): *Giving women credit: The strength and limitation of credit as a tool for alleviating poverty*. World Development 17(7), p 1017 - 1032.
- Board For International Food And Agriculture (BIFAD) (1988): *Task force Environment And Natural Resources: Strategies for Sustainable Agriculture*. Washington D.C.
- Board on Agriculture/ National Research Council (1989): *Alternative Agriculture Committee On The Role of Alternative Farming Methods In Modern Production*. Washington, DC: National Academy Press.
- Boon, E.K. and Hens, L. (1997): Environmental planning. In: *Environmental management in West Africa*. Eds, Boon, E.K. and Hens, L., Proceedings of a seminar, Cote D'Ivoire, July 24 to 7 August; p63 – 97.
- Bortei-Doku, E. (1990): "CUSO Northern Ghana Women in Development Project" *Baseline Survey Report*, Accra: CUSO Ghana.
- Botkin, D. Keller. E. (1995): *Environmental Science. Earth As A Planet*. Oxford University Press.
- Brady, N.C. (1990): *The Nature And Properties of Soil 10th Ed*. Macmillan Publishing Company, N.Y.

- Bratton, M. (1986): *Financing smallholder production: A comparison of individual and group credit schemes in Zimbabwe*. (Public Administration and Development 6 (2); pg 115 - 132.
- Brown, C. K. (1994): *Gender roles in household allocation of resources and decision-making in Ghana*. Family and Development Programme. University of Ghana. Sponsored by UNFPA. pp 25-51.
- Bukh, J. (1979): *The Village Woman In Ghana*. Scandinavian Institute Of African Studies, Uppsala.
- Carr, M. (1979): *Women in rural Senegal: Some implication of proposed integrated food and nutrition interventions*. USAID, Washington.
- Carr, M. (1989): *Women And The Food Cycle*. Intermediate Technology Publication.
- Carr, M. (1991): *Women And Food Security*. Intermediate Technology Publication.
- Cebotarev, N. (1988): "Women, Human Rights And Family In Development Theory And Practice With Reference To Latin American And The Caribbean" *Canadian Journal Of Development Studies*: pp 188- 200.
- Clerk, B. (1975): *The work done by rural women in Malawi*, *Eastern Africa Journal of rural development*, 8: 2, p80 – 91.
- Conklin, H. (1957): *Hanunoo Agriculture: A report on an integral system of shifting cultivation in the Philipines*. Forestry development paper 12,FAO,Rome.
- Cutrufelli, H. (1983): *Women of Africa: The Roots Of Oppression*. London: Zed. Nicolas Romano, trans
- Dolphyne, F.A. (1990): *The Emancipation Of Women: An African Perspective*. Accra: Ghana Universities Press.
- Dover, M. and Tabolt, L.M. (1987): *To Feed This Earth: Agroecology for Sustainable Development*. Washington, DC: World Resources Institute.

- Dumor, E. (1983): "*Women in Rural Development in Ghana*" In *Rural Africana* No.17 fall 1983. East Lansing Michigan: The African Studies Centre. MSU, 69-81.
- Dangme West District Assembly (DWDA) (1996): *Five year medium term development plan*. The District Planning Coordinating Unit (DPCU). P 3 – 53.
- Elder, M. and Wong, H. D. (1994): *Family of earth and sky: Indigenous tales of nature from around the world*. Beacon Press, Boston.
- Ellen, R. F. (1993): *Rhetoric practice and incentive in the face of the changing times: a case study of Nuauulu attitudes to conservation and deforestation*. In *environmentalism: the view from anthropology* (ed.) Milton, K. Routledge, London: p 126 – 143.
- Enger, E.D. and Smith, B.F. (1992): *Environmental Science*. A study of Interrelationship, 4th Ed. Wim. C. Brown Publishers.
- FAO (1993): *Forest Resources Assessment, 1990. Tropical Countries*, FAO Forestry. Paper 112 Rome.
- FAO and UN (1985): *Tropical Forestry Action Plan*, Rome.
- Gadgil, M. and Berkes, F. (1991). *Traditional resources management systems*. Resource management optimization.pp 127-141.
- Garbrah, B.W. (1986): *Population and Environment in Ghana*, With Reference To Accra. National Conference on Population and National Reconstruction. University of Ghana, Legon, pp. 189-202.
- Goudie, A. (1983): *Environmental Change*, 2nd Ed. Contemporary Problems in Geography. Oxford University Press, pp.222.

- Goudie, A. (1989): *The Nature of the Environment*, 2nd Ed. Basil Blackwell Ltd. 108 Cowley Road Oxford, pp. 280.
- Greenstreet, M. (1978): *Women's position in society; their role, status and Legal rights Report of the seminar on rural women in West Africa*, Ghana, November, pg. 116 -122.
- Gustave, J (1998): *Women in water supply*. The people Daily Graphic, July 11. pg. 9.
- Halm, A.T. and Asiamah, R.D. (1984): *Soil Erosion In The Savannah Zones of Ghana*. Soil Research Institute, Kumasi.
- Hamilton, R. (1978): *The Liberalisation of Women: A study of Patriarchy and Capitalism of the T.B. Bottomore and M.Y. Mulkay* Eds. Controversies in Sociology. London: George Allen and Unwin.
- Holt, S.L. and Ribe, H. (1991): *Financial Institution for the poor & reducing Barriers to access for women. World Bank Discussion Paper 117* Washington DC.
- Horestein, N.R. (1989): *Women and Food Security In Kenya*. The World Bank WPS 232, pp. 1-5.
- Hossain, M. (1988): *Credit for Alleviation of Rural Poverty: The Grameen Bank in Bangladesh*. International Food Policy Research Institute, (Research Report 65), February.
- ILO (1991): *African Employment Report Addis Ababa*, J A S P A.
- Kydd, J. and Christiansen, R. (1982): *Structural change in Malawi since independence, consequence of a development strategy based on large scale agriculture*. World Development, 10: 5.
- Laing, E. (Ed) (1994): *Ghana- Environmental Action Plan*. Advent Press, Accra, Ghana.

- Leslie, J. (1988). *Women's Work And Child Nutrition In The Third World*. World Development vol. 16, Number 11. Pergamon Press. Great Britain, pp.1341-1362.
- Manuh, T. (1984): "*Law And The Status of Women in Ghana*". Paper Prepared for ECA, Addis-Ababa.
- Ministry of Forestry and National Resources, Energy Studies Unit (MFNR) (1981): *Malawi Rural Energy Survey, Lilongwe*.
- Ministry of Forestry and National Resources, Energy Studies Unit (MFNR) (1982): *Malawi Small Holder Tree Planting Survey, Lilongwe*.
- Minnow, F. (1985): *An evaluation of approaches to integrate women into the development process with particular reference to Ghana*. A project work submitted to the Institute of Social Studies. In partial fulfillment of the requirement for M.A Degree in Development Studies, The Hague pg 66.
- MOFA (Ministry of Food and Agriculture) 1993, *Annual Report*
- Morgan, J M., Morgan, M. D., and Wierstma, J H (1995): *Introduction to environmental science*. 2nd Ed. W. H. Freeman and Company.
- Molyneux, M. (1988): "*Mobilisation Without Emancipation? Women's Interest, the State and Revolution in Nicaragua*" In *Feminist Studies*, 112 (Summer 1985), pp. 227-252.
- Montgomery, C.W. (1992): *Environmental Geology*. 3rd Ed. Wim. C. Brown Publishers, U.S.A.
- National Council on Women and Development (NCWD), (1991): *Annual Report*.
- Nti C. A., Inkumsah D. and Fleischer G. S. (1999): *Influence of women's workload on their nutritional status in selected communities in Ghana* Blackwood Science Limited.

- Nukunya, G.K. (1969): *Kinship And Marriage Among the Anlo Ewe*. University of London. The Athlone Press NY.
- Nukunya, G.K. (1991): *Tradition And Change In Ghana*, University of Ghana, Legon.
- Okigbo, B.N. (1990): *Assessment of soil degradation in the Southern State of Nigeria*. *Environment working paper, No. 39*, World Bank Sector Policy and Research Staff. Washington DC: The World Bank.
- Olaitan, S.O and Lombin, G. (1984): *Introduction To Tropical Soil Science*, Macmillan Publishers Ltd. pp 105-106.
- Opong, C. and Abu K. (1987): *Seven Roles Of Women: Impact Of Education Immigration And Employment On Ghanaian Mothers*.
- Palmer, I. (1981): Seasonal Dimensions of Women's Role: *In Seasonal Dimensions To Rural Poverty*. Frances Pinter Publishers, London. Pp 195-201.
- Posey, D. A. (1996): *Protecting indigenous peoples right to Biodiversity: People, property and bioprospecting environment*, Vol.38 (8): pp 6-45.
- Posey, D. A. (ed.) (1999): *Cultural and spiritual values of biodiversity*. United Nations Environment Programme. Intermediate Technology Publications: pp. 731.
- SAC (Standing Committee on Agriculture) (1991): *Sustainable Agriculture*. SAC Technical Report Series, No. 36, Report of the work group on sustainable agriculture, Standing Committee on Agriculture. East Melbourne: Council for Scientific and Industrial Research.
- Sarantakos, S. (1993): *Social Resarch*. Macmillan Press Limited Great Britain. P 247 – 278.

- Savane, M.A. (1981): *Implications for Women And Their Work*. Introducing Nutritional Considerations Into Agricultural And Rural Development Projects. The ACC/ SMB Committee on Nutrition. Food And Nutrition Bulletin Vol. 2, Number 3. pp 1-4.
- Sen, C. and Grown, C. (1987): *Development crises and alternative visions*. Third World Women's Perspectives. New York: Monthly Review Press.
- Sigot, A. J. (1995): Discourse on gender and natural resource management. In: *Towards common ground*. Gender and natural resource management in Africa. Eds., Sigot, A.J., Thrupp, L.A. and Green, J. World Resource Institute, Washington DC, USA. P 1 – 11.
- Spring, A. Smith, C. and Kayuni, F. (1983): *Women farmers in Malawi*. Their contribution to agriculture and participation in development projects; Mimeo.
- Statistical Services (1987): *1984 Population Census of Ghana: Demographic And Economic Characteristics*. Total Country. Accra, Statistical Service.
- Statistical Services (1992): *The Pattern Of Poverty In Ghana, 1988-1992*. pp 25.
- Statistical Services (2000): *2000 Population Census of Ghana: Demographic And Economic Characteristics*. Total Country. Accra, Statistical Service.
- Symth, I. (1990): "Women's Work And Marriages" of *The Working Paper Sub-Series on , Women, History And Development: Themes And Issues*, No. 74 The Huge: 153 – 155.
- Tsikata, E. (1989): "Women's Political Organisations, 1951-1987" In *E. Hansen and Kwame. A. Ninsin (eds). The State, Development And Politics In Ghana*. London: CODESRIA Book Series.
- United Nations (1993): *Earth Summit Agenda 21: The United Nations Programme of Action from Rio*, New York.

World Bank (1990): *World Development Report, 1990*. Indian Women's Work And Health. Washington DC, 442 pp22.

World Bank (1992): *World Development Report, 1992*. Development and the Environment. Washington DC.

Young, K. (1988): *Gender And Development: A relational Approach* Mimeograph.

APPENDIX

**Effects Of Agricultural Activities Of Rural Women In Sota In The Greater
Accra Region On The Soil, Water Bodies And The Vegetation**

(QUESTIONNAIRE)

The information being collected is for an M.Phil thesis, and is a requirement for the M.Phil work. The purpose of this interview is to collect information to examine the effects of the agricultural activities of the rural women on their environment with a particular reference to women in Sota in the Dangme West District of the Greater Accra Region of Ghana. Any information you provide will be confidential. Thank you.

SECTION A: BACKGROUND INFORMATION

1. Age:.....
2. Marital Status:
 1. Never married [] 2. Married [] 3. Divorced []
 4. Widowed [] 5. Separated []
3. Ethnicity:
 1. Dangme [] 2. Ewe [] 3. Akan [] 4. Ga []
 5. Others.....
4. What is your religious background?
 1. Christianity [] 2. Islam [] 3. Traditional []
 4. Others (specify).....
5. Educational level attained?

- 1. No formal education 2. Primary 3. Middle school/JSS 4. Secondary/SSS/Technical/vocational 5. Post secondary 6. University

6. For how long have you been farming? yrs]

7. Which agricultural enterprise are you involved in?

8. Do you have farm land? 1. Yes 2. No

9. If yes, what is the size of it?.....

10. How did you acquire the land?

- 1. Lease 2. Purchase 3. Family head 4. Friend
- 5. Husband 6. Others.....

11. Which other enterprise are you involved in apart from agriculture?

.....

SECTION B: AGRICULTURAL ACTIVITIES AND THE ENVIRONMENT

CROP FARMING

12. How do you prepare your land before planting your crops?

- 1. Slash and burning 2. Slash only 3. Hoeing 4. Ploughing
- 5. Ploughing and harrowing 6. Weeding

13. Who prepares the land?

- 1. Self 2. Others, specify.....

14. If self, how did you learn to prepare the land, the way you do it?

.....

15. For how long have you been cultivating this particular piece of land?

.....

16. What crops do you grow and what is the acreage of each?

TYPE OF CROP	ACREAGE
1. Maize	
2. Cassava	
3. Pepper	
4.	
5.	
6.	

17. Do you fertilize your soils?

1. Yes [] 2. No []

18. If yes, what type do you add to your soil?

1. Organic fertilizer [] 2. Inorganic []

19. Do you use any agrochemical besides fertilizer?

1. Yes [] 2. No []

20. If yes, which do you use?.....

21. Do you know about integrated pest management (IPM)?

1. Yes [] 2. No []

22. If yes, which aspects of IPM do you practise?

.....

23. Do you practise rainfed or irrigated farming?

1. Rainfed [] 2. Irrigated [] 3 Both []

24. If irrigated, what is your source of water for irrigation?

1. Dam [] 2. River [] 3. Wells 4. Others.....

25. Do you mulch your crops? 1. Yes [] 2. No []

26. How do you dispose of your crop residue? Explain.

.....

27. Do you practise agro forestry? 1. Yes [] 2. No []

If yes, what trees do you grow?.....

LIVESTOCK FARMING

28. what type of livestock do you raise and what is your stock size?

TYPE OF LIVESTOCK/POULTRY	NUMBERS
1. Cattle	
2. Sheep	
3. Goats	
4. Poultry	
5. Others	

29. How do you raise your livestock/poultry?

1. Intensive [] 2. Semi-intensive [] 3. Free range []

30. How are your livestock /poultry watered?

1. At home [] 2. Dams [] 3. Rivers [] 4. Others.....

31. Is this the only source of water in the community? 1. Yes [] 2. No []

32. How do you dispose of your animal waste?.....

AGRO-PROCESSING

33. what agro-processing are you involved in?

AGRO PROCESSING ENTERPRISE	MATERIALS USED	PROCEDURE	WASTE DISPOSAL
1. Gari processing			
2. Fish smoking			
3. Broom making			
4. Palm oil production			
5. Palm kernel oil production			
6. Charcoal production			
7. Others			

SECTION C: ENVIRONMENTAL AWARENESS

34. Do you think agricultural activities have an effect on the environment ?

1. yes [] 2 no []

35. If yes ,what effect does it have on the environment?

.....

36. Have you observed erosion on your farm or in the community?

1) Yes[] 2) No[]

37. If yes ,what do you think causes this?.....

.....

38. How do you think erosion can be prevented or controlled?

.....

39. Why do you think people farm continuously on a particular piece of land?

.....

40. Do you know of some crops which are grown by farmers which either has adverse effects on the soil or improve upon soil structure and texture? 1) Yes[] 2) No[]

41. If yes, mention a few.....

42. What type of water bodies are found in this community and what are they used for?.....

43. Do you think your farming activities have contributed to the pollution of these water bodies? 1) Yes[] 2) No[]

44. If yes, how?.....

45. Is it important to plant trees? 1) Yes[] 2) No[]

46. In your opinion, is there any link between agricultural activities and the environment? 1) Yes[] 2) No[] 3. No idea [] 4. Others.....

47. If yes, mention a few linkages.....

.....

48. Why do you think these links are of any importance.....
.....

49. What effect do you think poor agricultural practices would have on this community?.....
.....

50. Have you ever educated someone on environmental issues before?

- 1) Yes[] 2) No[]

51. If yes, which aspects of the environment.....
.....

52. What suggestions would you give to any agency which would want to solve environmental problems in your community?.....

53. Would you want some education on environmental issues?

- 1) Yes[] 2) No[]

54. If yes to Q53, which aspects of environmental issues would you want education in?.....
.....

55. What do you think would happen to man when the last tree is cut down?.....
.....

The following are statements about environment. Please indicate, for each statement, your level of agreement with the statement. (Use the following scale for each question).

- 1. means you strongly disagree with the statement (SD)
- 2. means you disagree with the statement (D)
- 3. means you are uncertain about the statement (U)
- 4. means you agree with the statement (A)
- 5. means you strongly agree with the statement (SA)

	SD	D	U	A	SA
	1	2	3	4	5
56. trees are not part of the environment.					
57. Slash and burn improves the quality of the soil.					
58. Smoke causes air pollution.					
59. Trees should be cut down for good land preparations.					
60. Grass promotes soil erosion.					
61. Deforestation leads to a reduction in surface water.					
62. Felling trees increases rainfall.					
63. Many trees on a farm lowers the fertility of the soil.					
64. Ploughing with tractor causes more soil erosion than ploughing with a hand hoe.					
65. Cover crops enrich the soil.					
66. Inorganic fertilizers leave toxic materials in the soil.					
67. Inorganic fertilizers are better than farm yard manure for crop growth.					
68. It is better to burn crop residues than to bury them in the soil.					
69. Inorganic fertilizers cause pollution of water bodies.					
70. Fishing with chemicals is good.					
71. Vegetables produced with farm yard manure are not good for human consumption.					

THANK YOU FOR YOUR PATIENCE AND CO-OPERATION
 INTERVIEWER: GRACE SETORWU FLEISCHER