KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

FACULTY OF RENEWABLE NATURAL RESOURCES

DEPARTMENT OF AGROFORESTRY

FARMERS INDIGENOUS PRACTICES FOR CONSERVING IMPORTANT TREE SPECIES IN THE AFIGYA SEKYERE DISTRICT OF ASHANTI

BY

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A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN AGROFORESTRY

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Indigenous knowledge and biodiversity are complementary phenomena essential to human development. Global awareness of the crisis concerning the conservation of biodiversity is assured following the United Nations Conference on Environment and Development held in June 1992 in Rio de Janeiro.

Of equal concern to many world citizens is the uncertain status of the indigenous knowledge that reflects many generations of experience and problem solving by thousands of ethnic groups across the globe (Sutherland, 2003).

Very little of this knowledge has been recorded, yet it represents an immensely valuable data base that provides humankind with insights on how numerous communities have interacted with their changing environment including its floral and faunal resources (Emebiri *et a*l., 1995).

According to Warren (1992), indigenous knowledge, particularly in the African context, has long been ignored and maligned by outsiders. Today, however, a growing number of African governments and international development agencies are recognizing that local-level knowledge and organizations provide the foundation for participatory approaches to development that are both cost-effective and sustainable.

Much of the world's biological diversity is in the custody of farmers who follow age-old farming and land use practices. These ecologically complex agricultural systems associated with centers of crop genetic diversity include not only the traditional cultivars or 'landraces' that constitute an essential part of our world crop genetic heritage, but also wild plant and animal species that serve humanity as biological resources (Oldfield and Alcorn, l991).

The deliberate maintenance of diversity in domesticated and non-domesticated plants and animals characterizes farming systems across the African continent as well as in most other parts of the world, providing an important opportunity for systematic in situ maintenance of genetic resources. Informal agricultural research and development systems parallel those of national governments, providing another opportunity for national agricultural research and extension services to work with the creative interests and activities of farmers and other rural people (Warren, 1992)

The human race has been dependent on plants for both material and emotional needs for millions of years. This has enabled them to evolve a unique system of knowledge on the utilization and conservation of plant genetic resources (Ravishanker, 2003). At first, human influence on natural resources was portrayed as being destructive, but now, ecologists have started to appreciate how traditional people use their resources without destroying them.

The forests of the humid tropics of Africa contain high value indigenous tree species that are harvested and utilized for various products (Buttoud, 1995). Man generally, utilizes these species according to Kattel (1996) in three ways; these are direct

utilization by household (fuelwood, food and medicine); indirect utilization as inputs into the farming system (fodder and mulch); and as products for direct sale or for processing prior to sale. In one of the rare detailed studies on the food production potential of the indigenous woody perennials in the agricultural and pastoral areas of Africa's dry region, Becker (1983) identified 800 species of wild plants with human nutrition potential in the Sahel and estimated that the annual harvestable production of leaves and fruits amounted to about 150 kg ha^{-1} in the Saharo –Sahel, 300 kg ha^{-1} the characteristic Sahel and 600 kg ha^{-1} in the sudano-sahel region. Thus in these ecological zones, 23, 45 and 90 kg respectively of edible materials would be available per hectare annually.

For many years, the gathering of forest products from the wild has been possible without much detrimental effect on the environment. However, Foudoun and Tiki Manga (2000) noted that the increasing population pressures on natural resources have negated the earlier notion that environmental degradation as a result of wild gathering was negligible. Earlier, Duguma *et al.,* (1998), Leaky and Simons, (1998), Leaky and Tomich (1999) have advocated for the domestication and cultivation of such species. Farmers as noted by Foudoun and Tiki Manga (2000) are quite knowledgeable about the use and conservation of high value indigenous tree species. However, Herzog *et al.*,(1996) acknowledged earlier that without systematic recording and development of database, this knowledge would be lost to the future generations. One of the first steps in the domestication research they observed would be to capture and save this indigenous knowledge, which is fundamental.

Domestication can be most effectively achieved by amalgamating specific local knowledge with scientific knowledge and by integrating these domesticates into

appropriate farming practices that will create sustainable land uses. Such approaches according to Walker *et al,* (1995) should be in the context of social, economic, cultural and environmental factors to clearly determine needs and constraints facing farmers.

According to Asibey (1995), the stigma underlying the disregard of local knowledge, cultures and institutions has continued to the extent that a so-called "new pride" is associated with the loss of such fundamental facets of life as local languages and traditional diets. This loss is often interpreted as a mark of affluence. This has resulted in the loss of real pride and identity and eroded local knowledge, which could have formed important building blocks for governance, sustainable development and poverty alleviation, he added.

The role of nineteenth century colonialism and social science in ignoring and maligning indigenous knowledge has been well-documented (Warren, 1989a). Studies that depicted local communities and their knowledge as primitive, simple and static are now countered by a rapidly expanding data base generated by both biological and social scientists that describes the complexity and sophistication of many indigenous natural resource management systems.

The fact that so much effort is now being invested in understanding the basis for indigenous natural resource management indicates that the negative attitudes commonly held about indigenous knowledge during the colonial era have began to change.

1.2 Justification

In the Afigya Sekyere district of Ashanti, the rural populations derive a significant part of their food and other basic requirements from various indigenous trees that are seldom cultivated. Many of these species occur naturally in the forest environments that are currently under pressure as the demand for agricultural land increases.

These tree species are getting extinct and therefore has affected the income levels and livelihood of the rural folks in the Afigya Sekyere district of Ashanti.

Hall and Swaine (1981) earlier stated; "that the forest environment has set the scene for historical development of the people of Southern Ghana and for that matter, it is our duty to ensure that such an important part of the country's heritage is preserved for future generations". In view of these, it will be very important to study the practices used to conserve important tree species in this area.

1.3 Objectives

The general objective of this study is to identify the indigenous practices undertaken by farmers to conserve natural resources.

The specific objectives were to:

(i) Delineate and describe the different land use systems in the Afigya Sekyere District;

(ii) Identify important tree species, their habitats and the indigenous practices being undertaking to conserve them.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In rural areas throughout Africa, wild plant resources fulfill a wide range of basic needs and are a resource base harvested for informal trade or barter, whereas in urban areas, a much smaller range of species and uses is found.

Cultural groups who depend on subsistence harvesting of Non Timber Forest Products to sustain livelihood often live in biologically diverse forest regions. These groups have developed traditional ecological knowledge, gained by generations of community interacting with natural forested areas (Gadgil *et al* 1993; Turner *et al* 2000; and Davidson-Hunt and Berkes, 2001). Of the authors who have presented definitions of traditional ecological knowledge (Freeman 1992; Hunn 1993; Purcell 1998; Kimmer 2000), Berkes (1999) seem to offer the most comprehensive, "a cumulative body of knowledge, practice and belief, evolving by adapting processes and handed down through generations by cultural transmission about the relationship of living beings (including humans) with one another and with their environment". The importance of traditional ecological knowledge to conserve global biodiversity has been recognized by the United Nations Convention on Biological Diversity, which calls for the recognition and protection of traditional knowledge (Kimmer, 2000).

Cary and Mooney (1990) earlier stated that since the beginning of this century alone, over 75% of the genetic diversity of most important trees and crops has disappeared from farmers' fields and this has increased agricultural vulnerability and reduced the essential variety of the diets of rural people.

According to Ladipo *et al* (1996), there are two situations for which farmers consider conservation and tree domestication justified: When there are market opportunities and when the product for household consumption or its substitute is no longer available.

Stevel (1990) also acknowledges that in these instances, farmers may take the initiative to domesticate and cultivate the species.

Emebiri *et a*l (1995) noticed that for most indigenous forest trees of Africa, virtually nothing is known about their conservation, or potential for genetic improvement.

2.2 STATE OF FOREST IN GHANA.

In 1992, the International Union of Conservation of Nature (IUCN) estimated that there was about 15000 km^2 of "intact closed forest" remaining in Ghana, covering about 7% of the countries land area (total 230,020 km^2) (IUCN 1992). This, according to Kotey *et al* (1998) represents the current state of deforestation process which began about a century ago reaching its peak between the 1950s and 1970s.About a third of Ghana's forest have been estimated to have disappeared in the 17 years between 1955and 1972 (Hall, 1987) while the average annual rate of deforestation since the turn of the century has been estimated at 950 km^2 (World Bank 1988). According to Fairhead and Leach (1996), recent critical analysis has challenged assumptions about the nature and extent of "original" forest cover and the rate of deforestation in the early parts of this century. The annual rate of deforestation showed in the 1980s according to Kotey *et al* (1998), is now likely to remain low since all but a tiny fraction of a closed canopy forest outside the demarcated forest reserves has been converted to farmland.

2.2.1 Biodiversity in Ghana's Forests

The closed forest and Savanna zones of Ghana support wide diversity of plant and animals. More than 3600 plant species have been identified, over 2100 being found in the forest zone. (World Bank, 1988). Within this zone, 125 plant families have been identified and a species diversity of about 300 plants has been recorded in a single hectare (World Bank 1988). Of the 43 endemic plant species in the country, 23 are known to exist in the forest zones. Seven are found only in the wet evergreen forest (Hall and Swaine, 1981). These include *Hymenostegia gracilipes Cola umbratilis* and *Alsodeiopsis chippi* (IUCN, 1988). In total, 730 tree species of which 680 attain a dimension of 5 cm or more at breast height have been recorded from the closed forests (Hawthorne, 1989).

The evergreen forest is the most prolific in its floral diversity (Hall and Swaine, 1981). In contrast, the much drier southern marginal and southeast outlier forest is species poor, with 90% of the vegetation attributed to a single species in some of the southern outlier forest plots. Nevertheless five endemic or near endemic species including *Talbotiella gentii*, *Dalbergia Setifera* and *Turraea ghanaensis*, are found in these forest types.

2.3 Indigenous Knowledge Systems and Natural Resource Conservation

The paradox of the forest according to Abbiw (1990) is that where it occurs man's tendency is to destroy it, and where it does not occur the tendency is to create it. Directly and indirectly, it serves a multiplicity of purposes.

Hall and Swaine (1981) observed that cultural and economic issues are among the numerous reasons for the conservation of forest in Ghana.

Rainforests are disappearing rapidly and the rate of deforestation is accelerating due to fragmentation and segmentation of forestlands, land conversion, over logging, overexploitation of forest resources and other Tropical management practices. (Table2.1). Among variety of ecosystems, tropical rainforests are one of the highest priorities in the conservation of biodiversity: tropical rainforests are essential for sustaining life and a stable environment on earth; the number of species is quite high but the relative frequency of any single species within a given ecological community is really low. (Haruyama, 2002). Tropical rainforests are therefore vulnerable when adverse impact on them exceeds their carrying capacity.

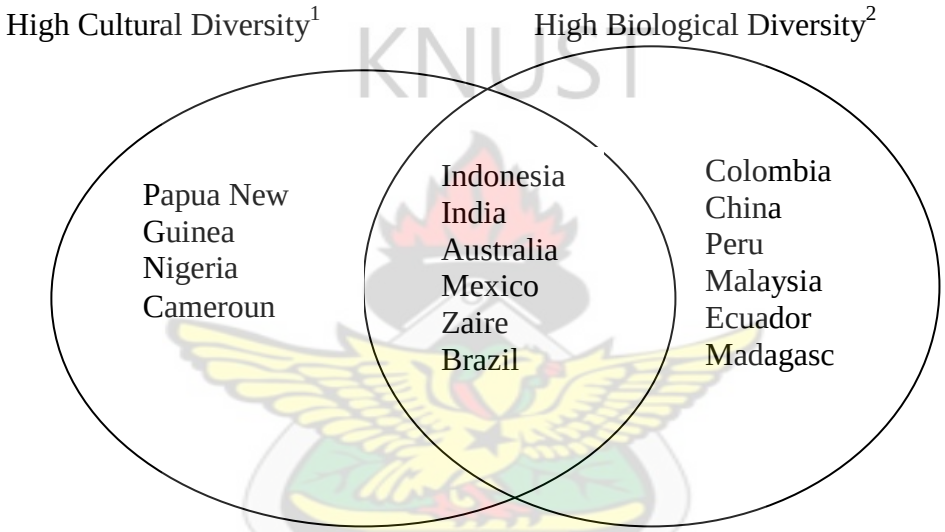
Table 2.1: Regional Forest Cover and Forest Cover Change.

	Land Area(Ha)	**Total Forest 2000**		**Change 1999-2000**		**Forest 1995[2]**	**Change 1990-95[2]**
		Million Ha	**%/yr**	**Million Ha\yr**	**%/yr**	**Million ha**	**Million Ha\yr**
Africa	3,008	650	17	-5.3	-0.8	520	-3.7
Asia	3,167	542	14	-0.4	-0.1	503	-2.9
Oceania	849	201	5	-0.1	n.s[1]	91	-0.1
Europe	2,276	1,040	27	0.9	0.1	933	0.5
North & Central America	2,099	539	14	-0.6	-0.1	537	-0.3
South America	1,784	874	23	-3.6	-0.4	871	-4.8
World Total	13,183	3,856	100	-0.9	-0.2	3,454	-11.3

1) n.s[1] means not significant.

Source: FAO (2001)

Many of the remaining tropical rainforests are inhabited and managed by indigenous people. The fact implies an inextricable links between biological and cultural diversity. Of the twelve (12) countries where mega diversity can be seen, six (6) of them are also ones with a very high level of cultural diversity. (Fig.2.1)



1. Countries where more than 200 languages are spoken.
2. Countries listed by biologists as "mega biodiversity" countries for their exceptional numbers of unique species.

Fig. 2:1 Cultural and biological diversity

Source: World Watch Institute, cited in IUCN (1997).

Rural people in Africa have always maintained a certain formidable power, which guards their indigenous institutions and knowledge systems, thereby maintaining some level of self-reliance (Donnelly-Roark, 1995).

Different human societies have elaborated a striking diversity of ways of working with nature. Many of these according to Gadgil (1995) are ecologically adaptive and some may have become ecologically maladaptive. Supporting this statement, Gary and Caroll (1997) added that, many if not most societies have had some lasting destructive impact on the natural world. However, some societies have certainly minimized their environmental influences and lived in a more sustainable fashion than most.

The diversity of traditional resource use practices represents a pool of human experiences spanning many millennia and many cultures. The conservation of this rapidly diminishing pool of experience, a kind of cultural diversity, is as pressing as the conservation of biological diversity (Gadgil, 1987).

Several studies have documented systems of traditional knowledge (Ruddle and Johannes, 1985; Freeman and Carbyn, 1988). Others showed that community- based resource management systems worked because of the presence of appropriate common property institutions, not merely because of a superabundance of resources (Mcay and Acheson, 1987; Berkes, 1999)

According to Gliessman *et al.*, (1981) and Irvine (1989) indigenous peoples interacted with their environment, modifying nature but actively maintaining it in a diverse and productive state. On the other hand, Diamond, (1992) argues that virtually wherever humans have settled, environmental destruction has been the rule.

Gadgil, (1995) observed that the ways in which the various societies approach the utilization of their natural resource base depends on their perception and experience of how it responds to patterns of resource use. He added that if the resource base is perceived as fluctuating in a capricious fashion regardless of how it is used, a society would tend to impose few restraints in its use. Societies that perceive their resource

base as infinite and ever expanding by virtue of technological advances are less likely to observe any resource use restraint.

It is when the resource base is perceived as well -demarcated, finite and sensitive to the resource use patterns that societies are most likely to stress restrained, sustainable patterns of resource use.

Lenski and Lenski (1979) observed that many societies have developed sustainable resource use practices, and it is possible to examine the conditions under which the wise use of resources has presumably evolved. They stressed that these societies are characterized by plant cultivation without the use of the plough or iron implements, and that hunting, fishing and gathering of whole varieties of resources from a finite territory is critical to their subsistence.

Prudent resource use is likely to be a survival value for such societies, for they are often in acute terrestrial conflict with neighbouring societies. At the same time, any serious resource shortages, even if short lived and seasonal, are apt to seriously weaken the ability of these societies to withstand assaults on their territories by their neighbours they added. Such societies according to Lenski and Lenski (1979) may therefore be in danger of cultural, if not genetic, extermination if they exhaust their resource use. This according to Gadgil (1987) may have favoured the evolution of cultural traditions of prudent use.

The Global Biodiversity Strategy, for example, includes as one of its principles for conserving biodiversity the principle that "cultural diversity is closely linked to biodiversity. Humanity's collective knowledge of biodiversity and its use and management rests in cultural diversity; conversely, conserving biodiversity often helps strengthen cultural integrity and values" (World Resource Institute *et al*., 1992).

Brush (1989) echoed that "to acquire a comprehensive base of knowledge for genetic resource conservation, the genetic establishment must accept a mandate to be concerned not only with germplasm but also the knowledge systems that produce it".

According to Regier *et al.*, (1989), modern resource management science is well suited by design for conventional development but not for sustainable use. The task then is to rethink and to reconstruct a new resource management science that is better adapted to serve the needs of ecological sustainability and the people who use resources. To do this, in the opinion of Gadgil (1987), there is a need to conserve both biological and cultural diversity, which are tied together.

The global effort to conserve and protect the natural environment according to Gary *et al,* (1997) is a recent phenomenon, though efforts to conserve economically important natural resources have a long history; in the classical Greek period, Aristotle commented on the widespread destruction of forests in the Baltic region.

In order to arrive at sustainable natural resource management, Hausler (1995), advocates the need for policy makers to look for a new type of development co-operation, which provides space to non-western cultures, and alternative conceptions of development, aspirations and priorities of the local land managers on their own terms

By means of culture, religion, local rules and regulations enshrined in farming practices, land tenure system, folklore, beliefs and stories, the indigenous African did not only protect forest/biodiversity but did as well conserve it through such practices (Poku-Marboah, 2001).

2.4 Indigenous Knowledge and Control of Resource Use.

These various traditional ecosystem approaches require a belief system, which includes a number of prescriptions for restrained resource use. It is possible that such apparent restraints may have nothing to do with long-term conservation of the resource base.

As Smith, (1983) and Borgerhoff-Mulder (1988) put it, “we must examine each supposed instance of restraint to access whether it could involve such a discontinuation of resource use”, for instance the cost of harvest has increased excessively.

The range of practices pertaining to restrained resource use by human groups according to Gadgil (1985) may be classified under these broad categories:

- There may be a quantitative restriction by harvesters on the amount of harvest of a given resource stock of a species or from a given locality. The imposition of such quotas according to Gadgil (1985) implies that harvesting is halted at resource densities greater than those at which individuals would find the net gain too low to continue. As a result, these quotas are likely to enhance total yield on a long-term basis, at the sacrifice of some immediate return.
- Harvesting a certain resource may be abandoned when resource densities decline. Eaton (1985) documented that in parts of New Guinea, for example, the hunting of birds of paradise is temporarily abandoned if their population decline. Such a response is expected from harvesters attempting to maximize short-term net gain, since a fall in resource density would progressively increase the cost of harvesting, he added.
- Harvesting from a certain habitat patch may be abandoned if yields from that patch are reduced. In the Torres Strait, fishing may be stopped in regions where fish yields are known to have declined (Nietschmann, 1985).
- Harvesting of certain species may be abandoned in a certain season. It is a taboo in many Indian villages to hunt certain animals in the four months from July to October (Gadgil, 1985). In the Torres Strait, hunting and fishing are carried out in phases with appropriate tides, winds, seasons and sea conditions, which render them highly sporadic over time. (Nietschmann, 1985).

- Harvesting from a certain patch may be abandoned in certain seasons or years. According to Berkes and Freeman (1986), goose hunting is regulated in James Bay, thereby creating a shifting sanctuary system.
- The harvest of certain life history stages by age, sex, size or reproductive status may be prohibited. For example birds breeding at a heronry may be left undisturbed in certain villages in India, though they may be hunted elsewhere in other seasons (Gadgil, 1985b).
- The harvest of certain species may be prohibited. Some species are never harvested because of the relative difficulty of procuring them or the risk of injuring during hunting, or they may carry parasites that can affect humans. If these conditions do not operate, then conservation can indeed serve the long-term interests of human resource use if the species thus protected enhances the availability of other species that are harvested. This is likely for some widely protected species such as trees belonging to the genus Ficus, but less likely for a wide range of species protected as totemic by given tribal groups (Gadgil, 1989).
- Certain habitat patches may either never be harvested or may be subject to very low levels of harvest through strict regulation. It is extremely difficult to arrive at workable prescriptions on quantitative quotas, closed seasons or protected life history stages that would decidedly guard against resource decimation. Providing refugia (sacred groves, sacred ponds etc.) may then be the most easily perceived and the most efficient way of guarding against resource depletion (Gadgil and Vartak, 1976).
- Certain age-sex or social groups may be banned from employing certain harvesting methods or from utilizing certain species or habitat patches. In New

Guinea, adult males are banned from hunting rodents and on Fanafuti atoll in the pacific, turtle meat was taboo to all except the king (Zann, 1985).

This could assist in long-term conservation by restricting access to a limited number of individuals who may more readily use the resource in a prudent fashion. Gadgil (1985) argues that such restrictions may benefit certain segments of the community in positions of power without serving the interests of long-term conservation.

2.5 Indigenous Knowledge and Development

International and national development agencies have recognized the value of participatory approaches to decision-making for sustainable approaches to development. During the past decade a rapidly growing set of evidence indicates a strong relationship between indigenous knowledge and sustainable development. "Serious investigation of indigenous ethnobiological/ethnoecological knowledge is rare, but recent studies show that indigenous knowledge of ecological zones, natural resources, agriculture, aquaculture, forest and game management, to be far more sophisticated than previously assumed. Furthermore, this knowledge offers new models for development that are both ecologically and socially sound (Posey, 1985).

Development activities that work with and through indigenous knowledge and organizational structures have several important advantages over projects that operate outside them. Indigenous knowledge provides the basis for grassroots decision-making, much of which takes place at the community level through indigenous organizations and associations where problems are identified and solutions to them are determined. Solution-seeking behavior is based on indigenous creativity leading to experimentation and innovations as well as the appraisal of knowledge and technologies introduced from other societies.

Farmers can be excellent conservators of biodiversity. Small-scale farming systems in Sierra Leone, for example, are characterized by diversity, which is valued for its own sake (Richards, 1985). Small-scale, resource-poor farmers in developing countries breed local crop varieties for improved production using informal innovation systems based on indigenous knowledge...They often employ their own taxonomy, encourage introgression, select, hybridize, field test, record data and name their varieties" (Lamola, 1992). In Niger, a USAID-funded project has discovered a farmer-based agricultural research and extension system that parallels that of the national government (McCorkle and McClure, 1992). Investigating the nature of farmers' experiments that augment biodiversity could be of considerable use to national agricultural development programs (Haverkort, l991).

In Rwanda it was found that farmers recognize several dozen different potato varieties, which they distinguish according to plant and tuber traits, as well as agronomic and culinary characteristics (Haugerud and Collinson, 1991).

East African farmers recognize in maize, as in potato cultivars, important differences in taste, texture, storability, marketability, disease and pest resistance, and response to moisture stress. At least nine possible end uses, many of them simultaneously relevant on a single farm, help to determine the maize genotypes East African farmers prefer" (Haugerud and Collinson, 1991). "Sustainable agriculture in all nations will require greater scientific respect for, and more effective collaboration with, those who possess the wisdom of generations of 'nonscientific' farming" (Haugerud and Collinson, 1991).

"The characteristics of polycultures that make them desirable were generally ignored by agricultural researchers. But recently research concerning polycultures has blossomed and some of their benefits are becoming clear (Liebman, 1987). Polyculture is the norm in farming systems in Africa and other parts of the world, a traditional strategy to promote diet diversity, income generation, production stability, minimization of risk,

reduced insect and disease incidence, efficient use of labour, intensification of production with limited resources and maximization of returns under low levels of technology (Altieri ,1987).

Much of the world's biological diversity is in the custody of farmers who follow age-old farming and land use practices. These ecologically complex agricultural systems associated with centers of crop genetic diversity include not only the traditional cultivars or 'landraces' that constitute an essential part of our world crop genetic heritage, but also wild plant and animal species that serve humanity as biological resources (Oldfield and Alcorn, l991). Farmers evaluate cultivars using a wide variety of criteria that can be of immense interest and value to crop breeders. In Zambia, the farmers' evaluation of a high-yielding hybrid maize variety and description of the positive and negative characteristics of locally adapted open-pollinated varieties led to a more effective national maize breeding program (Warren, 1989b). Taking the time and effort to record the indigenous agricultural knowledge for a given ethnic group can provide important guidance for the research agenda for both national and international agricultural research centers (Warren, 1992; Richards 1989; Titilola *et al,* 1989).

Development agencies are beginning to review the role of indigenous knowledge in the development process at the policy level. A vast heritage of knowledge about species, ecosystems, and their use exists, but it does not appear in the world literature, being either insufficiently 'scientific' or not 'developmental.' Much of this information can be interpreted only by local scientists (Waren, 1992). If indigenous knowledge has not been documented and compiled, doing so should be a research priority of the highest order. Indigenous knowledge is being lost at an unprecedented rate, and its preservation, preferably in data base form, must take place as quickly as possible (Warren, 1992).

2.6 Indigenous Knowledge and Environmental Protection.

Indigenous knowledge is used in the environment development field more as a tool and as a method to improve the planning of interventions aimed at agricultural productivity and natural resource management (Hausler, 1995).

Hausler indicates that experience derived from the practice of environmental management over the last decades have shown that it is imperative to heed people's aspirations, knowledge and social organizations for sound local management of natural resources.

Redclift (1993) pointed out that the confused and limited way in which environmental problems are often understood hampers their solution.

Undermining indigenous knowledge can lead local people to become increasingly dependent on outside expertise (Richards, 1985) and the greatest consequences of the under utilization of indigenous knowledge as Atte (1992) put it, is the inefficient allocation of resources and manpower to inappropriate planning strategies which have done little to alleviate rural poverty. With little contact with rural people, planning experts and state functionaries have attempted to implement programs which do not meet the goal of rural people, or affect the structures and processes that perpetuate rural poverty. Human and natural resources in rural areas have remained inefficiently used or not used at all, he added.

2.7 Indigenous Science and Technologies for Sustainable Agriculture and Food Systems.

Agricultural science and technology are not neutral but are deeply rooted in a society's history and culture. Failure to respect African people's knowledge has led to the imposition of alien technologies, which undermined local people's self-confidence (Ntombie, 1994). He added that failure to recognize the farmer's point of view and its analysis has meant that, farmers have never really been part of most development initiatives.

Scientists have recognized from bitter experience that technology transfers from the west, such as pesticides and mechanical cultivation, have not worked well in Africa. In the West, the climate is temperate and soils and rainfall patterns are different from those of Africa. In most African countries, rainfall is sporadic, and in some countries, the land is bare three- fourths of the year. Rain often comes in heavy showers falling on fragile landscapes (Ntombie,1994).

The local farming systems that existed prior to the transfer of Western technology evolved over a long period and were designed to cope with local climate and landscape. According to Ntombie (1994), local farmers used mixed cropping with a lot of ground cover. The ground cover protected the land from erosion, but when monoculture, row planting and plough system came from the Western countries, these technologies facilitated the washing away of soil and land degradation.

The alien farming system had no roots in the people and so the people together with their local knowledge and technology were marginalized, Ntombe (1994) added.

According to Wild (1972), Africans knowledge of indigenous plants and their African names is declining rapidly because youngsters no longer go through the herd boy experience in close contact with nature, learning African plant names from their elders

and tasting indigenous fruits but, rather must go through long periods of learning more exotic subjects with different practical uses.

Wild (1972) also noted that African plant names have a long tradition of accurate usage and are far more comprehensive than European common names in the number of species they cover and their usefulness to everyone who works in African bush.

Learning from Indigenous knowledge can improve understanding of local conditions and provide a productive context for activities designed to help the communities. In addition, the use of indigenous knowledge assures that the end user of specific agricultural development projects are involved in developing technologies appropriate to their needs (Warren 1993).

Indigenous knowledge is still an underutilized resource in the development activities. It needs to be intensively and extensively studied, and incorporated into formal research and extension practices in order to make agriculture and rural development strategies more sustainable (Scoones and Thomson 1994). Special efforts are needed to understand, document and disseminate Indigenous knowledge for preservation, transfer or adoption elsewhere.

Identifying, documenting and incorporating Indigenous knowledge in agricultural extension organization is essential to achieve sustainable agricultural development. Indigenous knowledge systems provide a frame of reference for strengthening agricultural extension programmes and this led to reorganization of interventions made by extension personnel. The participatory technologies that are developed through Indigenous knowledge integration will (i) 'provide diversified technological options, which enable farmers to choose using their own decision-making systems; (ii) originate from the farmers' own knowledge and (iii) use diversified sources in active participation of research minded farmers' (Rajasekharan, 1993).

2.8 Indigenous Plant Medicinal Practices.

Medicinal properties of plants have been recognized and utilized by communities for thousands of years. Tribal elders possess a great deal of knowledge about medicinal plants and medicines for curing certain life-threatening diseases.

The use of plants and their extracts for healing by fetish priests, native doctors, and other 'specialists' was the main method of treating various illnesses before the advent of Western medicine. The practice continues still, especially among rural communities (an estimated 82% of the population in developing countries) who, in any case may not have access to a hospital or health post (Abbiw, 1990). In the remote rural areas of Ghana, there may be only one medical doctor to 70000 people, while in the urban centers like Accra, it is 1:4000.

The practice of herbal healing is equally practiced in the urban areas as a result of the shortage of imported drugs (Abbiw, 1990). A World Health Organization (WHO) survey completed in 1983 confirmed that developing states are more interested than ever in making use of traditional, indigenous resources in implementing their primary health care programmes.

. In contrast with Western medicine, which is technically and analytically based, traditional African medicine, according to Anyinam (1987), takes a holistic approach: good health, disease, success or misfortune are not seen as chance occurrences but are believed to arise from actions of individuals and ancestral spirits according to the balance or imbalance between the individual and the social environment.

Traditionally, rural African communities have relied upon the spiritual and practical skills of the traditional medicinal practitioners whose botanical knowledge of plant species and their ecology and scarcity are invaluable.

Throughout Africa, the gathering of medicinal plants was traditionally restricted to Traditional Medicinal Practitioners (TMPs) and the knowledge of many species was

limited to these people through spiritual calling, ritual, religious control and the use of alternative names unknown to outsiders.

Hedberg *et al*. (1982) observed that the number of traditional practitioners in Tanzania was estimated to be 30,000 – 40,000 in comparison with 600 medical doctors (MDs) (Table 2.2). Similarly, in Malawi, there were an estimated 17, 000 TMPs and only 35 medical doctors in practice in the country (Anon., 1987).

Table 2.2 Ratios of Traditional Medical Practitioners (TMPs) and Medical Doctors to Total Population in selected African countries.

COUNTRY	TMP: TOTAL POP.	MD: TOTAL POP.	REFERENCE
NIGERIA Benin City National average	 1: 110 ?	 1: 16 400 1: 15 740	 Oyenye & Orubuloye (1983) Gestler (1984)
GHANA Kwahu district	1: 224	1: 20 625	Anyinam (1984)
KENYA Urban (Mathare) Rural (Kilungu)	 1: 833 1: 146 - 345	 1: 987 1: 70 000	 Good (1987) Family Health Institute (1987)
TANZANIA Dar es Salaam	 1: 350 - 450	 ?	 Swantz (1984)
ZIMBABWE Urban areas Rural areas	 1: 234 1: 956	 ? ?	 Gelfand *et al* (1985)
SWAZILAND	1: 110	1: 10 000	Green (1985)
SOUTH AFRICA Venda area	 1: 700 - 1 200	 1: 17 400	Savage (1985) Arnold & Gulumian (1987)

Ba'Aka men and women know of a wild vine that, when shredded, and applied as a paste can kill the skin parasite *Tunga penetrans* that, in the simplest cases causes painful lesions around the toe, and in the worst cases, result in severe deformities of the feet (Ntiamoah-Badu *et al*, 1995).

It has been estimated that about 25% of prescription drugs (about 7000) in the U.S have active ingredients, which are extracted from plants (Puri, 2000).

Neem tree has been dubbed "corner drug store of rural India", and is an integral part of India's cultural heritage. Neem has been used in India for the past 2000 years as an insecticide, fungicide, a contraceptive and antibacterial agent (Puri, 2000).

According to Biswall and Biswall (2003) the improper and unstandardised documentation of traditional knowledge results in patents being granted to parties who are traditionally not owners of this knowledge on medicine

This leads to conflicts in trade interests of the parties involved. The responsibility for the conservation of these medicinal plants remains undefined. As a result, sustainable management of the resources suffers. Large scale exploitation of these resources occurs due to profit maximization by patentee, thereby leading to extinction of many species with medicinal values and many more becoming endangered.

The demand for timber, fuel wood and charcoal, and agricultural expansion has also caused the loss of many valuable medicinal plants (Shiva, 1992).

2.9 Gender and Indigenous Knowledge Systems

Bodies of local knowledge are structured by systems of classification, sets of empirical observations about local environments, and systems of self-management that govern resource use. They are accessible, in the first place, to those members of a social group charged with specific resource management and production responsibilities. In this sense, indigenous knowledge systems are by their very nature gendered (Warren, 1989). They are fuelled by the experimentation and innovation of those groups within a community, which have been assigned specific production and management responsibilities.

As gender is the primary social differentiation among adult, economically active members of a society, it is logical that specific spheres of activity will become the specialized domains of different genders, as they increase their knowledge and skill over time (Fernandez, 1992). As a result of this gender specialization, Appleton (1993) observed that the indigenous knowledge and skills held by women often differ from those held by men and that, the kinds of relationships which exist between these two sets of innovators will affect hierarchies of access, use, and control, resulting in different perceptions and priorities for the innovation and use of technology by women and men he added.

Feldstien and Poats (1988) observed that gender is a cultural construct related to the behaviour learned by men and women; it affects what they do and how they do it within a specific social group. Gender differentiation comes about as a result of the specific experiences, knowledge and skills which women and men develop as they carry out the productive and reproductive responsibilities assigned to them The degree of gender specificity attached to the knowledge and skills within a society depends not only on

the way responsibilities are allocated among men and women, but also on the degree of flexibility men and women have to carry out the other's assignments (Feldstien and Poats, 1988).

Fernandez (1992), pointed out that in parts of the Andes, women have much more knowledge of livestock management practices than men, while men know much more about soil classification criteria than women. Public recognition of this specialized knowledge is reflected in the fact that women are consulted when choices are made as to the appropriate grazing and/or breeding strategies. On the other hand, men make the choices pertaining to the selection of appropriate fields for specific crops. However, if for some reason a woman were obliged to run the farm alone, she would have to make specialized decisions regarding both the animal and crop sectors (Fernández, 1992).

Thus in both women's and men's generation, adaptation and use of knowledge and technology are shaped by the economic, social, cultural, political and geographical contexts in which the two sexes live, but which each gender experiences in a different way (Appleton, 1993a). Since the primary social differentiation among adult, economically active members of a society is gender, it is not surprising that responsibility for spheres of activity is distributed first along gender lines. The practice of solving problems in these 'assigned' areas leads not only to specialization in those areas, but also to the generation of knowledge, which can be applied, to the solution of future problems.

Depending upon the culture, some types of knowledge may be complementary, meaning that both female and male knowledge systems are needed to understand a particular dimension of production or decision-making. Other types of knowledge however, may be shared, although such 'shared knowledge' cannot be assumed. In the

opinion of Norem *et al*, (1989), there are at least four ways to think about gender differences in knowledge systems. Women and men may have:

- A different knowledge of similar things;
- A different knowledge of different things;
- Different ways of organizing knowledge; and
- Different ways of preserving and transferring knowledge.

The historical need to deal with agro-ecological specificity is closely linked to the development of socio-cultural diversity and gender-differentiated knowledge and skills. In the quest for generalization, the risk of losing diversity and the possible contributions of knowledge from different systems to sustainable development have been overlooked (Fernandez, 1992). Unfortunately, as local knowledge systems gain new recognition, their holistic and gendered nature is often overlooked. Women, who are often visible in their own cultures and production systems, are becoming less and less visible as disconnected 'bits' of local--indigenous--knowledge are made known to the outside world. There is little or no reference to the differentiated role of men and women in the generation, transmission and use of knowledge.

The recognition and reinforcement of indigenous knowledge systems can form the basis for an alternative development model. The capacity of these systems to integrate multiple disciplines and the resultant synergism are beginning to demonstrate higher levels of efficiency, effectiveness, adaptability and sustainability than many of the conventional technology systems (Mathias-Mundy, 1993).

Innovation in indigenous knowledge systems must be encouraged, so that individuals can find new opportunities to mitigate the effects of the scarcity of natural resources, migration from rural to urban areas, drought, wars and unfavorable market conditions. If indigenous knowledge systems are to continue to contribute to the quest for sustainable development, their capacity to focus on diversity and locality as well as to

innovate on the basis of gendered-knowledge-generating processes must be recognized and respected (Fernandez, 1992)

2.10 Indigenous Knowledge and Livelihood Security

The increasing benefits from access to sustainable use of biological resources, especially non- timber forest products (NTFPs) and local agricultural products according to Xu (2003) have created a system of knowledge economy.

The sustainable livelihood of forest or biodiversity dependent community according to Xu (2003) can be measured as: SL= B x IK x EP

Sustainable Livelihood (SL) = Biodiversity (B) (natural capital) x Indigenous knowledge (IK) (social capital) x Enabling environment (both policies and marketing forces).

Scoones *et al* (1994) observed that sustainable livelihood analysis does not pay enough attention to the local placed indigenous knowledge.

Most approaches to measuring poverty according to Vandana (1992) use yardsticks that are meaningful from traditional view of development, such as income or access to school and hospital. He added that these approaches fail to take into account livelihoods that operate outside monetary systems and alternative indicators of well being, hence are criticized by most people.

Laderchi *et al.* (2003) observed that studies where "poverty" is measured using different approaches yield different populations of "poor" people.

Shiva (1992) argues that wealth can be found in natural resources and the knowledge that people use to manage them. In the case of subsistence pastoralism, the management of traditional livestock breeds and the use of locally available natural resources can be seen as a form of wealth, he added.

Indigenous people use environmental and behavioural knowledge to assess rangeland and livestock condition, to decide where and when to settle, and when to provide supplementary feeds and minerals, all of which are important influences in livestock and rangeland productivity, (Western *et al*, 2003).

Pastoralists use their wealth of ethnoveterinary knowledge to optimize animal health so as to sustain livelihood (Ole Lengisugi and Mziray, 1996*).*

The snake charmers of Northern India use their indigenous knowledge to earn a living.While they could not be called rich, they had enough to sustain themselves and their families with this profession (Dutt *et al*, 2003).

Livestock owners in Kenya can also control the genetic composition of the herd through selective breeding to achieve certain goals, including increasing efficiency of milk and meat production, all geared towards the sustenance of livelihood (Shiva,1992).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Location

The Afigya Sekyere District is among the eighteen (27) Districts in Ashanti Region. It is located in the North central part of Ashanti region. It shares boundaries with five districts; Ejura-Sekyeredumase to the North, Sekyere-West to the East, Ejisu-Juaben and Kwabre to the South and Offinso to the West. Specifically, the district lies between longitudes $1^{o}40'W$ and $1^{o}25'W$ and latitudes $6^{o}50'S$ and $7^{o}10'N$ of Ghana (Fig 3.1)

The District covers a total land area of 780 km^2 (78033.92 hectares) forming about 3.27% of the total land area of the region. Fifty three thousand, two hundred and fifty (53,250) hectares of this is under crop cultivation. The average land holding is 1.8 hectares per farm family.

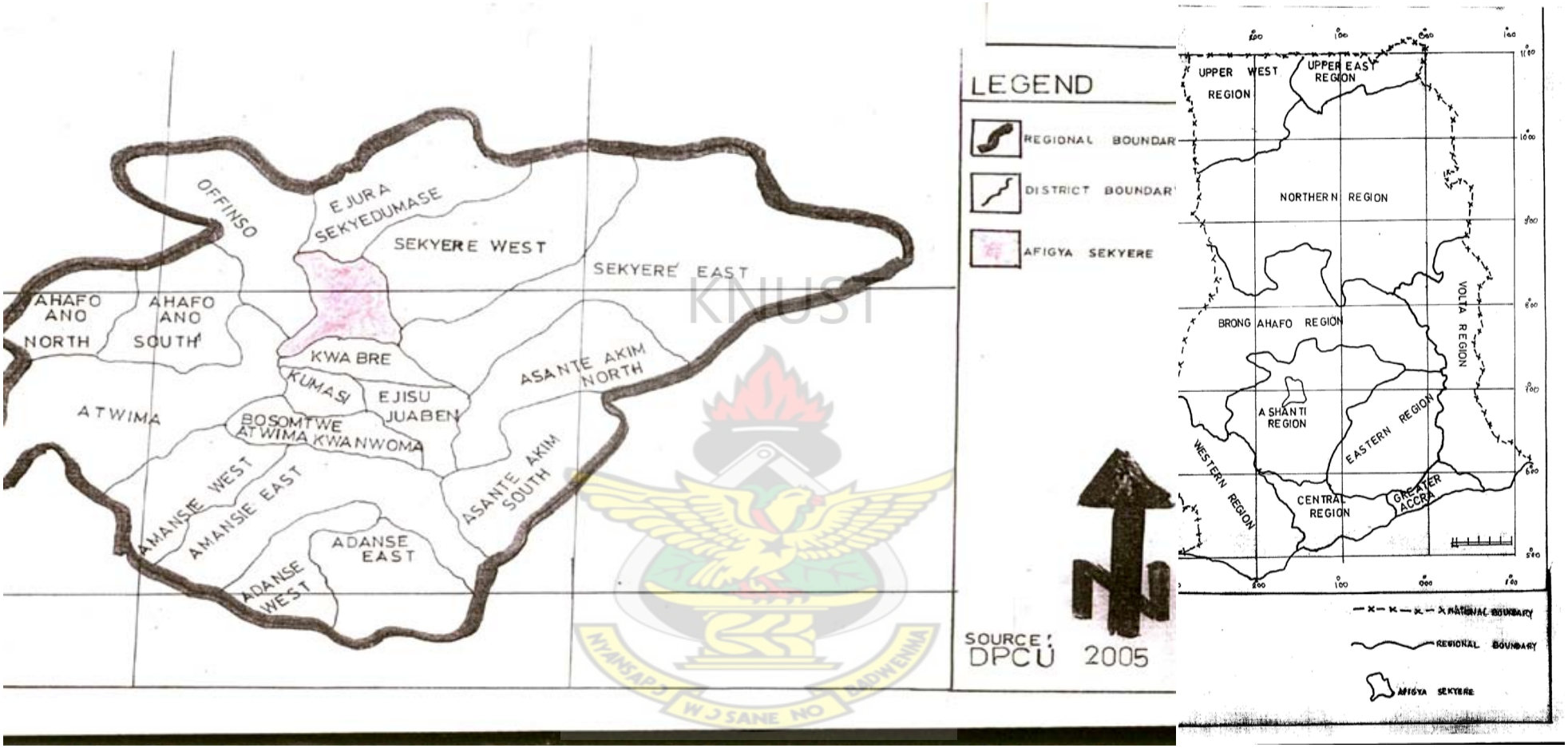


Fig. 3.1 The Afigya - Sekyere district in national context

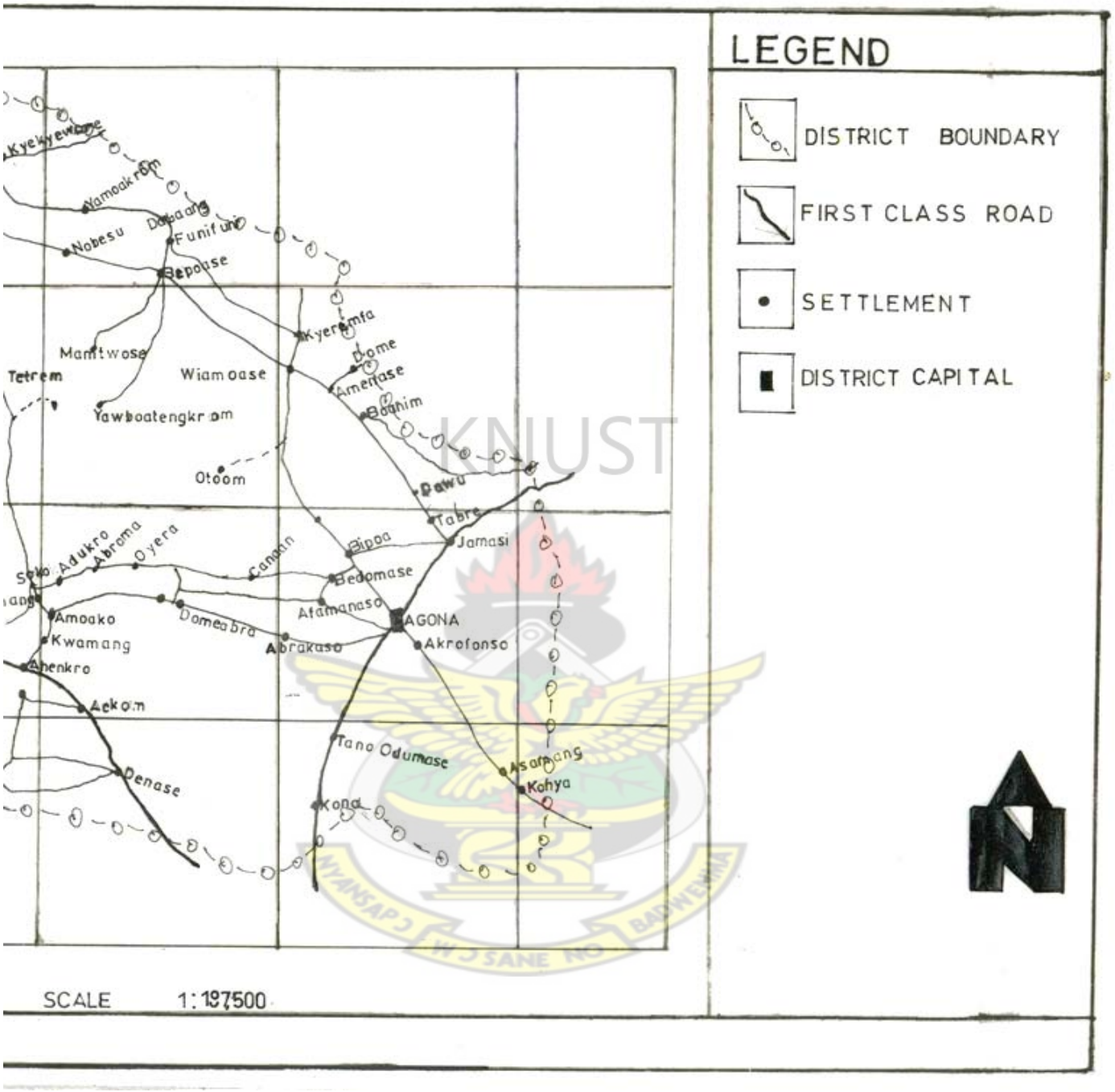


Fig. 3.2 Map of Afigya - Sekyere District

Source: District planning and coordinating unit (DPCU) 2004

3.1.2 Total Population

The total population stands at 119,093 (Table 3. 1). The growth rate is 3.3% per annum. The female population stands at 61,591 and the male population is 57,502. The rural population is 76,734(64.4%) and urban population is 42,359(35.6%). The current population forms 3.3% of the population of Ashanti region, which is 3,612,950, (DPCU 2004).

Table 3.1: POPULATION OF AFIGYA-SEKYERE DISTRICT

TOWN	TOTAL POP	MALE	FEMALE	1984	1970
Wiamoasi	12,677	9,952	6,725	9,965	6,185
Agona	9,321	4,660	4,661	6,010	4,204
Jamasi	9,096	4,323	4,773	6,892	4,892
Kona	5,853	2,770	3.083	4,800	3,488
Asamang	5,277	2,572	2,705	1,091	741
Bepoase	4,810	2,414	2.396	2,483	2,121
Tetrem	4,698	2,294	2,404	3,723	2,680
Kyekyewere	4,062	1,920	2,142	1,049	969
Bipoa	3,875	1,729	2,146	2,114	1,843
Tano Odumasi	3,453	1,1651	1,802	2,653	1,748
Ahenkro	3,415	1,703	1,712	2,267	1,857
Boanim	4,299	1,501	1,798	2,526	2,057
Afamanaso	2,508	1,147	1,361	1,715	1,416
Boamang	2,436	1,083	1,353	2,020	619
Kwameng	1,918	906	1,012	1,707	1,428
Konya/Brehoma	1,908	835	1,073	1,515	706
Amoako	1,581	764	817	1,119	956
Bedomase	1,492	692	800	951	630
Nkwantakese	1,455	708	747	1,366	1,554
Akrofonso	1,357	662	695	1,596	1,094

Source: 2000 Population and Housing Census, Ghana Statistical Service.

3.1.3 The Climate

The area falls within the West semi equatorial climatic zone. It has two rainfall maxima with very marked dry seasons. The end of March to late June and September to November mark the major and minor rainfall seasons respectively.

The minor wet season is followed by a long dry season from December to February: it is characterized by hot days, cool nights and low relative humidities. Temperatures are uniformly high throughout the year with the highest mean monthly temperature of about 30 ^{0}C occurring between March and April and the lowest of about 26 ^{0}C in August. The average monthly relative humidity ranges between 60% and 75%. Annual total rainfall is between 1150 mm and 1300 mm.

3.1.4 Vegetation and Drainage

The vegetation consists of secondary, moist semi-deciduous forests with a few reserves found around the Offin and Afram headwaters, Asufu East, Gianima and Ongwan. A derived savanna and grassland vegetation are found beyond Boanim and Wiamoase due to human activities such as charcoal burning and bushfires.

3.1.5 Topography and Soils

The physical features of the district consist of undulating lands with few escarpments at Jamasi, Wiamoase, Dawu, Kona, Boamang and Boanim. The basic soil types are the Kumasi, Offin, Boamang and Yaya soil associations, which are very fertile.

3.2 Data Collection

Seventeen communities were randomly selected from the Afigya Sekyere District (appendix 2).From each community a number of households were randomly selected based on information gathered from the Ministry of Food and Agriculture station in the district capital, Agona. The number per community was chosen according to the total

population. Those with population less than 500, 5% sampling intensity was applied. For those greater than 500 but less than 1000 and those greater than 1000, 2.5% and 2.0% sampling intensities were used respectively for the survey.

These individuals were randomly sampled and either (a) interviewed using a questionnaire focusing on the farmers awareness on species, the exploitation regimes (mode of harvesting and utilization), the revenue and the conservation strategy (traditional practices consciously or otherwise used by farmers to protect and maintain the plant population) or (b) involve in field observation on the following aspects;

i. Habitat or preferred niches of the species;

ii. The species frequency per niche (how often the important tree species are found in their habitat)

The habitat were clearly explained to farmers as

- High forest (undisturbed by man, farming activities or fire);
- Degraded forest (by timber or other human activities);
- Bush fallow (abandoned farmland);
- Crop field (active farmland with planted food crops);
- Cocoa plantation (farmland with planted cocoa) and
- Home garden (mixed crop field around the home)

3.3 Questionnaire Administration in the various communities

The mode of distributing the questionnaires was based on whether the respondent was educated or not. The educated were made to answer the questions themselves and a time frame given for its collection. The illiterates were made to answer the questions which were read to them by the interviewer. Details are shown in the table below.

Table 3.2 Questionnaire distribution and their retrieval in the communities

Community	Number distributed	Number retrieved	Percentage(%) retrieval
Agona	100	90	90.0
Wiamoase	90	80	88.9
Jamasi	40	30	75.0

Source: Field survey 2004

3.4 Data analysis

The data collected were grouped and analyzed using statistical package for social sciences (SPSS).The raw data was coded into the software and the results presented in pie charts and bar charts.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

This chapter discusses the data obtained from the field survey. The first part of the discussion focused on the Socio-economic characteristics of respondents namely, age and sex distribution, educational status, religion, household size and ethnicity. This was followed by the description of the general land use system of the study area. An analysis of off- farm activities was also discussed. The last part focused on the tree species found in the area; the indigenous knowledge, natural niches, relative abundance of the tree species and the conservation practices adopted to preserve the tree species.

4.2 Socio-economic Characteristics of respondents

4.2.1 Age and Sex Distribution

The ages of the 200 respondents ranged from 20-80 years. Thirty one percent (31%) of the respondents were in the age class 20-40 years. Forty percent (40%) were within the 41-60 year group and twenty-nine percent (29%) in the 61+-age class. These figures show that a greater number of the active working group (30-60 years) are involved in farming and would have some knowledge on farming practices that may lead to the conservation of important tree species in the localities.

Out of the two hundred people interviewed, fifty one percent (51%) were females and forty nine percent (49%) were males. The 2000 population census showed that females are more than male population in the district and this is reflective on the national distribution which also shows the same ratios. Since farming is the mainstay of the people in these communities, the ratio of females to males 51%: 49% which also corresponds to the national ratio indicate that gender related activities are not so much distinct in these communities. Women and children mostly do gathering of cola in the

various communities. As gender is the primary social differentiation among the economically active members of society, it is logical that specific spheres of activity will become the special domain of different genders (Fernandez 1992).

Since the primary social differentiation among adult, economically active members of a society is gender, it is not surprising that responsibility for spheres of activity is distributed first along gender lines. The practice of solving problems in these 'assigned' areas leads not only to specialization in those areas, but also to the generation of knowledge, which can be applied, to the solution of future problems (Appleton, 1993a).

4.2.2 Educational Status of Respondents

The level of basic/elementary education (primary, middle or JSS) among respondents was very high. Fifty percent (50%) had formal education up to the middle or JSS level. 28.5% had up to the secondary level and 21.5% had no formal education. The result of this high level of formal education [about eighty percent (80%)] according to Sarfo-Mensah (1994) may decrease conservatism and increase the level of understanding and absorption of knowledge when educational programs for example on conservation of nature are given to them. This will favour the conservation of natural resources in the area.

The perception of indigenous people about natural resources help them to interact with their environment, though modifying nature, they actively maintain it in a diverse and productive state as earlier observed by Irvin, (1989).

4.2.3 Religion of Respondents

Christianity was the major religion of the respondents (65.5%), followed by Islam and then others (eg traditional religion) (fig. 4.1).

The presence of various religious groups in the area is very important when considering conservation practices. Some days are tagged “bad days” in the working days of the week where almost everybody stays away from a particular land. This saying, I belief is geared towards the conservation of natural resources in these areas and have since made significant contribution to the protection of wildlife and other biological resources. This is in line with what Poku- Marboah (2001) observed about traditional religion, “that in traditional religion for instance; there is the belief of mystical powers associated with supernatural beings to ensure that the natural resources are not unduly disturbed”. As a result, there is the need for the scientific, economic and other real reasons behind these traditional prohibitions to be unearthed so that people in the communities who may not subscribe to the traditional religion may also have cause from which they may wish to accept the traditional beliefs and its´ related dos and don’ts.

Ninety-eight percent (98%) of the religious groups had knowledge on herbal medicine. Traditional religious groups (fetish priests) in the various communities make good use of plants to cure their clients. Since the people had knowledge on the efficacy of plant medicine, they are encouraged to take good care of trees (Nortey, 1978).

In Ghana, the National Environmental Action Plan (NEAP), which provides a coherent framework for interventions deemed necessary to turn the environment and development efforts into more environmentally sustainable programmes and practices, regrettably does not highlight the potential of religion in this endeavour (Anane, 2008). According to Anane (2008), the UNCED's Agenda 21 also puts away religion under the broad theme of traditional knowledge, culture and indigenous people with the argument that traditional knowledge is related to the entire culture of a people, including its identity, spiritual and religious beliefs. This tendency unfortunately

relegates the immense potential of religion as a key to natural resource management and sustainable development to the background because these terminologies do not take into account Western or orthodox religions.

Religion, I belief is indispensable to modern-day conservation and environmental protection efforts.

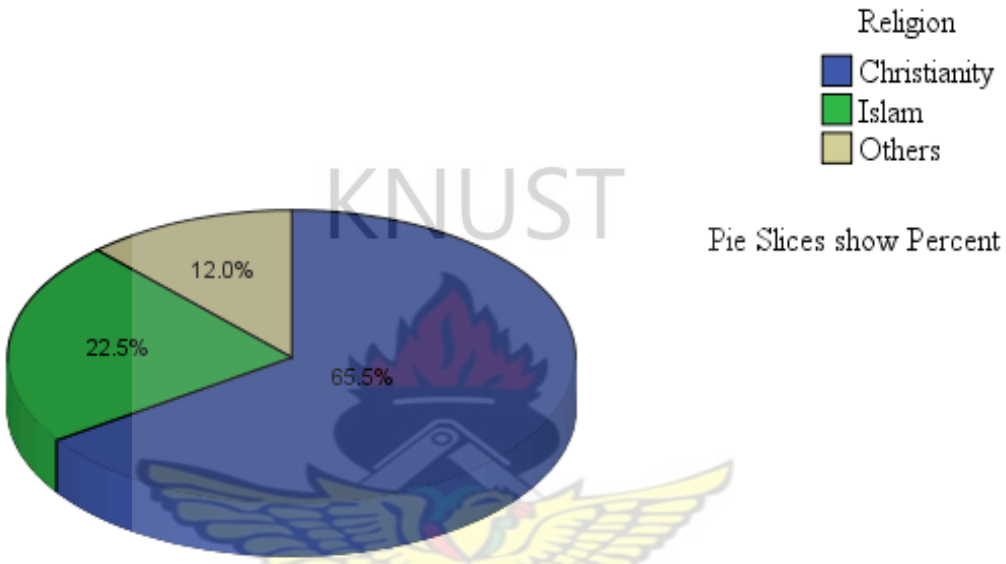


Fig 4.1 Religious grouping of respondents

4.2.4 Household size

Most of the people interviewed (about 70%) were family heads. Fifty six percent (56%) of the respondents had family size between five and eight. Twenty six and half percent (26.5%) of the respondents had families above nine people and 17.50% had between 1-4 families. The large family sizes which are above the national average of

3.5- 4.0 will mean that in terms of labour for agribusiness, the source will be readily available but at the same time, it will also lead to pressure on the resources as a result of high demand on the natural resources by the ever growing population (Sarfo-Mensah,1994).

4.2.5 Ethnicity

The majority of the respondents (61%) were natives of the district. The rest were immigrants, mostly those from Northern Ghana, (Table 4.1).

The respondents from the Northern sectors of Ghana were found working as caretaker farmers. They also engage in full time farming activities.

Ethnicity of farmers was very important as each of them had different perception when it comes to tree conservation. In the Northern region, (Kpila) for instance, farmers do not have access to the Dawadawa tree, no matter where it germinates. It is the chief who harvests and give farmers their share. Gadgil, (1985) earlier commented on this act and said that such restrictions may benefit certain segments of the community in positions of power without serving the interests of long-term conservation of indigenous trees.

The main aim of the migrant farmers was to increase output but not to nurture trees, as it may not be profitable to them.

Ethnicity is also a source of worry to many workers as majority being migrants will mean capital flight (draw of money) which often leads to conflicts. In this case, the balance may favour development and lessen conflicts as the majority are natives.

Table 4.1. Ethnic groupings of respondents

Ethnic Group	Number	Percentage
Natives (indigenes)	150	75%
Kusasi	20	10%
Moshie	10	5%
Others (Busanga, Basares and Ayamga)	20	10%
Total	**200**	**100%**

4.3 Land tenure

The indigenous land tenure and management system operates in the Afigya-Sekyere district. Land is mainly family owned and distributed according to family lines. Settler farmers contact landholders, friends or most frequently the family they reside with for land on a contractual basis such as a gift or sharecropping (Kasanga *et al*, 2001). Most families do not sell lands outright but rather resort to lease them out. The contractual terms in the study area include the share cropping arrangement, locally known as “abunu” or “abusa”. In both arrangements, it was the tenant who cultivates the land. The proceeds are equally shared between the tenant and the landowner under the “abunu”system and under the “abusa” system, the landlord takes two-thirds while the tenant takes one-third.This was done for both food and cash crops. For commercial purposes, the land is obtained through the chief or his representatives and the families involved. The indigenous people acquire lands by inheritance.

Tenurial arrangements sometimes make settler farmers feel reluctant to plant or nurture a tree. This is because they do not have security over the intended planting location; therefore adoption of tree planting technology may be out of question (Raintree, 1991). Since most of the respondents were indigenes and make up the majority of farmers, they are likely to nurture and take good care of trees which they deem important.

4.4 Farm sizes

Fifty-two (52) of the respondents had farms between one and two hectares. Seventy- six (76) of them had three to five hectares. Forty-four (44) had six to nine hectares and twenty- eight (28) had farms beyond ten hectares (fig 4.9).

Most of the respondents, especially the family heads had several pieces of land.

It was observed that those farmers with large hectares of land used them for perennial plantation crops like cocoa and oil palm.

Respondents with smaller holdings were mainly subsistence farmers growing food crops. Almost all the farmers had scattered farms which they claim help to reduce the risk of crop failure.

The slash and burn method was used in preparing land for cropping by the farmers.

Fig 4.2 Farm sizes of respondents

4.5 Length of fallow periods

Seventy eight (39%) of the respondents allow their farmlands to fallow for a period between one and three years. Fifty-seven (28.5%) of them allow for 4-6 years before returning to the land. (Table 4.2). The fallow periods show that land is not a problem in the study area despite the large family sizes of some households. It was observed that most farmers practicing relatively shorter fallow periods were sharecroppers.The longer fallow periods indicate that the people are natives and therefore owned most of the lands. This may allow for regeneration of trees that were pruned or coppiced during the active farming seasons. The main mode of soil restoration was through fallowing.

The farmers appreciated the effectiveness of fallowing as a method of controlling pests and diseases in crop fields. Traditional farmers facilitate natural replenishment of nutrients in the soil and ecological balance, for example pest to predator balance which ensures sustainable agricultural production (Ntombie, 1995).

Table 4.2 Distribution of farmers by length of fallow.

Fallow period	Number of farmers	Percentage of farmers
1-3 years	78	39.0%
4-6 years	57	28.5%
7-9 years	41	20.5%
10+ years	24	12.0%

Source: Field survey, 2004

4.6 Land use system in Afigya-Sekyere District

The major land use types found in the Afigya-Sekyere district are those for food crops and those based on perennial tree crop production system.

4.6.1 Food Crops System

Farming is the mainstay of the people, with about 90% being active farmers.

The main cropping system was a maize- cassava- cocoyam- plantain intercrop (Plate 1) and minor production of other root crops and vegetables

The food crops cultivated included *Manihot esculenta* (cassava), *Xanthosoma sagithifolium* (cocoyam), *Musa paradisiaca* (plantain), *Colocasia esculenta* (taro), *Zea mays* (maize) and *Dioscorea* species (yams) . These were the staple food of the people and they were usually cultivated in mixed stands. The farmers used mixed cropping with a lot of ground cover to protect the land from erosion as earlier observed by Ntombie, (1994).

The indigenous mixed cropping system according to Gata and Kativu (1991) is based on sound scientific principles.

Andrew and Kassim (1976) had earlier stated that mixed cropping is a modified form of crop rotation and said that such a system is more scientific than pure stand cultivation.

The indigenous farmers practiced mixed cropping for many reasons;

- To provide a wide variety of food for balanced nutrition
- To capitalize on the different maturing periods of the various crop varieties for food security throughout the season
- As an environmental risk management strategy
- To maximize gross margin returns per hectare
- For comparatively higher yields per given area as mentioned earlier by Ntombie (1994).

Depending on the fertility of the land and environmental condition, some farmers cultivated a piece of land twice a year in order to ensure food security throughout the whole year. Those who cultivated their lands once a year claimed the late crops do not do well in their locality. This can be attributed to the fact that the land would not have regained its fertility by the time of the second cropping and also there would not be enough rains to support plant growth at that time.

Table 4.3 Types of food crops cultivated by farmers in the Afigya - Sekyere district

Food crops	Number of farmers Cultivating the crop	Percentage of all respondents (%)
Cassava	200	100
Maize	200	100
Cocoyam	200	100
Plantain	120	60
Yam	80	40
Vegetables	40	20

Source: Field survey, 2004

Plate 1: A Cassava farm intercropped with plantain at Afamanaso

4.7 Tree Crop Production

Apart from food crop production, the farmers also engage in tree crop production which provides them with the bulk of their yearly income. The tree crops produced include cocoa, oil palm and citrus. Cocoa and oil palm plantations have been in existence since time immemorial but with the advent of the hybrid forms of these crops, many hesitant farmers have moved in to cultivate large hectares of the crops. The farmers engage the hands of migrant farmers who blend the system with their cultural practices.

4.7.1 Cocoa production

Theobroma cacao (Cocoa) is one of the major tree crops grown in the study area with an average farm size of 1.2 hectares per household.

The crop is established either by transplanting or planting at stake. The farmers used 1.8m to 2.7m for transplanted seedlings and 0.3m interval for those planted at stake and thinned as the crop grows.

The farmers intercropped cocoa with food crops like plantain, cassava and cocoyam during the initial stages and as the canopy closes, the food crops are removed leaving the main tree crop, cocoa.

Ricinodendron heudelotii (Nwama), *Funtumia elastic* (funtum) and *Ceiba petandra* (onyina) are the tree species left on the farm to provide shade, nutrients and moisture for the Cocoa seedlings.

The main problem of cocoa production was how to deal with pests like the black pod disease, swollen shoot, capsid and piercing moth which causes abortion of fruits.

The farmers admitted that the presence of cola trees in their cocoa farms was a "necessary evil"; it provided income through gathering during the lean season and competes with cocoa for nutrients and also harbour some parasites like mistletoes which reduce yield.

Ficus species were also a menace in the farms because the farmers reported they absorb a lot of water from the soil causing some of the stands to wilt leading to a reduction in production.

The first three years of cocoa production according to the farmers is labour intensive and since they do not have money, it has become a great problem to them.

4.7.2 Oil palm production system

Oil palm (*Elaeis guineensis*) is another tree crop that is grown in the area with average farm size of 0.8 hectares per household. The crop is established by seedlings with a planting distance of 8.8 m by 8.8 m triangular.

During land preparation, no tree is left on the land because the palm fronds provide shade. Initially it is intercropped with plantain, cassava, cocoyam and maize but when the canopy starts closing, these components die out themselves. For the first three years, wire gauzes were used to encircle the seedlings to prevent grasscutters from cutting them down.

Weed control is a problem to the farmers as they reported is labour intensive.

According to the farmers, oil palm farms require frequent fertilization because the stands take large amounts of nutrients during fruiting periods. Pests like the oil palm stem borer and fungal attacks which cause fruit rot are sources of worry to the farmers.

4.7.3 Citrus production system

Citrus senensis (sweet orange) is one of the tree crops cultivated on large scale in the study area. The average farm size is about 0.4 hectares per household. The plant is established by seedlings, with a planting distance of 2.7 m by 2.7 m rectangular.

During land preparation, there are no shade trees left on the land.

Food crops like cassava and cocoyam are intercropped at the initial stages, but as time goes on, they are left out.

The presence of mistletoes on the orange trees causes a decline in yield.

Piercing moths abort and destroy fruits which lead to low quality fruits.

Problems in accessing credits as the first three years of establishment is labour intensive.

There is also lack of technical support and declining soil fertility.

4.8 Tree Species

Numerous species of trees abound in the Afigya-Sekyere district which the indigenes use and maintain for future use. The farmers employ traditional tree management practices such as selective clearing to ensure the continuous existence of these trees as the basic farming system was bush fallowing followed by slash and burn agriculture. The tree species are absolutely necessary to the indigenes and hence have evolved ways of sustaining them.

4.8.1 Indigenous Knowledge of Trees

The respondents had a rich store of indigenous knowledge on trees. This was shown by the ease with which they mentioned the names of trees and where they can be found. The elderly were more experienced in the use of indigenous knowledge on trees than the younger farmers. This may be in agreement with what Wild (1972), said that Africans knowledge of indigenous plants and their African names is declining rapidly because youngsters no longer go through the herd boy experience in close contact with nature, learning African plant names from their elders and tasting indigenous fruits but, rather must go through long periods of learning more exotic subjects with different practical uses.

Their knowledge on propagation and regeneration of indigenous trees was enormous. It was also noted that most indigenous tree species mentioned had medicinal values. The respondents also had knowledge on trees which were good for fuel wood and fodder. Abbiw, (1990) also made similar observation in his work in Ghana.

This rich store of knowledge on trees according to the farmers was handed to them by their predecessors as they moved with them in all their farming activities. This is believed to stay with the generations to come as is the norm that every generation bequeaths the next with indigenous knowledge through various learning processes.

The trees mentioned by the farmers are arranged in order of importance (Table 4.4).

Table 4.4 Important tree species in the Afigya-Sekyere district.

Scientific name	Local name	% of farmers with knowledge on tree	Important use(s)
Cola nitida	Bese	100	stimulant, medicine, energy, for dyeing
Spathodea campanulata	Kuokuonisuo	100	Medicine, energy, soil fertility improvement
Rawuolfia vomitoria	Kakapenpen	98	Medicine, energy, fodder
Lannea welwitschii	Kumanini	80	Medicine, energy
Morinda lucida	Konkroma	80	Medicine, energy
Funtumia elastica	Funtum	78	Medicine
Kigelia africana	Nufutene	60	Medicine
Petersianthus macrocarpus	Asea	65	Medicine, energy
Trichilia monodelpha	Tanduro	90	Medicine, energy
Ricinodendron heudelotii	Nwama	85	Medicine
Alstonia boonei	Sinduro	85	For carving
Albizia zygia	Okoro	90	Medicine
Glyphoea brevis	Foto	50	Soil fertility improvement
Zanthoxylum gelletii	Okuo	60	Medicine
Pycnanthus angolensis	Otie	70	Medicine, energy
Azadirachta indica	Neem	100	Medicine

Source: Field Survey, April 2004

4.8.2 Natural niches of the tree species

The natural habitats of the tree species ranged from fallow lands through crop fields, home garden, to degraded forest, (Table 4.5.) Cola, being the most cherished tree is predominantly found in bush fallow and crop fields. There seem to be growing interest in the cultivation of *Cola nitida* in the area due to the huge profit made by farmers from the sale of the fruits.

Some farmers expressed interest in the domestication of some medicinal plants but lack the knowledge on their propagation methods.

Table 4.5 Tree species and their habitats in the Afigya-Sekyere district

Scientific name	Local name	Natural habitat(s)
Cola nitida	Bese	Bush fallow, crop field
Spathodea campanulata	Kuokuonisuo	Crop field, homestead
Rawuolfia vomitoria	Kakapenpen	Crop field
Lannea welwitschii	Kumanini	Crop field
Morinda lucida	Konkroma	Crop field
Funtumia elastica	Funtum	Bush fallow, crop field
Kigelia africana	Nufutene	Bush fallow
Petersianthus macrocarpus	Asea	Degraded forest, crop field
Trichilia monodelpha	Tanduro	Crop field
Ricinodendron heudelotii	Nwama	Bush fallow
Alstonia boonei	Sinduro	Crop field, Bush fallow
Albizia zygia	Okro	Crop field
Glyphoea brevis	Foto	Bush fallow
Zanthoxylum gelletii	Okuo	Crop field
Pycnanthus angolensis	Otie	Bush fallow
Azadirachta indica	Neem	Homestead, Crop field

4. 8.3 Relative abundance of the species in their niches

Most of the species according to the farmers used to be abundantly scattered in their natural habitats, but due to population growth and overexploitation, their numbers have been dwindling. This has brought about reduction in revenue, especially the one obtained from gathering of wild fruits like *Cola nitida.*

The species population density ranged between 3 and 25 trees per hectare across all the villages visited. (Fig. 4.3). The trend may be due to the importance of the various species to the communities and also their exploitation regimes.

The farmers complained that *Cola nitida* used to be found in many cottages and villages on cocoa farms but now it is difficult to get enough seeds even during the prime season.

The reasons for the decline in the population of Cola and other related species in the area according to the farmers are;

- Felling of the tree for roofing purposes;
- Felling of the trees to make way for the mass cocoa fertilization and spraying exercise (they contend these stands compete with the cocoa for the added nutrients);
- Sources of infection of cocoa farms by mistletoes, hence they fell them to prevent infesting their cocoa farms and
- Food crops grown around certain trees like Cola do not yield as those on other trees or plain land (cocoyam and cassava close to cola have softer corms and tubers respectively).

Table 4.6 Proportion of farmers with various reasons for the decline in tree species in the Afigya-Sekyere district.

Reason(s) for reduction in tree population	Percentage of farmers
Felling for construction purposes	60%
For mass spraying exercise	30%
As a source of Mistletoe infecting farms	10%
Reduction in yield of food crops	2%

Source: Field survey 2004.

Note: some farmers gave more than one reason

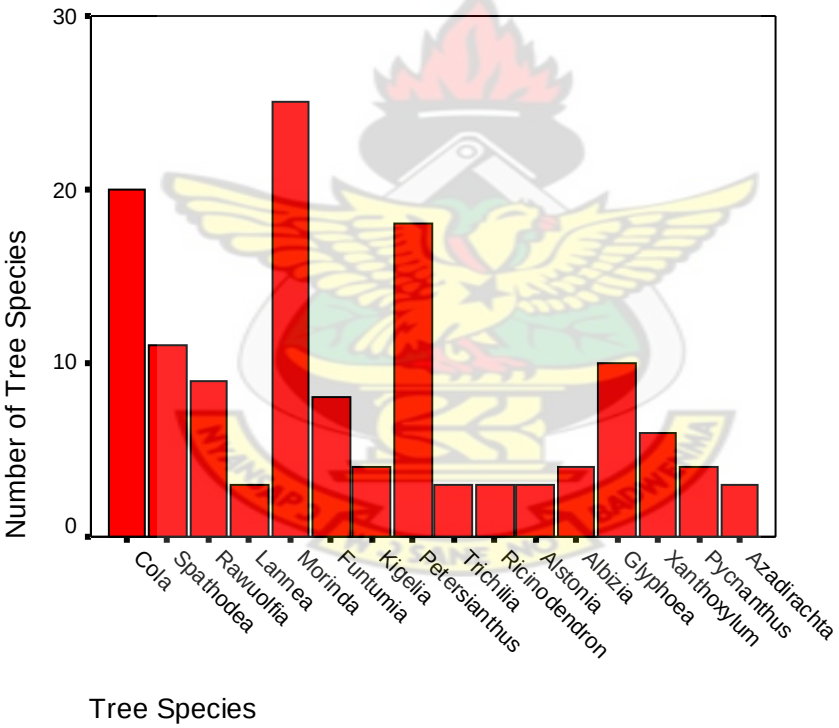


Fig 4.3 Relative abundance of tree species in the Afigya-Sekyere district.

4.8.4 Importance of trees in the Afigya-Sekyere district.

The tree species mentioned by the farmers have a lot of uses which include fodder, fuel, soil fertility improvement and medicine.

Most people prefer using herbal medicine to orthodox medicine. These people argue that it was the main method of treating various illnesses before the advent of western medicine. The practice of herbal medicine is equally practiced in the urban areas as a result of the shortage of imported drugs (Abbiw, 1990). The herbalists claimed they have medicines for a wide range of diseases and disorders but never disclosed how they are prepared. Trees with medicinal properties include Sausage tree (*Kigelia africana*) as an anthelmintic, African nutmeg (*Pycnanthus angolensis*) which also serves as an anthelmintic, Neem (*Azadirachta indica*) for feverish conditions, African Tulip tree (*Spathodea campanulata*) serves as an appetizer, medicine for Schistosomiasis and soil fertility improvement – provision of moisture for plant growth, *Albizia zygia* is also an appetizer, *Alstonia boonei* for asthma, *Rawuolfia vomitoria* for feverish conditions and as an emetic , *Zanthoxylum gelletii* for heart diseases and hernia, *Ricinodendron heudelotii* maintains pregnancy and prevents abortion of fetuses (Abbiw, 1990).

The nut of *Cola nitida* is used as food while the bark is used for dyeing cloth and for the preparation of concoctions for sick domestic animals.

The twigs of *Trichilia monodelpha* (tanduro) are used to clean the teeth.

Some of the trees are very good sources of fuelwood examples include *Morinda lucida* (Konkroma), *Terminalia ivorensis* (emere) and *Lannea welwitschii* (Kumanini).

4.8.5 Tree Conservation Practices

The immense contribution provided by trees (and related products) on the lives of the indigenous people of Afigya Sekyere district of Ashanti has resulted in the evolution of strategies aimed at protecting the important tree species in the area. The study showed

that the people are engaged in the conservation of important tree species using approaches such as:

- Selective clearing during land preparation for cropping;
- Sustainable bark harvesting from medicinal plants (Plate 2);
- Weeding the undergrowth to prevent wild fire from reaching them (Plate 3) ;
- Spraying and removal of mistletoes, tendrils or climbers entangling the trees;
- Pruning of tree stands (Plate 4) ;
- Artificial propagation and recognition of individual property in certain species like *Cola nitida* and
- Community's effort to protect illegal exploitation of plants in the wild

This is in agreement with what Gadgil, (1995) documented, "that the ways in which various communities approach the utilization of their natural resource base depends on their perception and experience of how it responds to patterns of resource use". He added that if the resource base is perceived as fluctuating in a capricious fashion regardless of how it is used, a society would tend to impose few restraints in its use. Societies that perceive their resource base as infinite and ever expanding by virtue of technological advances are less likely to observe any resource use restraint.

It is when the resource base is perceived as well -demarcated, finite and sensitive to the resource use patterns that societies are most likely to stress restrained, sustainable patterns of resource use.

The above conservation approaches evolved as a result of the growing awareness of the farmers in the Afigya Sekyere district to preserve the potential of the wild tree species. The farmers argued that only local knowledge and skill have been used to preserve these tree species and in some cases domesticating them as is happening in the case of Cola.

It was also observed that the trees provide the people with many of their domestic needs like fruits, medicines, fuel wood and wood for construction as well as fodder for their livestock. The rural folks cannot do without these, hence the need to put in place a conservation measure to protect these wild species and this has perpetuated from generation to generation.

The effort to conserve these trees such as *Cola nitida* also stem from the fact that there has been expanding market opportunities for the products at local, national and international arena as also observed by Fondoun and Tiki Manga, (2000).

Plate 2 : A herbalist removing the bark of a tree

Plate 3: A farmer weeding the undergrowths around a tree

. Plate 4: A Farmer pruning and removing tendrils on a tree

4.9 Animal production

The type of livestock raised in the study area included sheep, goat, poultry cattle and pigs. Almost every household visited had poultry (43%). This was the largest livestock kept by the respondents. Sheep and goats were also found in most households (fig 4.4). Pigs were rarely seen in the study area. This was attributed to the fact that about 90% of the inhabitants were Adventists. The small numbers of pigs found were reared by people to cater for the minority non Adventists.

The livestock raised in the study area according to the farmers helped to 1) supplement the protein needs of the people, 2) their income and 3) to provide occasional meat for the household during festive occasions.

With an exception of pigs which were confined, most farmers raised their livestock on a free range system. Coops were provided for the poultry by some farmers and in the

cottages some allow them to roost on trees. Wooden fences were provided to house the sheep, goat and cattle. The farmers supplemented the feed eaten by the animals by giving them maize, cassava and plantain peels on their return home. The farmers also used fodder as a supplementary feed for sheep and goats.

Fig 4.4 Types of livestock kept in the Afigya - Sekyere district

4.10 Off-farm activities

Although off- farm activities play an important role in the livelihood of the people as it provides a substantial amount of money, some of the respondents do not engage in this due to old age. Almost all the young farmers engage in one kind of off- farm activity or the other. Many of the off- farm activities apart from petty trading, masonry, civil

service, driving and drivers' mate, were tree related like gathering of cola, palm wine tapping, distilling of local gin and practicing of herbal medicine. (Table 4.7).

Cola was one of the important fruit trees in the study area because it serves as the 'life line' for most of the people during the lean season.

The total income obtained from off-farm activities ranged between twenty to hundred Ghana cedis a year and the amount obtained from on-farm activities (gathering and farming) ranged between thirty and eight hundred Ghana cedis for the same period (Appendix 3).

Out of these amounts accrued, about 69% of the respondents were able to save 1% - 10% while the rest had nothing to keep after expenses (Appendix 4). This conforms to what Shiva, (1992) said "that wealth can be found in natural resources and the knowledge that people use to manage them".

Most of the people inevitably depend on farming and tree-related activities for their livelihood and thus would make sure to conserve the sources of their livelihood.

Table 4.7 Distribution of farmers according to off-farm activities

Off- farm Activities	Frequency	Percentage of farmers (%)
Petty trading	50	25
Cola gathering	191	95.5
Masonry	17	8.5
Palm wine tapping	40	20
Drivers' Mate	9	4.5
Driving	5	2.5
Civil Service	70	35
Carpentry	20	10
Herbal medicine practicing	13	6.5

Note: Some farmers had more than one off- farm activity.

Source: Field survey, April 2004.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

From the above results, it can be concluded that farmers in the Afigya-Sekyere district of Ashanti have in-depth knowledge on practices that tend to conserve the important tree (non-timber) species in the communities. They are aware of the benefits of trees in all conditions. The high educational levels of the farmers (about 70%) have contributed to the conservation of trees in the study area. Farmers in the study area have deep knowledge on indigenous trees and their uses which cuts across the socioeconomic attributes of trees. These include soil fertility improvement, medicinal qualities, tree-crop associations and fallow management qualities. Some of the farmers had no knowledge about the propagation methods of some of the tree species.

The major land use systems found in the Afigya-Sekyere district are those for food crop production, Cocoa production system, Oil palm system and Citrus production system

The use of the trees as food, medicine, soil fertility improvement, source of energy and fodder is also very important. The species are also economically important for income generation for the farmers especially during the lean season.

The practices undertaken by the farmers to ensure the continuous existence of the tree species include: Selective weeding during land preparation for cropping; Sustainable bark harvesting from medicinal plants; weeding the undergrowth to prevent wild fire from reaching them; spraying and removal of mistletoes, tendrils or climbers entangling the trees; Pruning of tree stands; avoidance of cutting down natural tree stands while clearing forest lands and the Community's effort to protect illegal exploitation of plants in the wild.

Degraded forest, bush fallow, and food crop fields were identified as the niches of the important tree species. The tree populations differ in the various land use types. *Cola nitida, Morinda lucida and Petersianthus macrocarpus* were the most abundant tree species in the communities.

5.2 RECOMMENDATIONS

The rich knowledge on indigenous practices should be documented by the district assembly for use by future generations.

The disappearance of the natural vegetation and even its replacement with artificially established forests of exotic species are changing the ecology of the environment with a consequent disappearance or change in occurrence of many useful species, thus depriving rural communities of their benefits. Forestry officials should train farmers in the propagation methods of the tree species which are important but are getting extinct.

The conservation and tending of trees may be influenced by tenurial agreement. Making the agreement flexible to farmers, especially settler farmers will contribute to the conservation of trees.

The negative perception by farmers on certain tree species need to be eroded by educating them on the ecological importance of all trees.

The strategies developed by the indigenous people to protect tree species need to be improved through the application of sound scientific principles in order to help local farmers to properly manage, conserve and use the useful non timber forest products.

There should be workshops to transfer indigenous conservation knowledge to primary school pupils through songs, local dances, herbal medicine and stories.

Further research work on the ways of developing strategies and agroforestry interventions that could be used to conserve the important tree species in the study area would help in the sustenance of the livelihood of the people.

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APPENDIX 1

Questionnaire

A. Personal Data

(i) Name ……..

(ii) Gender : ……..

(iii) Age ……..

B. Educational Level

(i) Basic / Elementary: [ ]

(ii) Secondary: [ ]

(iii) Vocational: [ ]

(iv) Tertiary: [ ]

C. Religion

(i) Christian: [ ]

(ii) Muslim: [ ]

(iii) Others: [ ]

D. Household Position

(i) Head [ ]

(ii) Member [ ]

(iii) Household Size [ ]

E. Socio – Economic

(i) Total Population of area …….

(ii) Total land area of respondent……..

(iii) Ethnicity: indigenous / setter/ migrant

(iv) Farm income

- How much do you earn from your farm? …….

(v) Land Tenure

- Does the land belong to you? Yes / No
- How did you acquire it?.....

(vi) Off-farm activities

- Do you engage in any off-farm activities? Yes / No
- If yes what are the major type(s) and location of off-farm employment

F. Farming Systems

(i) What type of farm system(s) do you adopt?

a) Cropping system (only crops) / mixed cropping?

b) Livestock system

c) Mixed farming

d) Crop / animal (separate enterprise)

e) Others

f) Reasons for adopting this system ……..

……

G. Intensity of Cropping

(i) How many times do you cultivate the crop(s) in a year?

i. Once [ ]

ii. Twice [ ]

iii. Others [ ]

(ii) Give reasons:

…….....

……..

H. Size of Farm

(i) What is the average size of your holding?

……..

I. Land preparation and cultural practices

a) How do you prepare your land for cultivation? …….

……

……

……

b) What cultural practices do you adopt?

(i) Crop rotation: cropping length?

(ii) Bush fallow: length of fallow

(iii) Inter crop with leguminous crops

(iv) Others

J. ANIMAL PRODUCTION

Indicate the type, management system (s) and the proportion of household having each type of animal.

ANIMAL TYPE	% HOUSEHOLD	MANAGEMENT SYSTEM
Cattle	MSF	Fr He Pd St Si
Sheep	MSF	
Goats	MSF	
Poultry	MSF	
Pigs	MSF	
Bees (Hives)	MSF	
Fish (ponds)	MSF	

NB M = Most, S=Some, F=Few,

Comments…….. Fr= Free range, He = Herding, Pd = Paddocking, St = Stall feedings, Si=Semi Intensive

K. TYPES AND SOURCES OF FEED

Indicate for each potential type of feed, when it is used and for which type of animal

TYPE OF FEED	FREQUENCY	WHEN USED	TYPE OF ANIMAL
Grass land (local)	MSFN	DWA	
Grass lad outside local area	MSFN	DWA	
Planted pastures (grazed grass / legume	MSFN	DWA	
Tree / Shrub fodder (cut)	MSFN	DWA	
Purchased feed	MSFN	DWA	
Other	MSFN	DWA	

NB: D=Dry season, W=Wet seasons, A=All year round, M=most, S=Some, F=Few, N=None.

L. Constraints of the Land use system (LUS).

i)What are the problems of your farming operations?

……..….....

.....

.....

.....

M. Type of Important [non timber] Trees

ATTRIBUTES / IMPORTANCE

	Food (part)	Medicine (part)	Fodder (part)	Energy (part)	Soil fertility improvement (part)	Soil Conservation (part)	Habitat	Frequency
SPECIES								

HF = High Forest, CF=Crop Field, M=Mountainous, BF=Bush Fallow (Abandoned Farm)

N. Indigenous practices and conservation Methods

(a) Why do you conserve the trees?

……..……

……

……

……

b) Do you know how the tree (s) is / are propagated?

i) If yes, how?

……..……

……

……

ii) If no, would you be interested to know the propagation methods?

……

……

iii) What practices do you adopt to ensure the continuous stay of those trees?

……...……

……

……

……

O. Period of maturity

If tree is fruit-bearing:

(a) Season of fruiting: What season does the tree fruit?

……

(b) Which part of the fruit is of economic importance?

……..

(c) What is the yield per tree? ……

(d) Harvesting techniques:

(i) Do you pluck the fruits or pick the falling ones or fell the whole tree?

……

(ii) What is the lifespan of the collected fruits? ……..

(iii) Which part of the fruit is of economic importance? ……

(iv) How do you preserve the fruits? .....

…….

P. Trade and Marketing

(a) How do you get the fruits / tree parts sold?

……

……

(b) How much do you earn from the collection or processing of the fruits / tree products?

……

……

(c) Income earned from fruit / trees parts ……

(a) Feeding ……

(b) Clothing ……

(c) Funerals ……

(d) School fees ……

(e) Medical bills …….

(d) Percentage of income that earned in cash after expenses?

……

Q. Relationship between ethnicity and conservation

……

……

Appendix 2

Questionnaire distribution and retrieval in the communities

Community	Number distributed	Number retrieved	Percentage(%) retrieval
Agona	50	46	92.0
Bipoa	10	9	90.0
Bedomase	10	9	90.0
Afamanaso	10	8	80.0
Kona	8	7	87.5
Asamang	12	11	91.7
Wiamoase	46	42	91.3
Amenase	10	10	100.0
Bepoase	10	9	90.0
Dome	5	4	80.0
Kokoteasua	12	10	88.3
Kyeremfa	7	5	71.4
Jamase	16	12	75.0
Kyekyewere	7	5	71.4
Tabre	5	4	80.0
Dawu	6	4	66.7
Apaah	6	5	83.3

Appendix 3

Income levels of respondents

Statistics

Income levels of respondents

N	Valid	200
	Missing	0

Income levels of respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	200000-500000	38	19.0	19.0	19.0
	500000-1000000	49	24.5	24.5	43.5
	1000000-2000000	70	35.0	35.0	78.5
	2000000-4000000	22	11.0	11.0	89.5
	4000000+	21	10.5	10.5	100.0
	Total	200	100.0	100.0	

APPENDIX 4

Amount left after expenses

Statistics

Amount left after expenses

N	Valid	200
	Missing	0

Amount left after expenses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	62	31.0	31.0	31.0
	50000-100000	56	28.0	28.0	59.0
	100000-500000	52	26.0	26.0	85.0
	500000-1000000	18	9.0	9.0	94.0
	1000000+	12	6.0	6.0	100.0
	Total	200	100.0	100.0	

APPENDIX 5

CHI-SQUARE TEST FOR INCOME AND AMOUNT OF MONEY LEFT AFTER EXPENSES

Chi-Square Test

Frequencies

Income levels of respondents

	Observed N	Expected N	Residual
200000-500000	38	40.0	-2.0
500000-1000000	49	40.0	9.0
1000000-2000000	70	40.0	30.0
2000000-4000000	22	40.0	-18.0
4000000+	21	40.0	-19.0
Total	200		

Amount left after expenses

	Observed N	Expected N	Residual
0	62	40.0	22.0
50000-100000	56	40.0	16.0
100000-500000	52	40.0	12.0
500000-1000000	18	40.0	-22.0
1000000+	12	40.0	-28.0
Total	200		

NPar Tests

Test Statistics

	Income levels of respondents	Amount left after expenses
Chi-Square[a]	41.750	53.800
df	4	4
Asymp. Sig.	.000	.000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 40.0.