2002

Ecosystem health and sustainable livelihoods: Exploring the prospects in community-based resource management in the East Mamprusi District, Ghana

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Ecosystem Health and Sustainable Livelihoods: Exploring the Prospects in Community-Based Resource Management in the East Mamprusi District, Ghana

By

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B.A. (Hons), University of Ghana, 1998

THESIS

Submitted to the Department of Geography and Environmental Studies in partial fulfillment of the requirements for the Master of Environmental Studies (MES) degree
Wilfrid Laurier University

2002

Abstract

Institutional processes, social and economic trends play a role in defining the outcomes of people's interaction with and use of their ecosystems. The resource use decisions of households influence the livelihood and health dimensions of ecological change. This thesis identifies community assets and activities, and examines how they both affect human and ecological health, productivity and community sustainability. It studies the relationship between changing biophysical conditions and community well-being in terms of health and livelihood by examining how agro-ecosystem based resource use systems influence community environmental change and vulnerability to health and livelihood problems inherent in their ecosystem.

Three communities in the East Mamprusi District of Ghana provide the setting for this study. The findings point to a growing consequence of intense agro-ecosystem-based livelihood activities: environmental changes, which contribute to the decline of food production and poor health resulting from poor nutrition. The utilization of the predominantly natural assets is influenced by biophysical conditions and socio-economic issues that shape the state of a communities' ecosystem. Decline in quality and abundance of assets that have been a means of keeping wealth as well as meeting expenditures such as medical expenses, food and school fees, is also attributed to the transformation of community resource tenures and polices, increasing incidence of animal mortality from chemicals used in spraying farms crops and the decline in grazing

land, while household wastewater is a source of breeding grounds for mosquitoes, which cause malaria. It is argued that improvements in health (both human and ecosystem) and the sustainability of livelihoods have to focus on the creation of livelihood and environmental opportunities which enable communities to adapt to risk of the weather and expand their livelihoods and prosperity beyond dependence on the shrinking natural resource base. In essence, bridging the gap between rainy season farming and dry season idleness by farmers could take the form of initiating vegetable gardens, but this option should be explored against the environmental impacts that the creation of small dams may cause to communities. Furthermore, there are prospects for livelihood and well being to be considerably enhanced from increased investment and management of plantation activities involving tree crops such as shea and cashew, which offer an emerging source of income for communities in the district.

ACKNOWLEDGMENT

Putting together this thesis has been both exciting and challenging and the accomplishment of this mission has benefited from the support and advice of a number of individuals who have been involved in this process. First of all, my heart felt gratitude goes to Dr. Scott Slocombe, who offered invaluable comments and suggestions from the very beginning of this study and has maintained considerable interest and support at all stages of this project. I am also thankful to my thesis committee member, Dr. Kevin Hanna for his comments and support, the external readers, Dr. Bob Sharpe and Dr. M. Walton-Roberts for their useful comments and to Dr. Adam Iddrissu for assistance and advice.

The production of this thesis has been made possible through the diligent and wonderful contribution of agencies and non-governmental organizations. The International Development Research Centre (IDRC) in Ottawa, provided the funding for the field research in Ghana through the Ecosystem Approach to Human Health Award for which I am grateful. The Village Aid Project, a British NGO in Tamale, gave me support for the fieldwork. Many thanks to Gumah Joshua and Moses Tampuri for their assistance in the field data collection.

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CHAPTER ONE

INTRODUCTION

In the face of rising global natural resource exploitation levels in recent decades, the biggest challenge to humankind is how to ensure the efficient utilization of these scarce resources without undermining their capacity to regenerate and satisfy the future needs of others. The Earth Summit's Agenda 21 (UNCED, 1992) placed the resource and environment crisis at the top of international agenda and sought to promote environmentally sound and sustainable development. The immensity of global resource problems must be viewed within the context of the massive loss of biodiversity, deforestation, declining air quality, scarcity of fresh water resources and the encroachment of deserts, particularly in Sub-Saharan Africa (UNEP, 2000). Furthermore, these ecological changes transcend resource scarcity as they are increasingly impacting on human health and the productivity of life-supporting resources.

This research focuses on livelihood and health dimensions of ecological change and studies the relationship between ecosystem and human well-being by examining how agro-ecosystem based resource use systems influence community environmental change and vulnerability to health and livelihood problems in the East Mamprusi District of Ghana. The underlying idea is to understand the institutional, social, and economic processes, and structures that play a role in defining the outcomes of people's interaction with and use of their ecosystems. A significant understanding of the stimulus for

ecological and livelihood change would provide a building block for ecologically and socially sustainable community development initiatives. This thesis is based on a case study which explores the link between two important concepts (Sustainable livelihoods and Ecosystem health) that have become the central emphasis in the global development and environment agenda, and seeks to provide a developing country perspective on issues related to these concepts

One of the critical areas of growing concern with regard to deteriorating environmental conditions resulting from human activities in many parts of the developing world is the bleak future faced by those whose livelihoods are based on the exploitation of land, water and vegetation assets (Cleaver and Schreiber, 1994). According to Wood et al (2000), the World Wildlife Fund (WWF) estimates that 30% of the natural wealth of the Earth has been lost in the span of one generation and such devastating trends threaten numerous species, ecosystem processes and life support systems (Chaplin, 2001). As a result, a global response to resource degradation has manifested in protocols and initiatives such as the Kyoto Protocol on Climate Change, the Convention on Biodiversity, National Biodiversity Strategies, National Agenda 21s and the Global Environmental Fund initiative (UNEP, 1997).

While inequality, poverty and social exclusion have significantly deepened among rural people during the past decades, accelerating globalization has also contributed to a process of global environmental change due to the nature and pattern of consumption growth (UNDP, 1998). In spite of the great advances made in the area of technological development, large numbers of people mostly in the developing world remain poor and preoccupied with survival needs. As a result of transformations in social and economic

structures and policies, the sustainable exploitation of natural resources has become elusive to these communities in many developing countries.

According to the UNDP (1997), some 220 million people in Sub-Saharan Africa are income poor and it is argued that the conservation of the environment is difficult at the current level of poverty (Mortimore and Tiffen, 1995). This is premised on the notion that poor people, by virtue of their limited access to alternative means of livelihood are compelled to exploit their limited stocks and a vicious circle of human need, environmental damage and more poverty ensues (UNCED, 1992). With the continuous over-exploitation of their natural resource base, the poor are not only compromising the quality of the environment, they are also limiting the livelihood options for themselves as well as future generations (Naresh and Vangile, 1995).

In most parts of Sub-Saharan Africa, rapid population growth has become a critical factor in the degradation of resources and as a result previously sustainable traditional land use systems have collapsed or are critically displaced and no longer ecologically sound to practice. The population of the region is estimated to be growing at between 2.5 and 2.9 % per annum (UNDP, 1996). It is argued that rapid population growth pushes people into marginal lands and without any investment in the land they degrade it and that contributes to more poverty (Morgan, 1996). The intrusive character of these human interactions with ecological systems has triggered different kinds of health and livelihood conditions as well as economic decline. The lack of access to basic needs and various forms of deprivation all present a challenge to the livelihoods of the rural poor and heighten livelihood vulnerability among them. According to the World Human Development Report for 1998, the number of people who are undernourished in

Sub- Saharan Africa has doubled from 103 million in 1970 to 215 in 1990 (UNDP, 1998).

Furthermore, the failure of governments and other agencies to design appropriate institutions in environmental and resource management to address long-term livelihood and environmental goals has exposed the very core of rural communities existence to unprecedented levels of threats and decline. These threats are most imminent in indigenous livelihood systems, indigenous crop varieties, medicinal plants and the knowledge of their uses (Appiah-Opoku, 1999). Declining ecological diversity undoubtedly has a serious impact on the security and choices of livelihood strategies for rural people. The formulation of strategies that enable the poor to reduce and adapt to environmental changes which stem from the degradation of local ecosystems, would be a clearly focused complement to the sustainable development process (UNCED, 1992; UNDP, 1997).

Whilst some success has been recorded in community management of their own resources (Mortimore and Tiffen, 1995), a variety of socio-economic, political and cultural forces, which underlie the systems of resource use, have also contributed to many of the problems in community resource management (Koku, 2000). Some traditional systems of livelihood resource management such as slash-and burn agriculture, have become less adaptive under higher human population, resulting in the transformation of rural landscapes into ecologically fragile environments (Berry, 1993). Others have argued that institutional issues such as tenure systems have failed to provide security and have exposed community resources to the danger of degradation (Nsiah-Gyabaah, 1994). Ecological stress is manifest in the form of soil erosion and impoverishment,

deforestation and the loss of plants and animal diversity with a consequent decline in ecosystem productivity and increased food insecurity, which have become common features of the landscape in most developing countries.

The intensity of these livelihood activities is contributing to the encroachment of the desert, which threatens a significant portion of Sub-Saharan Africa (UNEP, 2000). Additionally, rural livelihoods are increasingly challenged by a growing need to achieve a balance between the declining productivity of agro-ecosystem resources and increasing demands for adequate nutrition and healthy environments. The nature and consequences of these environmental, social and economic problems highlight the need to consider human and ecological welfare in the integration of ecosystem management in livelihood activities as part of strategies to promote sustainable rural development.

The research was undertaken in the East Mamprusi District in Ghana (figure 2), a tropical country lying between latitude 4° 11" and 11° 5" and longitude 3° 15" East. With an estimated land surface area of 23.85 million hectares (238 539 km square) (Iddrisu, 1995), the country has a total population of 18.4 million and a population density of 71.1 persons per square kilometers. About 36% of the population live in urban areas while the remaining 64% lives in rural areas (Ghana Statistical Service, 2000). The economy of Ghana is based on agriculture, which is the main occupation of the predominantly rural population (Liang, 1994). It is estimated that about 54% of the population is employed by the agricultural sector. The two main ecological zones, the forest zone and the savannah zone, contribute different types of food and cash crops to the national economy. Cash crops such as cocoa, cocoyam, coffee and plantain are produced in the forest belt while maize, yam and cotton come from the drier savannah zone.

The East Mamprusi District is located in the northeastern part of the Northern region of Ghana in the Savannah woodlands zone and covers a total area of approximately 7760 square kilometres. The district is one of the 13 local government administrative units which together make up the Northern Region. In the savannah woodland ecosystem, community livelihood activities are fraught with a series of ecological concerns. Pressures of deteriorating soils trouble the very foundation of livelihood activities that rely on extensive natural resource extraction. Studies by Al-Hassan et al (1997) indicated that poverty levels have been affected by the declining productivity of agro-ecosystems. The threat of malnutrition, which accompanies declining productivity of soils, has multi-faceted effects on the health and well being of communities.

Given the fact that medicinal plants are an important source of health care for many communities in Ghana, environmental degradation means a great setback to indigenous health service. Resource depletion complicates the burden on women to provide for household food needs in spite of the differential access to resources because they have to find additional sources of food to feed the family when food becomes scarce. Pervasive poverty and limited opportunities and resources for the improvement of living conditions are all dimensions of deprivation, which contribute to environmental deterioration. Livelihood vulnerability has been heightened by the general lack of access to credit, social support and inadequate health, which expose communities to hazards and risks and reduce their capacity to cope and recover from economic, social and natural shocks and stress.

The idea is emerging that the underlying causes of livelihood deprivation, which are embedded in environmental resource depletion need to be addressed if rural livelihoods are to become adaptive and resilient (Scoones, 1998). As a result, research on ecological health and livelihood is critical to addressing the underlying causes of livelihood deprivation. The challenge here is for appropriate resource management structures and policies to be instituted to address food and income gaps and improve the conservation of biodiversity, which have multiple-purposes in the lives of the community. Economically effective and ecologically sound measures need to be implemented to tackle ecological health concerns, livelihood and resource depletion. In examining ecosystem health and sustainable livelihoods in the East Mamprusi District, this research explored measures to facilitate sustainable use and management of natural resources that enhances human health, ecological integrity and resilience. There are high prospects that a diverse environmental resource base will help to reduce livelihood insecurity that arises from environmental degradation and poor access to environmental resources.

1.1 Objectives of the Study

In light of the problems outlined in the background, the study seeks to address these objectives.

- To identify community assets and activities and examine how they both affect human and ecological health and productivity and community sustainability.

- To examine how ecological and economic constraints have affected the composition of livelihood strategies and the exploitation of resources.

- To outline the prospects for effective community-based resource management and use of traditional knowledge systems to enhance human and ecological resources and livelihood adaptation

This research seeks to come to grips with relationships in community livelihood assets and activities and increased vulnerability to risk, shock, and stress and community instability. The focus on community-based resource management and traditional knowledge systems is significant because they all constitute sources from which assets, entitlements and social networks are derived for earning a living. Ultimately, the goal of this study is to contribute to greater understanding of the socio-economic outcomes of human resource use systems affecting long-term ecological and economic sustainability in a rural agro-based community

1.2 Organization of the Thesis

The thesis is organized into six chapters as follows: Chapter one is the introduction consisting of the background, the objectives, and the thesis outline. Chapter Two deals with a review of the relevant literature on key concepts and themes of the thesis, namely community-based resource management, ecosystem health, sustainable livelihoods, and traditional knowledge with the emphasis on livelihood and health. In Chapter Three the methodology used in the study is examined including the sources of data, justification for choosing the methodology and constraints of doing research in a developing country, and the choice of study communities and respondents.

In Chapter Four, the study area is examined. This includes a general overview of the East Mamprusi District, and the selected communities, and the biophysical setting. A quantitative and qualitative analysis of ecosystem health, traditional knowledge systems, community-based resources management and livelihoods in the East Mamprusi District is presented in Chapter Five. The results of the analysis and key findings are also presented in this chapter. Chapter Six presents the conclusion and recommendations regarding measures for sustaining ecological health, livelihood and environmental opportunities which enable communities to adapt to risk of the weather and expand their livelihoods and prosperity beyond dependence on the shrinking natural resource base.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview

This chapter reviews literature on the concepts used in this research namely, ecosystem health, sustainable livelihoods and community-based resource management (which includes traditional knowledge, with greater emphasis on health, and livelihood systems). Significant findings of past research will be highlighted with the aim of identifying gaps in the literature with regards to these concepts and also providing background to the research to establish the basis for this study.

The significance of this review lies in the fact that it explores the problems and lessons in the literature particularly within the context of Sub-Saharan Africa. It is also geared towards highlighting the diverse research perspectives on ecological, livelihood and resources crises in both developed and developing countries.

The first part of the review considers the broad context within which ecosystem health has been applied, taking into consideration issues related to its assessment and the link between ecological systems and human health. The relationship between various components of the ecological system and human activities and the relevance of ecosystem health in sustainability are reviewed. The ecological dimensions of livelihood change and notions about agricultural and socio-economic changes, the underlying forces and interconnections are then considered.

The second section of this review looks at community-based resource management systems, especially in relation to resource tenures in Sub-Saharan Africa, institutional issues and co-management. The third section reviews literature on livelihoods, taking into account the link between current environmental crises, policy and institutional issues. It also explores the critical roles of environmental resource management interventions in contributing to sustainable livelihoods.

The final section reviews the literature on traditional knowledge particularly in resource management systems. It takes a look at the integration and application of traditional knowledge in livelihood, health and resource management and the problems and lessons learned.

2.2 Ecosystem Health

The Earth's ecosystems have been subjected to varying degrees of stress and the apparent threat that such changes pose to the health and well-being of human kind have been extensively studied by scientists and non-scientists alike. These studies include the development of ecosystem health indicators (Spiegel, et al, 2001); identification of ecosystem and sustainability indicators (De Kruijf and Vuuren, 1998:); measurement of indicators of human health in ecosystems (Cole, et al, 1998); models of human health towards an ecosystem context (VanLaeeuwen, et al, 1999); integration of ecosystem health with community livelihood (King and Hood, 1999); ecosystems and community health (Panelli and Parkes 2001) and the application of the health concept to ecosystems (Callicott, 1992; Bormann, et al 1993, Vogt, et al 1997; Constanza, et al, 1992; Rapport, 2000). The ecosystem health concept is echoed in Aldo Leopold's "land health" which he defined in terms of nature's capacity for "self-renewal" (Callicott, 1992; Leopold, 1941:3). While these studies share common ideas about the connection between human activity, ecosystem health and human health and sustainability, they provide different views of health models in ecosystem context.

Spiegel, et al, (2001) have demonstrated through the development of ecosystem health indicators, the usefulness of an ecosystem perspective in community governance and management of health risk in the inner city. The framework for defining such ecosystem health indicators often requires transdisciplinary approach because indicators are built on environmental, economic, and socio-cultural data. The most popular analytical approaches that have been used in the development of ecosystem health indicators are driving-force-pressure-state-exposure-effects action (DPSEEA) and the

pressure state response framework.. These models have been popularized by recent studies in which ecosystem human health indicators have been defined at the individual, household and neighbourhood levels and the result of the analysis is used to set new priorities and pursue long-term ecohealth interventions (Yassi, et al, 1999, Spiegel, et al, 2001). In particular, the DPSEEA, involves the identification of the *driving forces* which produces *pressures* on the *state* of the ecosystem and ultimately, on human health through potential *exposure* pathways.

Ecosystems have been identified with certain characteristics such as the existence of multiple spatial and temporal scales, arrangement within nested hierarchies, and self-organization through positive and negative feedback loops (VanLaeeuwen, et al, 1999). The ecosystem health perspective is therefore adopted in order to broaden the criteria for sustainability beyond simple economic goals to include ecologically based criteria. In such an ecologically based criterion, hierarchical approaches are adopted to understand how the social systems embedded in ecological systems can be managed without changing the complexity and diversity of ecological systems. This complexity and diversity underscore the emphasis by ecologists and environmental scientists on the critical importance of ecosystem management systems in order to restore species composition and the biophysical environment to forestall undesirable impacts on humans and other living organisms (Panelli and Parkes, 2001; Vitousek, et al, 1997; McMichael, et al, 1999). This idea has an ethical basis and is substantiated by the argument that natural systems and resources constitute the primary assets of the health and sustainability of any human community (De Kruijf and Vuuren, 1998:1).

Similarly, Nielson (1991:7) has noted that the application of the health paradigm to ecosystems is an important "strategy for dealing with societies' concern over environmental degradation and the sustainability of natural resources." Notwithstanding the evidence and concern that deteriorating ecosystems have impacts on human health and sustainability of the global system (Rapport, 2000), ecologists have found it very difficult to arrive at a definition based on indicators of health against which unhealthy ecosystems can be assessed.

Health has been more easily defined in a negative way (Panelli and Parkes, 2001; Costanza, et al 1992), but attempts have been made to characterize healthy ecosystems using indicators such as vigor, organization and resilience (Mageau et al, 1995, Rapport 1998). According to Constanza (1992:248) "an ecological system is considered to be healthy and free from ecosystem distress if it is stable and sustainable (i.e. maintaining its organization and autonomy over time) and is resilient to stress." This idea has much in common with the view of Bratton (1992) who considers ecosystems as healthy based on their ability to yield certain products or amenities. Within the context of agro-ecosystems, a piece of land is regarded as sick if it experiences soil erosion and has lost its soil fertility or is overgrazed (Callicott, 1992). Furthermore, Norton (1992) defined a healthy system as one that is able to maintain its complexity and capacity for self-organization. Some of the most practical definitions of ecosystem health tend to be anthropocentric in that they characterize a healthy ecosystem in terms of "its ability to provide ecosystem services and meet human need" (King and Hood, 1999:7)

Land degradation is a key challenge of ecosystem health in Sub-Saharan Africa, which has been seen as contributing to declining food production, increasing poverty and malnutrition. According to Lindskog and Tengberg (1994), the assessments of land degradation have tended to describe the process of degradation, which results in efforts being directed at dealing with symptoms instead of causes. It is also noted that research on land degradation has been discipline-oriented without adopting an integrated approach. According to Costanza et al (1992:6) the definition of health in the context of ecosystems must be applicable to "all complex systems at all levels including organisms, ecosystem and economic systems." In this context, four states of health are critical in any definition of health that applies to complex systems. These four states are: a system that is able to maintain its structure and functions, a diseased system, a system in the process of collapse and a dead system.

Other studies in ecosystem health have drawn analogies from medicine to explain the standards for protecting the health of ecosystems by using such analogies to emphasize the dynamism of systems and the interrelated nature of activities in different parts of the system (Norton, 1991). Such an integrated perspective for examining the fundamental issues and combination of activities, which underscores the changes in ecosystem health, is particularly important in this present investigation

It is significant to note that the broad focus of ecosystem health definitions is on the system's function, performance and self-renewal or the ability to recover from distress and to provide ecosystem services (Rapport, 2000). Drawing from these ideas, ecosystem health may be defined for the purpose of this research as a system's capacity

to maintain a level of diversity and self-organization which enhances its stability and resilience to keep the system vibrant and from falling into distress.

According to Rapport (2000), some analysts have raised doubts about the applicability of the health concept to entities beyond the level of humans. This argument has its basis in the theory of population medicine and public health in which organisms are characterized by cooperation among parts rather than the competition that characterizes ecological systems. As a matter of principle, this assertion could be considered to be right, but in practice, it is possible to distinguish between "fully functional" and highly impaired ecosystems (Rapport, 2000:169) and this constitutes the basis for identifying healthy systems within the context of ecological systems.

Despite all these controversies, the importance of the ecosystem health concept lies in its relevance for tackling the interconnectedness of global problems and the complexity in managing and ensuring the sustainability of natural resource systems which support human existence and prosperity (Rapport, 1989; Constanza, 1992; Waltner-Toews, 1996).

Several studies have highlighted the link between human health and the health of ecosystems on which people depend on for support (Peden, 2000; Costanza et al, 1992). These findings suggest that the effects of human activities such as destruction of species and ecosystems, global warming, and the use of agricultural chemicals such as fertilizer, pesticides, and herbicides pose a risk to the health of ecological systems. Vital means of human survival such as the sources of nutrition are influenced by the health of agro-ecosystem, and their degradation implies greater risk to human health. Similarly, King and Hood (1999) found that rural health and self-sufficiency in rural Zimbabwe are

undermined by the loss of traditional livelihood strategies which is the result of environmental crisis attributed to a combination of conflicts, unfavorable policies and agricultural practices. The circumstances under which livelihoods are being transformed in Sub-Saharan Africa, are more complex than often perceived and nothing is more urgent than the need to find measures for sustaining community well-being in the absence of traditional livelihood strategies and transformed land use systems.

The emergence of the agro-ecosystems health approach as a systems view of agriculture has inspired growing interest in understanding the forces which shape changes in agro-ecosystems. Agro-ecosystems are distinguished from other ecosystems in that they are managed by humans to provide food and other agricultural products (Waltner-Toews, 1993; Xu and Mage, 2001). The agro-ecosystem health approach has resulted from the global challenge to ensure a sustained improvement in the livelihood and well being of agricultural communities owing to changes in the biophysical resource base and the economic viability of production.

Notwithstanding the benefits of increased agricultural production, the cumulative impacts of soil erosion, salination and pesticides and eutrophication are causing extensive environmental and social stress (Waltner-Toews, 1993; Peden, 2000) that raises doubts about the potential of human production systems to remain in harmony with the natural resource base. As a result of negative feedbacks such as environmental degradation and increasing livelihood insecurity which undermine human well being, the prospect of achieving socio-ecological sustainability among agricultural communities is increasingly elusive. According to Peden (2000), the effective management of agro-ecosystems could provide a cost-effective method for improving human health and well-being. Thus,

sustaining a diverse range of species of plants and animals, which provide the support base, is critical for enhancement of natural resource productivity within the context of agriculture. On the contrary, rural livelihood systems, particularly in Africa, which have been sustained under a system of annual expansion of the area of cultivation have severely damaged the "environmental integrity and social and economic viability of local communities" (Waltner-Toews, 1993). Overreliance of the rapidly growing rural population on local resources together with mounting demand from the urban population for fuel wood as their main source of energy complicates pressure on the producing rural areas and on the sustainability of farm and forest environments (Morgan, 1996). Since limiting the impact of agriculture under the rapid growth of population is impossible, it becomes important to investigate methods for improving communities' ways of husbanding their natural resources for livelihood that does not compromise their health and that of the ecosystem.

The role of forces such as economic growth, development and poverty, population growth, migration and urbanization, energy consumption and production and agriculture expansion and intensification in driving regional environmental change have been noted by Uitto and Morgan (1996). At the local level, environmental changes also arise from institutional issues and the nature of property regimes (IFAD, 1995). Thus, minimizing human-induced stresses on ecological systems has been increasingly woven into the goals of achieving sustainable development in development interventions. The current research is part of the search for resource management trends that enhances the well-being of rural communities while reversing the current trends to ecological distress.

2.3 Community-based Resource Management

Community-based resource management has evolved as an alternative to a resource management approach in which regulations compelled communities to follow prescribed practices which ignored customary approaches, to one which now seeks to integrate the knowledge of the local people and recognize them as partners (Brokensha and Little, 1987; Onibon, et al, 1999). The roots of current community-based resource management can be traced to the United Nations Conference on Environment and Development in 1992 that advocated the need for participatory development through recognizing the rights of local communities to manage their natural resources (Twyman, 1998). There is evidence to show that the exploitation of community natural resources is influenced by the institutional arrangements affecting the different social actors (Leach, et al, 1999), which contributes to different environmental outcomes and has implications for ecological and economic stability.

Consequently, institutional reforms have become a common feature of the current approach to community resource management. Co-management systems, which incorporate the interest of different stakeholder groups, are increasing being adopted to address natural resource management issues in Sub-Saharan Africa, particularly in the areas of fisheries and wildlife (Grundy, et al, 2000). It is strongly advocated that measures such as devolution to local level of the responsibility for natural resource management would provide solutions for environmental problems and the attainment of sustainable development (Leach, et al, 1999; Holmberg, et al 1993). However Onibon, et al (1999) have raised concern about the extent to which mere devolution would enable

communities adequately to take up the challenge of assuming true responsibility for managing natural resource.

According to Nakashima (1993), co-management requires that equal consideration be given to the different systems of knowledge and management that each cultural group brings to the process, and it is doubtful whether traditional knowledge can be fully integrated with western science in co-management systems, judging from instances where traditional knowledge systems have been marginalized under some co-management projects. While inadequate participation has often been cited as a constraint to conservation efforts (Koku, 2000), Porter and Young (1999) have noted that decentralized environmental management institutions in developing countries face an enormous challenge of being able to effectively manage resources with limited financial capacity. Furthermore, issues such as the perception of the intended beneficiaries as passive recipients, and the absence of clear criteria to judge project success have been noted as flaws in the sense that they impede the effective management of community natural resource projects (Leach et al, 1999; Pimbert and Pretty, 1995). Thus it is imperative to investigate the community's environmental and livelihood outcomes as a result of changing institutions and resource management structure.

Further discussions on institutions in community-based resource management have focused on the nature of resource tenures and their implications for the use and conservation of natural resources (Brokensha and Little, 1987). It is argued that apart from tenure systems, other variables such as changes in the level of decision-making, wealth differentiation, commercial market linkages and demographic pressure also have implications for natural resource exploitation. This is because increase in household

population size coupled with interest in the production of cash crops for the market influences the levels of resource extraction. Within the context of Sub-Saharan Africa, natural resources deterioration has been widely perceived to be occurring as a result of the tenure rules under which such resources are held and used (IFAD, 1995). Many of these analyses of resources deterioration are based on Hardin's Tragedy of the Commons (1968) in which communal tenure is identified as a structural feature of environmental degradation (Fischer, 2000).

The privatization of these common resources has been regarded as a solution for achieving tenure security and ecologically sound resource use (Fischer, 2000:569) even though other studies (e.g. Bruce and Migot-Adholla, 1994) have identified communal resource tenures as appropriate institutions for natural resource management in Africa. This perception is attributed to the fact that common property resources and open access resources have been misunderstood to be the same and therefore the misdirection of policy has been inevitable (IFAD 1995; Carney and Farrington, 1998). As noted by Carney and Farrington (1998), common property and open access resources are distinguished by the regulations that govern their use. The power to exclude outsiders is the essence of common property regimes as opposed to open access. This means that such common pool resources are in effect private property for the group (Bomley, 1989; Behnke, 1995). Nesmith and Beck have emphasized the importance of such common property resources as sources of income and subsistence provision in West Africa. Similarly, Mearns (1992) points to the critical role of environmental entitlements as one of the many sources from which people derive their livelihood.

It is clear that in community-based resource management, two levels of institutions can be distinguished: the macro level and the micro level. The macro level institutions are the bodies and the agencies involved in resource management. The micro-level is the systems of rights of access and ownership. An effective community-based resource management system must seek to weave the two levels together through greater appreciation of their relevance and contributions to the process of management.

Field studies have been carried out on resource management in Ghana (e.g. Afikora-Danquah, 1997; Leach et al, 1999), but the examination of the changing dynamics in community resource management and institutions as well as their implication for health and livelihood and community sustainability is one of the focal areas of this present research. In a study, Afikorah-Dankwah (1997) examined the link between human activities and patterns of environmental change and concluded that institutional arrangements affecting the different actors involved in resource management lead to different ecological outcomes. Perspectives on ecological constraints and institutional factors, which define and regulate access to resources and its implications on sustainable resource management, is lacking. Nor is there data on how systems of resource management relate to health and community stability. Inequalities in resource rights, land ownership and distribution affect resource management, livelihoods and environmental sustainability. In view of the difference in resource access between households and communities, understanding of the forces defining resource access will be useful in the improvement of community resource management.

It is becoming increasingly clear that environmental degradation does not only have ecological dimensions, but also has developmental as well as social dimensions. The growing crisis in rural livelihood systems makes the quest for judicious exploitation of the diminishing natural resources all the more important. Many studies (e.g. Nsiah-Gyabaah, 1994; Morgan, 1996; Brokensha and Little, 1987; Kruijf and Vuuren, 1998) have presented a deterministic view of the relationship between population, poverty and environment. Natural resource deterioration is being attributed to high population growth, which results in agricultural intensification, biomass burning, settlement and infrastructure development. Although this Malthusian notion has been very popular, empirical evidence form the Machakos District in Kenya has shown that this is not always the case (Mortmore and Tiffen, 1995). Some other studies have focused attention on the complexity and diversity of society-environment relationships in order to explore and analyse the ways in which society is shaped by and in turn influence their environment (Leach et al, 1997). This kind of integrated approach to resource problem solving is central to this research.

Currently, natural resource management has become a critical element of environmental problems in Sub-Saharan Africa due mainly to the massive conversion of savannah to cropland under increasing population (Cleaver and Schreiber, 1994). Even though natural resource management programs have been implemented to address, among other issues, the declining agricultural and natural resource productivity, such programs have not done much to slow down the spiral of environmental degradation. Some natural resource management programs have sought to develop strategies that enable communities to undertake ecosystem restoration and community health, but also

enhance the economic value for ecosystem services that serves as an incentive for sustainable community resource use and management (King and Hood, 1999). On the contrary, Barbier (1999) reported that agricultural and economic policies in some Sub-Saharan Africa countries reinforce land conversion and do not encourage farmers to invest in land management and agricultural intensification. Similarly, Lopez (1997) has noted that as a result of increased agricultural prices due to changes in agricultural and economic policies, farmers increased the land area that they cultivated through shortening of the fallow period and by exploiting newly-forested areas. The over-exploitation of biomass, which does not allow land to regain its natural fertility, has thus fuelled land degradation. Given that biomass is an important input in the long-term sustenance of agricultural production among low input utilizing farmers, resource management methods that promote the maintenance of biomass have to be explored.

Poverty and population growth have no doubt contributed to the declining resource base, though indirectly because governments have been unable to reconcile the need to sustain economic growth with protection of the environment (Ukpolo, 1994). The result has been that in these regions of declining land productivity and rapid growth in the population, human and ecological welfare are greatly compromised as malnutrition, low income and associated socio-economic problems exacerbate the prudent use of increasingly scarce ecological resources. The restoration of natural resource productivity is therefore critical for the realization of adequate livelihood. The gap in the literature that this research needs to tackle is how ecological and economic constraints can be addressed at the community level. While pioneering research has significantly helped bring property rights systems in Sub-Saharan Africa to the forefront

of contemporary debate (for example, Brokensha et al, 1980; IFAD, 1995), it is critical now to examine its current transformation, the resource exploitation mechanisms as well as their implications for promoting the sustainable management of those natural resources. It is crucial for this research to establish socio-economic concerns of communities as they relate to natural resources as well as perceptions and priorities within the context of widening community livelihood options.

2.4 Sustainable Livelihoods

Carney (1998:5) defined a livelihood as "comprising the capabilities, assets, (including both material and social resources) and activities required for means of a living. A livelihood is sustainable when it can cope with, and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base". Similarly, Chambers (1987) defines livelihood as adequate stocks and flow of food and cash to meet basic needs. Sustainability is also defined as the maintenance or enhancement of resource productivity on a long-term basis. Hussein and Nelson (1998) have also linked livelihood adaptation and resilience with the long-term productivity of the natural resource base in their definition of sustainable livelihood. All these ideas are united by the consensus that the promotion of sustainable livelihoods must be linked with effective resource management, issues of equitable access to natural resources, and the alleviation of poverty through participatory and empowering process of development (Forsyth and Leach, 1998; Twyman, 2000). In many developing countries, the environment is largely a livelihood issue because changes in the

quality of the environment have a direct impact on human welfare. This underscores the notion that efforts at improving livelihood must revolve around more prudent environmental management.

According to Helmore and Singh (2001), the sustainable livelihood approach is defined by four essential characteristics namely, economic efficiency, social equity, ecological integrity and resilience. The sustainable livelihood concept unlike other approaches, build on the livelihood systems of the poor and the adaptive mechanisms they use to sustain their livelihoods in times of serious environmental and economic pressures (Helmore and Singh, 2001). In effect, this approach to community development takes into serious consideration, the assessment of the wealth of poor people as against the assessment of needs, which is advocated in the poverty reduction initiatives. The assessment and analysis of the wealth of the poor which emphasizes self-empowerment provides the foundation for community visioning of what they would consider to be sustainable livelihood and the development of community Action plans. At this stage the role of outsiders (government and plociy and Ngos) can be married to ideas of the local community through investment, micro-finance and markets and technological assistance

Poor people respond to a crisis of livelihood by adopting livelihood strategies such as the intensification and extensification of agriculture, diversification of remunerative activities and/or migration (Chambers, 1987). Scones (1998) and Hussein and Nelson (1998) have also identified these three strategies. As has been demonstrated by several studies (Ellis, 2000, Bernstein et al, 1992) livelihood diversification arises from the need to maintain multiple sources of survival. Diversification is not an isolated

case within certain households, but it cuts across a broad spectrum of farm sizes and income groups in sub-Saharan Africa and many parts of the developing world. Livelihood diversification therefore constitutes a significant component of livelihood strategies that people engage in to make a living. The pursuit of these strategies is most effective when other livelihood resources exist (Carswell et al, 2000).

The role of peoples' basic material, social, tangible and intangible assets in determining their ability to pursue different livelihood strategies has also been highlighted by Scoones (1998). This study identifies the key livelihood resources from which livelihoods are derived as natural capital, economic or financial capital, human and social capital. A number of authors (e.g. Scoones, 1998 and Carswell et al, 2000) have identified the major elements of a sustainable livelihood framework as comprising the institutional processes and organizational structures, livelihood resources, livelihood strategies, conditions and trends and the sustainable livelihood outcomes. Each one of these elements is made up of a number of issues and factors which influence the outcome of livelihoods, but institutional issues are most critical in the sense that they not only mediate access to natural resources and livelihood strategies, but also provide the social context within which livelihoods are constructed.

Gaining access to reliable sources of livelihood by the resource-poor needs to begin with good institutional and policy environments that create enabling conditions for management of the resources and assets that they have. This is also an important starting point for tackling vulnerability and sustaining the environment among poor people who are rationally more preoccupied with immediate survival needs than long-term gains (Neefjes, 2000).

It is also important to look at the gender dimensions of livelihood deprivation and resource access. Joekes, et al (1996) have noted that access to resources such as land, labour and other resources tend to be biased in terms of gender, but women play an important role in the collection of products from these resources. Women's participation in resource management is therefore crucial in improving livelihood and environment. Similarly, the writing of Mancusi-Materi (2000) indicates that unequal access to natural resources such as land, forest and water resources has significant implications for people's food security. These issues, coupled with soil erosion, and urban pressure has caused many landless people to become more vulnerable to food insecurity. Consequently, the nutritional status of these people is dictated primarily by the amount of food intake, which undermines the condition of health of those people. Akinyele (1997) has highlighted the role of poverty in creating a cycle of low production, poor nutrition, poor health and low income, with malnutrition and disease contributing to poor performance at school and work and reduced adult capacity for earning income.

In many developing countries there is an apparent failure to provide institutional and policy support for livelihoods that are based on environmental resource exploitation. This is failure has no doubt affected the capacity of community households to effectively manage and maintain ecosystems for their economically viability. Orr and Mwale, (2001) have investigated the change in livelihood strategies of people in rural Malawi resulting from market liberalization and found that some households experienced decline in their livelihood outcomes because higher input prices affected poor households since they could no longer afford such inputs. Improvement in the availability of services such as

micro-finance helped to improve the livelihoods of some households. In essence, the provision of support in the form of basic technologies and livelihood sensitive policies are different ways of facilitating the improvement in livelihoods (Chambers, 1987).

2.5 Traditional Knowledge Systems

A number of studies have acknowledged the relevance of traditional knowledge that indigenous communities possess and the critical role that it could play in the sustainable management of natural resources (Berkes, 1993; Brokensha et al, 1995). The growing acceptance of traditional knowledge is echoed in the report of the World Commission on Environment and Development, which states that:

> Tribal and indigenous peoples' lifestyle can offer modern society many lessons in the management of resources in complex forests, mountain and dry land ecosystem (WCED, 1987:12)
> These communities are the repositories of the vast accumulation of traditional knowledge and experience that link humanity with its ancient origins. Their disappearance is a loss for the larger society, which could learn a great deal from their traditional skills in sustainably managing very complex ecological systems (WCED, 1987:114-115)

This positive development is a great boost to the global efforts to make development participatory since acceptance of the knowledge of local people complements the process of ensuring their active participation in development initiatives. It has been argued that knowledge acquired by indigenous people in their ecological system is based on experience gained over several thousands of years of direct contact with their environment (Berkes, 1993). Efforts have been made to incorporate traditional

knowledge into the management of natural resources by relying on ethnobotanical surveys to collect information on people's knowledge of plant and animal species (Hellier, et al, 1999).

For example, the research findings of Critchley (1999), Appiah-Oppoku (1999) in Ghana and Rappaport, (1968) in Papua new Guinea suggest that farmers have accurate and extensive knowledge of different types of soil as well as soil conservation methods, which are used to improve soil moisture, reduce degradation and improve productivity. Such traditional knowledge is embodied in indigenous institutions through which environmental wisdom, ethics, human environmental practices and sacred cultural demands are expressed (Appiah-Oppoku 1999). Similarly, Lalonde (1993) has noted that most traditional management systems involve spiritual rituals, religious practices and taboos, while others are merely experience gained through contact with other people. Traditional systems of resource management also have institutional and regulatory frameworks that are well adapted to the social and environmental conditions of their respective milieux (Onibon, 1999).

According to Mensah-Abrampah (1995), community ecological resources such as fisheries and sacred groves provide coping strategies for a large number of community members and their protection is regulated by the established rules and regulations in the form of sanctions. It has also been argued that the foundations of traditional institutions are threatened by western culture and modern religion.

Research by Appiah-Oppoku (1999) in Ghana indicates that indigenous institutions such as healing which provide health care for community members constitute the basis for protection and conservation of certain plant species. The findings suggest

that the use of plant, animal and mineral substances to prepare medications is based on the knowledge of their properties. Brokensha and Riley (1980) have also indicated that the possessing of good ecological understanding in indigenous resource management is particularly important for species of plant and animals that are highly utilized by members of the community, implying that the factor of utility has a positive correlation with careful taxonomic identification.

Local knowledge is also reflected in farming systems such as intercropping and bush fallow systems, which are undertaken to blend crop varieties of different moisture and nutrients requirement and to ensure that the farmer does not lose completely in time of crop failure. There is evidence that the changing demand that is being placed on natural resources is a threat to the prospects of achieving ecologically sound development (Kruijf and Vuuren, 1998:5).

According to Atteh (1992), the ecological knowledge of indigenous societies in Africa, which encompasses individual and community wisdom and skills, is manifest in traditional management practices such as:

- Indigenous soil taxonomies
- Indigenous knowledge for potential use of local plants, forest products, and animal behaviour and acquired hunting skills
- Local knowledge of important tree species for agro forestry, firewood and integrated pest management, the control of soil erosion and fertility and fodder management.
- Indigenous agronomic practices such as contour banding, fallowing, organic fertilizer application, crop rotation and multi-cropping

- Indigenous soil and water conservation and anti-desertification practices

Lalonde (1993), presents case studies which highlight the use of traditional knowledge in natural resource management in Africa. The data suggest that farmers in Africa are knowledgeable of the insecticidal properties of the neem tree (*Azadirachta indica)* whose leaves and seeds have been used to repel insects and to treat fever. The validity of local knowledge systems has also been recognized in the traditional bush fallow system associated with shifting cultivation. Based on the usefulness of this method, low cost, labour intensive "alley cropping" has been developed whereby rows of food crops are grown to alternate with hedges of nutrient producing trees and shrubs, which are later pruned to enrich the soil with nitrogen rich material.

Similarly, the CAMPFIRE program of Zimbabwe, an innovative wildlife co-management initiative has developed through recognition of the knowledge possessed by indigenous people for the sustainable management of wildlife and marginal agricultural land. A key factor in this is that benefits from the wildlife resources are equitably distributed among local producing communities (Thomas, 1991). These three case studies provide a measure of optimism that many instances of untapped traditional knowledge, which is crucial for sustainable management, still exist. It could also be argued that some knowledge may exist, but is not being put into good use because of other resource needs that are beyond the reach of the local people to afford. Obviously, appropriate complementary structures, institutions and resources are crucial to the utilization of traditional knowledge.

Despite the positive features that have been identified with traditional knowledge, there are a number of constraints in the collection and utilization of traditional knowledge. The obvious one is the bias of academics and western scholars for things of western origin as well as the tendency for influential and powerful elite who have the power to choose the methods for dealing with local problems to regard traditional knowledge as inferior. Furthermore, there are also some insiders within the local community who harbour negative attitudes toward local knowledge "based on a loss of faith in local indigenous technology because of an invidious comparison with other technologies emanating from an external source of presumably higher status" (Compton, 1989:22). To a large extent, the implementation and utilization of traditional knowledge has been undertaken on a limited scale due to resource constraints and requirement for materials or equipment that will make it work better. The practice of traditional knowledge is also constrained by the fact that it is rooted in myth and regarded as not reliable

Some other researchers (e.g. Awa, 1989) have argued that attempts to incorporate traditional knowledge into development initiatives have suffered from the exclusion of women and their knowledge. This fact has largely been the result of negative attitudes toward women that isolate their knowledge that could have been used in the formulation of development initiatives. Since some types of knowledge are primarily the domain of women while others belong to men, it is only appropriate for the knowledge of both men and women to be taken into consideration in identifying problems and solutions that meet the inspiration of every gender in the development process (Norem, et al, 1989)

2.6 Summary

Ecological health means much more to humankind than a system's capacity to generate useful services. Healthy ecosystems are the foundation of human survival and the application of the health paradigm to ecosystem is a means by which society has responded to problems of degradation of resources and the quest for sustainable use of such resources. The concept is also relevant for tackling interconnections and complexity of local and global environmental issues. There is apparent agreement that health is relevant in ecosystem, but there is no consensus on criteria for measuring health because ecological systems are complex and no two different ecosystems are the same. The capacity to maintain complexity and self-organization (Norton, 1992), stability and resilience to stress (Costanza, 1992) are the salient features identified for defining health ecosystems. The literature provides evidence that ecological health problems are also associated with instances of socio-economic challenges such as poverty, low productivity and poor nutrition (King and Hood, 1995, Peden, 2000). The ecosystem health perspective has therefore been applied for the greater understanding and explanation of not just ecological decline, but also social and economic decline. One of the key findings is that there is a link between human health and ecosystem because the risks posed to ecological health by the destruction of species, global warming and the use of agricultural chemicals such as fertilizer and pesticides ultimately affect human survival (Peden, 2000).

Economic and ecological stability are influenced by institutional arrangements affecting community resource management. Transformations have been advocated in community-based resource management, emphasizing greater participation in real terms

through sharing of authority and benefits among stakeholders to bring about positive environmental outcomes that also promote socio-economic stability. This new era in community resource management has also been associated with decentralization of environmental management institutions in developing countries in which the prospects of inadequate funding is a threat to the adequate functioning of those institutions. The key issues identified with community resource management in Sub-Saharan Africa range from tenure, to demographic pressure as well as policies that are at variance with sustainable management.

The sustainable livelihoods concept emphasizes the critical importance of livelihood diversification in livelihood strategies. The sustainable livelihood analysis has identified three key livelihood strategies such as intensification and extensification of agriculture, diversification of remunerative activities and migration. The livelihood outcomes are the result of a combination of institutional process and organizational structures, conditions and trends (economic and social) as well as the nature of livelihood resources.

CHAPTER THREE

METHODOLOGY

This research entailed the collection of data from the study area in East Mamprusi of Northern Ghana, which was carried out over a period of four months from December 2001 to March 2002. The broad focus of this study was on livelihood and health dimensions of ecological change and the potential measures for sustaining livelihood and health through a strategy of institutional and resource management change. The methods used were devoted to ascertaining the views of local people as well as those of professionals and Non Governmental Organizations (NGOs) about socio-economic and ecological changes in the selected community. The methods used facilitated open discussion with community groups, providing a platform for better understanding a broader picture of the problems that confront them.

3.1 Sources of Data

This study relied on the use of both primary and secondary data. The study methods included extensive collection of secondary sources of data from books, journals, government publications and census reports in Ghana and Canada. Primary sources of data were gathered through field studies involving the use of Participatory Rural Appraisal (PRA) methods, semi-structured and key informant interviews with members of selected communities, governmental agencies involved in resource and environmental

issues, community organizations and Non-governmental Organizations. Interviews dealing with livelihood, environment, health and resources management were conducted in three communities. In addition health statistics were obtained from the Baptist Medical Centre in Nalerigu to cross check communities' claims about health issues.

3.2 The methodology and justification

It is necessary to state here that this research was conducted with rural people and there was a need for research methods to be appropriate to their context. According to Chambers, (1997:162) "many poor peoples' realities are local, complex, diverse, dynamic and unpredictable ... participation, empowerment and mutual respect enable lowers and poor people in general to express and analyze their individual and shared realities." In view of a number of constraints that have been identified with the use of questionnaires for gathering data on rural people and their way of life (Chambers, 1983), the choice of a more appropriate method was deemed important. These constraints include, the following:

- The idea that questionnaires often capture foreign concepts which have no immediate meaning to the indigenous population, especially within their social reality;

- There is the potential for these foreign concepts to distort the reality of the indigenous population;

- That questionnaires are not the best way of identifying social relationships or identifying causal relationships; and

- There is a tendency to concentrate on the quantifiable and the answerable at the expense of less tangible, but important qualitative aspects of respondents

Other constraints with research in developing countries is that quantitative data on socio-economic issues about rural communities is often difficult to find because of poor record keeping and this makes it very difficult for a study to crosscheck some of the information that is obtained in the research. In the particular case of this study, it was also not possible to find similar studies in these communities.

In view of such constraints and other considerations, some researchers (e.g. Berkes, 1998; and Hellier, et al, 1999) investigating indigenous knowledge and community management of resources in developing countries have used a broad range of techniques such as semi-structured interviews and participatory rural appraisal methods. Since this research involved gaining information about participants' own knowledge, livelihoods and environmental issues, a wide range of techniques was applied to facilitate more open expression of opinions on local realities. Based on fact that the data sought in this research was qualitative, it was essential for data gathering techniques to provide communities an opportunity to say what they know. At the same time, no single data collection tool was superior to the other; the different data collection techniques were meant to complement one another in providing more relevant information.

Different sets of semi-structured interviews (Appendix 1) were administered to individual household members on the one hand and community organizations, and Non-Governmental Organizations (NGOs). Informal semi-structured interviews were carried out with elders, village leaders, and other opinion leaders. The semi-structured and key informant interviews were tape recorded to permit the transcription of key sections of the interviews. In addition, interviews were conducted with certain professionals involved in resource management in the area. This included a two forestry officers, two agricultural officers, one officer of the Environmental Protection Agency (EPA) of Ghana, the District planning officer and representatives of two NGOs namely Bimoba Literacy and Farmers Co-operative Union (BILFACU), the Partnership for Rural Empowerment and Development (PARED). They were asked about environmental and livelihood issues and the issues pertaining to their initiatives in resource management. The semi-structured interviews conducted with household members sought to gain people's perceptions and experiences of present livelihood and the environment outcomes as a step towards identifying strategies for the attainment of the desired state of human and ecological welfare. In the case of the interviews conducted with the NGOs, community organizations and professionals, the focus tended to be on institutional issues, issues of capacity and effectiveness in promoting the desired management systems and livelihood outcome.

The key issues addressed in the semi-structured interviews were meant to present an outlook of the state of natural resources and livelihoods and to capture the communities' state of being as dictated by ecological conditions in order to facilitate greater appreciation of the level of socio-economic and ecological distress. In essence,

the key issues that were focused on related to access to different community resources and assets and the changing trends in livelihood opportunities as well as the measures and alternatives that could be explored. Furthermore, resources and livelihoods concerns had to be examined in relation to the various sources of risk in the environment, the element of health problems attributable to environmental decline and the strategies adapted to cope with the situation

The underlying reasons for this perspective is that various forms of socio-economic and institutional factors have operated to create the social and ecological outcomes and any verification of the causes must relate to the social and institutional processes and trends that dictates a communities' resources use arrangements and the resulting vulnerability which shapes the way people manage and use their local environment. Additionally, these questions were framed in order to facilitate the gathering of adequate and relevant data to fulfill the objectives of this study and to reflect the concerns elaborated in the problem. As research in most parts of Sub-Saharan Africa indicates there are fundamental issues of tenure to be addressed in resource management (Benneh, 1996). At the same time, the literature revealed that communities have few livelihood alternatives and are experiencing declining livelihood opportunities. The ability of the research team to communicate in the local dialect was an important consideration in the choice of communities for the study.

3.3 Choosing the study communities

It was considered important for the study to focus on pressures on livelihoods and natural resources as well as access to resources that secured adequate livelihoods in an ecologically sound way. These issues were the central domain for choosing the communities to be involved in the study as it aimed to establish the institutional dynamics and trends (social-economic, institutional and ecological) that dictates the degree and intensity of resource exploitation. Against this background, the research team sought the opinions and views of different stakeholder groups in the district regarding the selection of the communities to be involved in the study.

At the beginning of this study, consultations and discussions were held in Gambaga, the district capital and later in the selected villages with the following groups:

- District Administration Officers
- Non-Governmental Organizations operating in the district
- Assemblymen
- Village chiefs and opinion leaders

Following these consultations, three study sites were chosen for the study; Sakogu, Zadantinga, Zaari. Sakogu and Zadantinga represented communities with pressure on declining land resources and the problem in these two communities was connected to the demarcation of a state forest reserve in that part of the district. Zaari was an independent location in the sense that the changing environmental trend is not related to any intervention in community landholding and represents the many rural villages in the district where environment problems are a broader extension of the peoples' socio-

economic problems. The three selected communities are therefore typical of rural communities in the district and should be regarded as representative of communities all communities in the district

The three communities have a total population of about 4500 people and were selected on the basis of their different resource access and prevailing livelihood and resource constraints. The differences in resource access that served as a basis for selection pertained to access to land for farming activities, the level of economic opportunity in the village and resources issues such as yield of farmers and the pressure that is being exerted on the ecological systems by the local inhabitants. The communities' natural resource base, viewed in terms of household access to land and resources that are solely controlled by the community, was the basis for selecting Zaari. Land resource base as in the case of Sakogu and Zadantinga were considered to be very limited compared to current demands for such resources and further investigation of the underlying issues was deemed necessary. Each community has a local government elected representative to the District Assembly, who was very helpful in providing key information and facilitating the research process. Preliminary field visits were undertaken to each of these communities in December 2001 before the beginning of the research, in order to hold consultations with community leaders and establish contact with potential participants. With the help of key informants and village leaders the potential participants were notified of the intended study and their participation was solicited.

The research was conducted with a female research assistant who helped in obtaining the participation of women. The study also sought to capture the pattern of variations in ecological issues between rural and sub-urban areas and thus, Zagri and

Zadantinga represented rural settings with Sakogu being sub-urban area. All these study sites were selected on the basis of the evidence of environmental degradation, land and other resource access and health issues received from the informants.

3.4 Choice of Respondents

The choice of the three communities was to provide an opportunity for the comparison of resource use, prevailing livelihood and resource constraints, institutional process as well as health issues under different socio-economic settings. The selection of respondents for the semi-structured interviews was based on personal willingness to answer the questions that were being posed. The households in the selected communities do not have local government property numbers on them and are often scattered. Under this circumstance it was not possible to establish a sample frame to engage in systematic sampling before the interviewing. As a solution to the problem, a procedure known as the on the spot listing and sampling (Goldstein and Goldstein, 1981) was adopted.

On the basis of this procedure, four block or rows of houses were identified because there was no local government numbering system and a long each block or row, 20 houses were list. In order not to get confused about the sampling routes, the research team administered the sampling block by block and it was possible to determine that from each block a sample size of five would be obtained. This meant interviewing every fourth house in that block. This procedure was necessitated by the chaotic arrangement of houses in these study sites. In other communities where the number of houses were a little more than the twenty households that were desired, the research covered all households based those available. The respondents were chosen from a wide range of

livelihoods such as farming, hunting, gathering, trading, weaving, those in involved in cottage industries such as pito brewing and production of sheabutter as well as those involved in the extraction of firewood and charcoal

The identification of the member of the household to be interviewed varied from one household to the other. As the research sought to ensure a balanced representation of both men and women in the study, given the important role of women in livelihood and resource management, it was considered necessary to alternate male with female respondents using a tally system to get an equal number of both gender. One respondent was chosen from each household and it was mostly the household head and or any women depending on the next gender on our tally card. The choice of the household head was based on the fact that head of the household is usually responsible for ownership and control of family land and other resources and would be knowledgeable about these resource issues. In a household where the tally card decided for a woman, any woman in that household was interviewed.

A total of 60 households were involved in the interviews in the three study communities. The determination of this sample size was undertaken bearing in the mind the time involved in administering the semi-structured interviews and the fact that other research tools such at the Participatory Rural Appraisal will complement the data. Each interview lasted between 50 minutes and 90 minutes depending of the flow of the discussion and the individual's knowledge of the issues being discussed as well as the degree of cooperation. With regards to the PRA methods, 15-20 respondents were involved in each community. The respondents numbered 20 in each community (10 male and 10 female). The respondents were mostly between the ages of 30 and 60 and 70%

based their livelihood largely on agriculture. The main difference between the PRA methods and semi-structure interviews in terms of contribution to the data is that PRA methods facilitated greater discussion and expression of different views of issues than in semi-structured interviews.

3.5 Sample size

A total of 180 respondents were involve in different stages of the study and this takes into account the number of respondents in the PRA as well as the semi-structured interviews. This sample size was arrived at on the basis of the fact that these communities are quite homogenous in terms of the socio-economic structure and activities they pursue and the considerable length of time that involved in administering the semi-structure interviews and PRA tools. With regards to the semi-structured interviews, the sample of 60 was considered adequate given that it was to be complemented by participatory research tools.

3.6 Participatory Rural Appraisal (PRA) methods

The use of PRA was necessitated by the recognition that more appropriate research strategies, which give participants leadership and positions of power and not suppress local knowledge, were needed to enable the participants to present or articulate their individual or collective views/realities in an environment of trust on issues relating to livelihood and the environment. PRA was therefore deemed appropriate to gain an understanding of local environmental knowledge and values since this could be suppressed by inappropriate research strategies (Motteux, et al, 1999). The use of PRA

methods was also a way to involve the rural communities in analyzing their livelihood and to provide information about their priorities for dealing with ecological and health issues as well as their livelihood.

Participatory research tools such as transect walks and community natural resource mapping also provided a chance to reflect on natural resource issues, an opportunity for joint learning, and open discussion of the various resources, their uses and the pressures on them. Community natural resource mapping was useful for gathering data on the natural resource, livelihood and health issues, household assets, land use patterns, resources and assets, constrains, distribution and access to these resources.

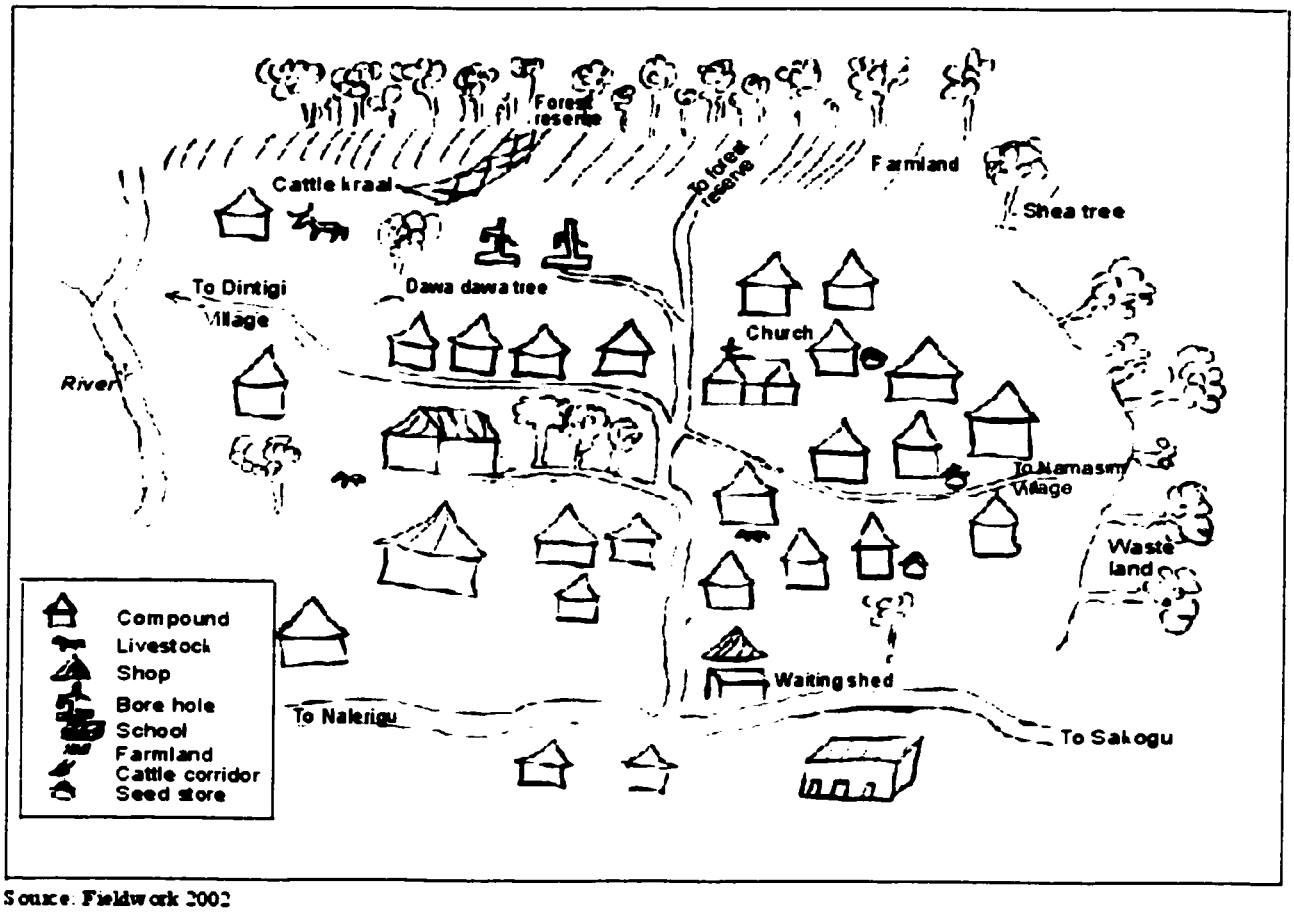
Through the community natural resource map, it was possible to identify the key natural resources in the area, their uses, the pressure on them, the source of this pressure and in what ways these pressures are constraining their livelihood and health and how this might be tackled. Using these maps, discussions were initiated in which participants identified the tenure types affecting land use systems and the broader community institutional systems of resources utilization. These tools were also used to gather data on livelihood strategies, coping and adaptive mechanisms, resource constraints, traditional knowledge systems, land use systems, changes in health, drought, income and productivity among others.

The construction of community natural resource maps made use of available local material such as beans, maize grain, peanuts, leaves and sticks to depict the different phenomenon that were being discussed. The maps were used to demonstrate the distribution of various community natural resources such as pasture, fuel wood sources,

and farmland and water sources. These maps were transferred onto paper with the help of participants as shown in figure 1. The PRA maps of Sakogu and Zaari are also show in Figure 4 and 5. Based on the representation of these elements with the local materials, questions were posed about the impact of changes in the distributions of the resources on the community and how they are coping. Transect walks were undertaken across various sections of the community that had been depicted in the community maps and that provided an opportunity to cross-check some of the earlier information they provided and to probe some issues further. The walks extended up to two kilometres from the village to cover important areas of the discussion such as forest reserves.

About 15 to 20 people were involved in each PRA session. The choice of participants for the PRA was done with the help of the Assemblyman, key informants and village elders based on who they thought was knowledgeable about environmental issues. There were basically two sets of PRA groups in each community: women and men had separate PRA sessions. The salient feature of the PRA methods is that it provides an opportunity to cross check the validity of what participants said about their community. PRA opens up discussion and provides an opportunity to probe issues further issues that are not very clear. To avoid repetition, it was necessary to ensure that those who took part in the interviews did not take part in the PRA workshops, but there were some opinion leaders whose inclusion in both studies was necessary because of they knowledge of the community

Figure 1 A Sketch Map of Community Natural Resources in Zadantinga in Ghana



Source: Fieldwork 2002

3.7 Method of Data Analysis

The data that is generated in this study is mainly qualitative, but some amount of quantifiable data was gathered, particularly on personal data and the responses to some of the questions. The Statistical Package for Social Science (SPSS) version 10 for windows was use to analyze the quantifiable data, with central interest in the distribution of some ecological, social and economic variables. For the greater part of the information, qualitative analysis was undertaken, basically through content analysis and common themes were later extracted from the responses. Table 1 illustrates some field data sources and the number of participants involved at different stages of the research. The analysis will make use of tables, percentages, and frequencies to display the data.

Table 1. Research Participants

Community	Semi-structured interviews	Percent	PRA	Percent
Zadantinga	20	33.3	35	34.6
Sakogu	20	33.3	34	33.6
Zagri	20	33.3	32	30.6
Total	60	100.0	101	100

Source (Field Research, 2002)

CHAPTER FOUR

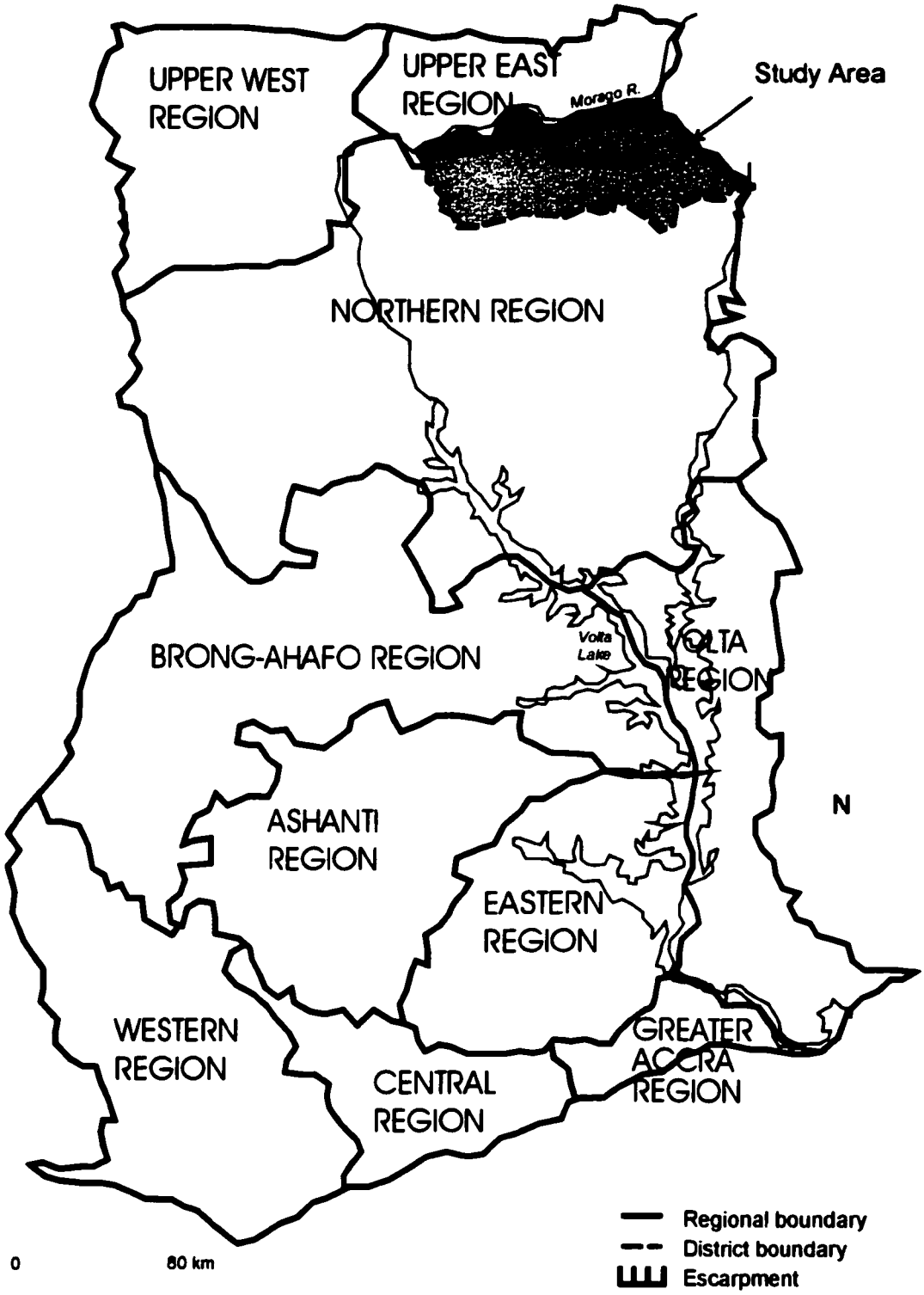
THE STUDY AREA

4.1 The East Mamprusi District

The East Mamprusi District is located in the between latitude 10° 28" and longitude 2° 15" East north of the equator in the savannah zone of Ghana. The district encompasses the entire area extending along the length and breadth of the Gambaga scarp which serves as the boundary between the Northern and Upper East Regions of Ghana (figure, 2). It shares boundaries with northwestern Togo to the east, the Gushegu-Kariga District to the south and the Bawku East District to the north and west Mamprusi district to the west. The entire landscape is quite evenly populated except for a stretch of land along the Gambaga escarpment, which has been demarcated as forest reserve. Like other parts of the country, many tribal groups have settled in the district, but the most dominant ones are the Mamprusi, Bimobas and Konkombas.

Rural semi-subsistence agricultural communities dominate the district, and there are six peri-urban settlements. These towns together have a total population of about 22,000 and some have fast growth rates because of the drifting of the rural people to them.

Figure 2 Map of Ghana Showing the Administrative Regions and East Mamprusi District



Source: Adam, 2000

There are an estimated 110 rural communities with a total population of about 180,000 people in the district (Ghana Statistical Service 2000). About 88,545 (49%) of the total population are male while 92,332 (51%) are female. The district is also deprived in terms of infrastructure like access roads to facilitate the easy movement of people and agricultural products and services such as health, water and sanitation. There are no specific figures for this district, but poverty figures shows that 30% of the very poor comes from the Northern Region (Ghana Statitistical Service 2000). The major hospital in the district is run by the Baptist Missionaries in Nalerigu, and it serves the people in the district as well as people of northern Togo and Burkina Faso. In addition there are about five health posts in different parts of the district. Since the year 2000, hydroelectric power has been extended to some towns in the district, but the dependence on fuel wood for household energy needs such as cooking is still high because majority of households are not able to afford the high tariffs on electricity. This situation accounts for the high demand for fuel wood that is often brought into towns from villages for sale. Cottage industrial activities such as pito (local beer) brewing, production of shea butter and commercial food vendors in market towns rely heavily on fuel wood.

Population figures for the Northern Region indicate that the population growth rate is 3.1 % per annum due to high fertility rate among women. According to the Ghana Living Standards Survey (2000), the mean household size for rural savannah areas is 5.1. Farming, which is the main occupation of the people is highly seasonal and restricted to months of May to October. The harvest of millet crop takes place in November and December and the rest of the year is spent by farmers with very little to do since their agricultural activities are mainly dependent of the rain.

The forest reserve in the district had been the home to wildlife such as elephant, lion, deer, but these animals have been thoroughly cleansed by years of uncontrolled wildlife hunting by traditional hunters. For many of the rural people in that district, living close to nature by exploiting the resources it provides has been their way of life since time immemorial. Increasingly however, this way of life is becoming a nightmare due to a combination of factors such as deforestation and population pressure among others, which contribute to the erosion of their livelihood and decline in their living conditions.

This part of Ghana was selected for the study in order to highlight the dimensions of human deprivations that are at the centre of community disintegration and the nature of current ecological and socio-economic trends. In selecting the district for this study, the researcher also took into consideration the ability of the research team to speak the languages of the selected communities. The East Mamprusi District was also chosen for the study because of its long history of human settlement and population concentration in northern Ghana and documented record of environmental degradation (Dickson and Benneh, 1977). The three communities which were selected for the study include Zadantinga, Sakogu, and Zaari. The 1993 Ghana Demographic and Health survey indicates that the fertility rate is highest in the Northern Region (7 children per women) where the Easy Mamprusi District is located (Ghana Statistical Service, 1998). The inverse relationship between high fertility and female education is translated from the low literature rate in the East Mamprusi District. The selected communities have inhabited in their respective localities over the past hundred years and the existence of both Sakogu

and Zadantinga far predates Ghana's 1948 forest policy during which those communities were affected by the demarcation of the forest reserve in that district.

The ecosystem of the area is highly influenced by agricultural activities, wood extraction, bush fires and presence of household animals that browse and trample on plants. The cultures of the different tribes in the district are not very distinct in terms of marriage, funerals, festivals and kingship. The rights of passage (marriage, and funerals) are performed in a similar fashion among the tribes.

In the East Mamprusi District and many other parts of northern Ghana, the social organization of community has a significant influence on the life the people. The chief is an important symbol of authority and is responsible for enforcement of laid rules regarding the social life of the people in their jurisdictions. Chiefs are predominantly male and the system of inheritance is patrilineal that excludes women from inheriting the property and this influences access to resources. Due to the absence of government law enforcement structures in the villages, chiefs adjudicate over problems and disputes in their localities with the advices of their elders and fines are imposed. More serious cases are reported to the police. A map of the East Mamprusi District showing the selected communities is shown in figure 3.

4.1.1 Zadantinga

Zadantinga is a farming community with a population of 961 people located about 13 kilometres to the east of Gambaga, the district capital and about four kilometres from Nalerigu, which is the major market town in the district for farm produce. It is located between latitude 10° 34" N and longitude 0° 21" W at an altitude of 357 metres above sea level. This community is located about two kilometres from a forest reserve along the Gambaga scarp. The demarcation of the forest reserve absorbed part of the land belonging to the community and the rapid expansion of the rural population has pushed the frontiers of cultivation to the edge of this forest.

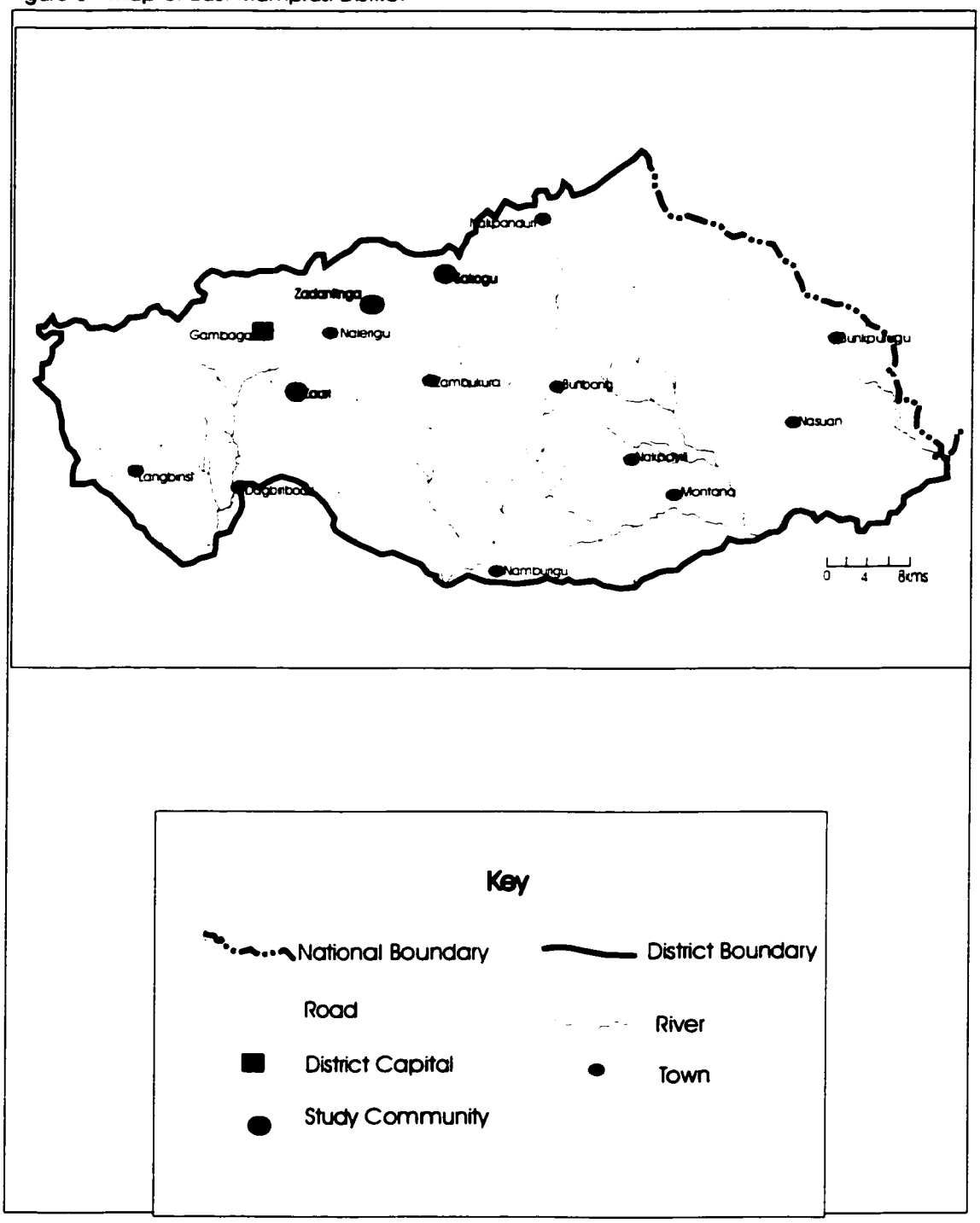
The expansion of livelihood activities of this land-poor community into the forest reserve has become a major concern to the district administrators. Discussions with a broad range of stakeholders including local NGOs, opinion leaders and some assemblymen revealed that large quantity of wood is extracted on a daily basis by women for sale in the nearby towns and these are instances of ecological problems which need to be investigated. Cash crops such as cotton and groundnuts are grown in addition to the main food crops such as maize and millet. The preparation of land for cultivation begins before the onset of the rains in late April, when old crops stalk and shrubs are cleared and burnt on the farm to make way for ploughing. The reason for burning the old crop material is that the local farmers believe the ashes add to the fertility of the soil.

The weeding of farms is undertaken with the hand held hoe and there are different strategies for undertaking weeding. Community members maintain a strong communal self-help system by cooperating to work in large numbers for one another in different turns. That way, farmers are able to work more effectively than individual farmer

working alone. This group work system has been extended into harvesting of crops such as groundnuts, millet, and cowpea as well as the threshing of millet and has helped to reduce the cost for individuals who undertake such activities on a large scale. Individual farmers who fall ill during a critical part of the farming season normally rely of this kind of communal assistance to have their farms cleared of any weeds.

The Zadantinga community, like many others in the district has a representative at the zonal farmers forum where farmers from different parts of the district meet to discuss issues affecting their activities. Key issues that feature here are access to fertilizer, new crop varieties and assistance that may be available to farmers at a particular time. Members of the single family and in most cases the extended family live in the same compound made of several rooms. While small animals such as goats and sheep are kept by individual households, members of the community gather their cattle and assigned a cattle caretaker to look after them. During the farming season, these small animals are tethered for a period of time and released for the rest of the year after the backyard farms have been harvested.

Figure 3 Map of East Mamprusi District



Sourcr: Ali Anafo (1998)

4.1.2 Sakogu

Sakogu is a town located about 23 kilometres to the east of the district capital. It is located between latitude 10° 34" N and longitude 0° 16" W at an altitude of 358 metres. It has a total population of about 2964 people with services such as a clinic, schools and potable water. The rocky nature of the land surface limits the amount of land available for backyard farming which is a common farming practice among communities in that part of the country.

Unlike the typical rural agricultural communities, livelihoods in Sakogu are more diverse and range from activities such as traditional brewing, sheabutter making, weaving, and tailoring, and trading at the local market. Sakogu has a community market that convenes on particular days of the week and this market is the main source of livelihood for many of the residents who sell their wares in it. Since the circumstances of land access in Sakogu are similar to those of Zadantinga it was selected to explore how resource access and exploitation, environmental issues and livelihood constraints and coping mechanisms occur within the context of a much larger population. Part of the land in this community was also absorbed into the forest reserve.

In terms of community infrastructure, there is a clinic with a medical assistant and a nurse permanently stationed there to provide some basic health care needs for inhabitants of Sakogu and surrounding villages. More serious cases are referred to the Baptist Medical Centre in Nalerigu, located at about 14 kilometers away. There is also a primary and junior secondary school in the community and residents have a 24 hours hydroelectric power supply from the Akosombo power in southern Ghana. Individuals from this community also engage in vibrant commercial activities with other commercial

town in northern Ghana and markets in northern Togo. Medical records from the Baptist Medical Centre revealed about 6-10 cases of HIV/AIDS and it is believed that such commercial contacts may have been a contributory factor for the infections. Whilst some households rely on bullocks to prepare land for cropping, the use of tractors to plough land is also common in Sakogu. The benevolence of relatives makes it possible for households which do not have bullocks to plough their fields.

4.1.3 Zaari

Zaari is another farming community located about seven kilometres to the south of the district capital (Gambaga) with a population of about 950 people. It is located between latitude 10° 28" 0N and longitude 0° 25" W at an altitude of 299 metres above sea level. It is known for being the supplier of fuel wood to the Nalerigu, which is located six kilometres away. The common agricultural crops produced by the community include millet, groundnuts, cowpea and maize. Apart from millet and maize, which are retained to feed the family, groundnuts and cowpea are mostly sold to acquire some household items from the market. The community members rear animals such as pigs, sheep, goats and cattle. The bullocks provide the main source of farm power for ploughing the farms in preparation for cropping and an average household two bullocks. Most households which do not have any bullock rely on the benevolence of their relatives and neighbours or hire the services of other less busy bullock plough owners during the farming season. Other much less privileged households use the traditional hoe to till the land and this method is much slower and energy sapping for them.

A common feature of northern Ghana is the presence in rural communities of the Fulani herd men, a migrant tribe from other parts of West Africa whose primary occupation is to take care of cattle for their owners in return for a piece of land to settle on. The livestock that the Fulani look after graze openly in the communally demarcated cattle corridors in the village but they are left to go on free range during the dry season. A Fulani household was also found in Zadantinga, but not in Sakogu. Zaari has a primary school, but the absence of a reliable teacher has forced some parents to send their wards to the nearby town located six kilometres away. Like most other rural communities in the area, Zaari is located close to a stream, which had been the traditional source water supply until two hand pump bore holes were installed in 1992. In recent years, the stream dries up after the rains and this drives livestock away to Nalerigu, a distance of about six kilometres where a dam retains water during the dry season. These have been contributory factors in the loss of livestock and other animals to thieves.

4.2 Biophysical setting

4.2.1Topography and drainage

Most of the District is very gently undulating, with broad, poorly drained valleys. Within the Gambaga highlands and on a few areas of the Upper Voltaian sandstone formations, the land is gently to steeply rolling and rises to a maximum height of just over 523 metres above mean sea level in the north-eastern part of the region. At the northern edge of the hills is a scarp overlooking the Morago River, which lie some 308 metres below. The

crest of the Gambaga scarp forms the northern boundary of the Nasia Basin, another major river that flows into the Volta River (Dickson and Benneh, 1987).

The drainage system runs mainly from northeast to southwest and appears to have been formed on a previous land surface. It has subsequently become incised and modified to the present alignment by various topographical influences. Erosion has caused the emergence of the Gambaga scarp and the resultant strike-stream development diverted the course of the White and Red Volta to the West. This river capture is incomplete, as the eastward extension of the Morago River is slowly shifting towards the headwaters of the Oti River. There is some evidence to suggest that the present is a period of renewed downward erosion after a period of infilling. In the lead waters of the Gambaga River, where the Gambaga – Nalerigu road crosses the stream, the stream runs on the rock bed between very deep vertical banks composed of alluvial and colluvial material. The rivers in this part of the country dry up during the long dry season (Blench et al 1999). Figure 2 is a map of Ghana showing the location of the Eat Mamprusi District and some geographic features of the area

4.2.2 Climate Characteristics

The geographical area of the East Mamprusi District is characterized by the tropical continental climate, which has a single rainy season extending from May to October followed by a prolonged dry season. Like other parts of the Northern Region of Ghana, two dominant air masses-the tropical maritime or the moist monsoon, and the tropical continental or dry Harmattan- dictate the climatic conditions in the area. The movement north and south of the Inter Tropical Convergence Zone (ITCZ) which is the meeting

point of these two air masses exerts considerable influence on the entire savanna area of northern Ghana (Kowal and Kassam, 1978).

The East Mamprusi District falls within the Guinea Savanna Ecological Zone, which is associated with total annual rainfall of about 1000–1300 mm per year. The peak rainfall period is usually late August or early September. About 60% of the rainfall occurs within the three months (July to September), with torrential rains creating serious drainage problems. Dry spells, which sometimes lead to drought, have become an important constraint to traditional agriculture in the district. These dry spells occur during the cropping season resulting in the depletion of soil moisture and rendering the soil less able to support traditional rain fed agriculture. Even when the rainfall is considered adequate, the individual rainfall events are extremely variable, leading to major difficulties in calculations of runoff generation and erosion control.

The Harmattan period (December to March) is a period of extreme dryness when dusty winds from the Sahara desert blow across the district causing some respiratory programs for many people. The mean annual temperature is about 28° C

4.2.3 Vegetation and soils

The ecosystem of the East Mamprusi District in general is highly influenced by agricultural activities and there is great variation in richness of tree vegetation between areas that are subjected to cultivation, fires and grazing and areas that are protected. The vegetation cover typical of the area consists of mixed formations of fire resistant trees and shrubs. The vegetation also consists of grasses such the *Andropogon gayanus*

(Gamba grass) and trees such as the *Parkia clappertoniana and Butyrospermum parki, Adansonia digitataand Acacia spp* (Liang,1994). The large presence of *Parkia clappertoniana and Butyrospermum parki* especially on farmland is the result of traditional farming methods that preserve these species because of their economic value. The *Andropogon gayanus* which grow in large turfs of up to two metres tall is considered one of the grazing grasses for livestock in northern Ghana. Besides the apparent scarcity of water which inhibits crop and animal production during the dry season, the limitations of soil quality in many places necessitate the initiation of soil and water conservation methods as a means of securing the resource base, and increasing soil and crop productivity

The savannah woodlands have very fragile savannah ochrosol soils with iron pan and various soil degradation problems easily arising when soil is intensively cultivated (Dickson and Benneh, 1977). Some areas such as valley bottoms contain sandy loam soils that are yellow and imperfectly drained and thought to have developed from the Upper Voltaian Sandstone. There are upland areas of large concretionary shallow soils that contain iron pan in their sub soils and are regarded as some of the poorest types of soil in Ghana in terms of agriculture. Deforestation has had a significant impact on soil through increased wind and water erosion which in some places has exposed the underlying rock firmation in the district, is impacted by the rate of deforestation

4.3 Natural resources and socio-economic change

In this part of Ghana, having access to a secure resource base has a bearing on human welfare especially food self-sufficiency. In these communities, the chief is in principle the overseer and owner of all community lands, but in practice individual families own land and key decisions regarding its appropriation rest with them. There are two principal farm types: compound farms and bush farms. Compound or backyard farms are normally located close to the compound house and are cropped early in the farming to beef up household food stock. The bush farms are larger and located further away from the house. The bush fallow system of farming is usually practiced in bush farms (Blench et al, 1999, Al-Hassan et al 1997). The reliance on the natural fertility of the soil for plant growth is now a greater challenge to farmer as large areas are increasingly becoming unviable to support any more crop production. The frequency at which agricultural fields are being cultivated has inevitably called for the use of productivity enhancing inputs such as fertilizer and the adoption of improved land management practices. Such ecological changes are at the root of lowering household incomes and declining economic assets such domestic animals and trees.

CHAPTER FIVE

DATA ANALYSIS ANALYIS AND DISCUSSION

5.1 Overview

This chapter discusses the research findings generated from qualitative and some quantitative analysis. The aim of this discussion is to bring the objectives of the research into focus and ensure that they are achieved. It collates the views of the various research participants and provides an analysis of their responses based on common themes.

The first part examines household assets and activities, noting their composition and variation among different communities, as well as the dynamics in the mediation of assets into livelihoods. The impact of activities on ecological and human well-being is also examined. This focus on assets and activities within the context of livelihoods and ecosystem health is to highlight the inherent processes and trends which define household capacity to access resources that in turn influences the nature and intensity of resource use and sustainability. This is followed by discussion of resource exploitation and livelihood strategies.

In the later part of the analysis, the discussion is on the state of ecosystem health, resource tenures and ecological change, traditional knowledge, community health and environmental change, resource management structures, and policies. The role of institutions is examined in relation to the different facets of livelihood constraints that the

people suffer. Central in the research analysis is the critical issue of health and well-being associated with community livelihoods and changing ecological conditions.

5.2 Household assets and livelihood activities

Rural productive resources such as the rich and diverse types of vegetation and land that constitute the ecosystem provide the basis for rural livelihoods. Research has provided evidence that the most important assets to rural communities are those that are closely linked to their natural environment (Koppel, 1990) and that rural livelihoods are often heavily reliant on the natural resource base (Scoones, 1998). This study explored the state of these resources from which rural livelihoods are constructed and the results of semi-structured interviews and PRA methods conducted in all three of the selected communities, demonstrates that environmental resources still play a key role in providing the daily food and other needs and therefore make significant contributions to livelihood of the household, but the availability of these resources is generally on the decline as a result of their intensive use. Resources from the environment are a source of food, medicines, household equipments, building materials, material for agricultural and other equipment. Medicinal plants have been a strong component of the wealth of knowledge utilized by the community members to cure illnesses under circumstances where access to medical care is poor. The state of these resources from which livelihood and local health service are constructed provided communities with the benchmark for assessing and describing the current ecological situation. The response of participants to questions regarding the livelihood dimension of the present state of natural resources during semi-

structured interviews provides indications that food production is facing a yearly decline and becoming more unreliable. Table 2 provides an illustration of responses regarding assets among the participants in the three communities

Table 2. Most important household assets

Village		Land	Livestock	House	Tree products	Milling machine	Vehicles	Total
Zadantinga	Count	12	6		2			20
	% within village	60.0%	30.0%		10.0%			100.0%
Sakogu	Count	10	5	1	1	2	1	20
	% within village	50.0%	25.0%	5.0%	5.0%	10.0%	5.0%	100.0%
Zagri	Count	10	8	1	1			20
	% within village	50.0%	40.0%	5.0%	5.0%			100.0%
Total	Count	32	19	2	4	2	1	60
	% within village	53.3%	31.7%	3.3%	6.7%	3.3%	1.7%	100.0%

Source (Field Work, 2002)

Household assets of the community members were identified as livestock, land and its resources, human capital such as labour and social networks. The pattern of responses derived from the household interviews indicate that access to livestock and land are considered a very important means of gaining a livelihood. Livestock has traditionally been a means of keeping wealth as well as providing a means for meeting expenditures such as medical expenses, school fees and dowry payments. PRA exercises, which involved community members in the identification and ranking of their assets further revealed that land is their most important and productive asset with livestock coming

second, followed by trees. A high proportion (53.3%) of the households interviewed regarded land as their most import asset while 31.3% of them regard livestock as the most important asset. Among livestock, cattle are the most important because of the enormous contribution that bullocks make towards cultivation of crops. About 77 % of the household in Zadatinga owned cattle or some form of livestock.

In these selected communities, access to certain kinds of resources determines the household's ability to engage in productivity activities. For instance, those who do not have bullocks depend on the owners of such animals to plough their fields. This implies that they are more likely to crop late, which makes them vulnerable to poor harvest in the event of inadequate rainfall. It is significant to point out that the ownership of bullock is critical in securing a livelihood, but they are also a means of raising income for households during the cropping season, when they are use to plough the fields for others households that lack bullocks for a fee. Those who do not have land also are not able to gain access to the most productive economic trees and the relief they bring. They are also likely to go into certain terms with landowners such as payment in cash or in kind (labour) to use their land and thus they are disadvantaged because of the unfavourable terms. It must be emphasized that an important feature of land use in all the three selected area is land borrowing involving landowners and tenant farmers.

It is important at this point to make a distinction between the ownership and importance of assets among different communities. Contrary, to the dominant response in favour of land and livestock in Zadatinga and Zaari, household members interviewed in Sakogu had different response. Even though 50% also considered land an important asset, the composition of assets of the respondents in Sakogu was broader than those of

Zaari and Zadantinga. Household assets included houses, which some individuals have built to rent out, as well as motorcycles, milling machines and vehicles. The diverse composition of important livelihood assets of the households in Sakogu signifies the capacity of most members of that community to engage in livelihood activities that are essentially not based on the exploitation of the ecosystem resources. Research has proved that access to a wide variety of livelihood assets that are not limited to only natural assets, but have a strong component of physical and economic capital has the potential to make livelihoods very resilient and adaptive (Carswell, et al, 2000). Based on this, it is obvious to see the challenge facing the some households in Sakogu who lack sufficient combination of household assets to pursue livelihoods as well as households in Zadantinga and Zaari.

There are wide variations among households in the three communities regarding the differences in access to resources. Interviews in all three communities revealed that households have different degrees of access to resources. About 60% of the respondents in Zadantinga said that households have different degree of access to resources with 55 % respondent giving positive response in Zaari and 80 % in Sakogu. These responses are shown in Table 3. The reasons accounting for this internal community difference in resource access in Sakogu and Zadantinga is the fact that some of the households in these communities were not affected by the allocation of land for forest reserve. Household interviews in all three communities indicated that trees constitute an important component of people's assets because the wide variety of tree products enhances the household's capacity to secure a livelihood and income to meet critical household needs.

Table 3. Differences in access to resources

	Frequency		Percent	
Community	Yes	No	Yes	No
Zadantinga	12	8	60	40
Sakogu	16	4	80	20
Zagri	11	9	55	45

Source (Field Work, 2002)

Important economic trees in these communities such as the Sheanut tree (*Butyrospermum parkii*) and the Dawa dawa (*Parkia clappertoniana*) provides a crucial income source through the processing and sale of the nut or beans, but it is also a significant source of domestic cooking oil and for the production of local detergents. Chalfin (2000) has found that over 21,000 tonnes of shea valued at US $4.5 million were exported from Ghana in 1996 and this comes mainly from the savannah zone. In view of the high income that is generated from sheanut, every land-owning household has taken the conservation of those trees as an element of their livelihood activities. Interestingly, the shea tree matures during a period of the year referred to as the hunger gap (Asenso-Okeyere et al, 1997) when food stock is lean and the tree has provided as important source of relief for earning some income to buy food. The Dawa dawa is regarded as an important source of spices for cooking meals in many parts of West Africa, which also underscores the need for their protection.

The size of land owned by households varies among the three selected communities. In Zadantinga, the average size of land was about 3-5 hectares, and about 3-10 hectares in Zaari. In Sakogu, there were some households that did not have land, but the average size of land holding was between 1-5 hectares. Based on this data, land is more accessible to households in Zaari than in Sakogu and Zadatinga, even though there are also significant variations in size of holdings among different households in Zaari. There are wide variations among households in the three communities regarding the differences in access to resources. Interviews in all three communities revealed that households have different degrees of access to resources.

Recent investigations into household land holding size in northern Ghana by Al-Hassan et al (1997) provide indications of varying intensity of land use systems between areas of high and low population densities. The present research findings indicate that the limited household land size is a constraint on economic opportunities. For the majority of households in Sakogu and Zadantinga, the constraint on land access is the starting point of their deprivation and their land use decisions are informed by the limited resource access. With the lack of education which characterises the majority of the respondents engagement in farming activities is one of the more reliable ways through which livelihood is earned. In the face of inadequate land access combined with other constraints like access to the necessary input, it becomes difficult to expand livelihood opportunities. Decisions favouring sustainable levels of land use are undermined when access is further limited by institutional processes and trends such as expanding household size in the of face of risks and shocks caused by deteriorating biophysical

conditions. Responses made to questions regarding the impact of livelihood opportunities that have been lost reveals that other opportunities such as river fishing which people engaged in in the past is no longer possible. Responses also provide evidence that there are significant changes in responsibility regarding the support provided by women towards the upkeep of the houses. During PRA sessions, men were very honest in admitting the considerable level of support that women provide in meeting food needs and this reveals a new pattern of responsibility which has traditionally been assumed by men.

In spite of the fact that the demarcation of the forest reserve has contributed to limited household land size in Zadantinga and Sakogu, it has been an important source of various products for many households particularly when bush fires spare the forest reserve. The obvious trend that is emerging from the research findings is that the most important household assets that facilitate the attainment of household livelihoods are agro-ecosystems-based assets. The range and variety of these assets is very limited and is subject to critical levels of exploitation because of the absence of complementary resources that facilitate sustainable levels of agro-ecosystem exploitation. This appears to be the defining element in the degradation of environmental resources because the excessive reliance of agro-ecosystem-based resources has an influence in community environmental change and deteriorating biophysical conditions. Because there is a greater reliance on natural capital, current biophysical conditions are contributing to the way agro-ecosystems are being managed. Thus the efforts that are directed toward improving living conditions facilitate a process of negative environmental change that runs counter to the most desire future livelihood outcomes.

The study also noted a relationship between gender and assets with differences in the ownership of assets between men and women. Access to land is gained through inheritance and females are excluded from inheriting land. As a result women do not often own land. Thus, land is a male dominated asset, but there are exceptional cases where a widowed or divorced woman may be given a portion of her family land to enable her to cultivate her own crops. Consequently, women have limited access to land and limited land use rights than men and it becomes difficult for many women to become truly independent of men. In effect, the question of social equity which an important criteria of sustainable livelihood is lacking in livelihood activities and assets distribution

The livelihood activities that people undertake to earn a living vary in intensity between communities. Livelihood activities in the study area include both natural resource-based and non resource-based activities. Natural resource based livelihood activities include livestock keeping, the cultivation of food crops and non-food crops, hunting, collection and gathering of food and wood products from the forest and woods and weaving. Non-natural-resource based activities include trade involving the marketing of farm output and inputs, the processing of shea nut into oil, the processing of peanuts into various products such as paste, cooking oil and cake, the brewing of local beer, rural manufacturing such as blacksmithing, tailoring, as well as repair of bicycles, and vehicles. The majority of these non-natural-resource-based activities are practiced by women, mostly the more privileged people with the resources to indulge in those initiatives. The processing of farm produce is predominantly a female activity that provides higher returns than when it is sold in its raw form. As noted by Chalfin (2000),

the processing of various products by women into finished items enhances their market value. During PRA sessions women admitted that in order to start such processing activities some basic capital is required, but it is very difficult for any savings to be done. Besides this, the raw materials that are required such as the groundnuts, sheanuts, millet and maize are often sold at low prices to meet some pressing income need and are then not available to help them expand their economic initiatives. This is one area that women thought that livelihood opportunities are declining for them since the falling output of crops every year due to a combination of bad weather and deteriorating land has caused the prices of these material to be higher. Additionally, the attention that has been brought to products such as the sheanuts with their introduction into the international market has deprived local buyers of affordable prices.

The kind and intensity of livelihood activities pursued in a community is most often determined by the socio-economic circumstances of the community and the livelihood options from which they can choose. In all three communities natural resource-based livelihood activities are widely practiced. The gathering of wood products was more intense in both Zadantinga and Zaari and than it was Sakogu. The collection of firewood in these two communities occurred all year round but it was more intensive during the period of food scarcity (from March to July) than other times of the year. The participation of women in intensive collection and sale of fuel wood is a primary indication of the lack of other options from which to make a livelihood. On the other hand, some women indicated that collecting fuel wood at certain times of the year, particularly after crop harvest was often meant to build a buffer of income against the lean period. Among men in Zadantinga and Zaari hunting was a more important

livelihood activity and is more intensive during the dry season when men have little work to engage them. In view of these apparently limited ventures that are available to enable people to make a living semi-structured interviews revealed that one possible area where resources could be used to assist households is the introduction of micro-finance schemes that enable people to purchase inputs and materials to pursue diverse activities. There is a general notion that resources should be made available to enable idle men during the dry season to engage in vegetable farming. Such support has to deal with the lack of water in streams during the dry season

Women in Sakogu had a broader range of non-natural-resource-based activities to choose from because of the additional activities that could be undertaken at the local market. Although women do not own land, they are able to collect forest products such as shea trees and dawa dawa, but the right to the collection of these products depends on the type of land on which the trees are growing. If the piece of land is not under cultivation, there is normally no restriction on collection of these products, but products cannot be collected on a piece of land that is under cultivation. Livelihood activities of women in Sakogu also included trading, tailoring and sale of food and consumer items in kiosks.

In all three selected communities, farming is undertaken by both men and women. On the other hand, while men cultivated both food and cash crops, women are more involved in the cultivation of peanuts and beans and vegetable crops such as okra and pepper. The cultivation of cash crops such as groundnuts and cotton has intensified over the 15 years and has come to compete with food cultivation for available land. Nearly 50% of all cultivated land is devoted to the cultivation of groundnuts. The respondents

complained that much of the predicament in having enough land for cultivation is the result of the intensified cultivation of groundnut. As a result, there is diversion of resources from food crop cultivation into groundnuts, but much of the income from it is used to meet other needs rather than buying food. Therefore market prices of these crops have mediated the intensified use of land. It is apparent that not only has population growth affected resource exploitation, but also the commercialization of rural livelihood activities has affected the exploitation of land resources, diverted attention away from food production and changed consumption.

Among the selected communities, Zadantinga was the only place where cotton is widely cultivated. This crop is grown on contract for the Ghana Cotton Company. It was noted that the indigenous variety of cotton is no longer being cultivated because of the impoverished nature of the soil. The new variety, which has been introduced by the Ghana Cotton Company, requires fertile land and enormous attention. As a result the cultivation of the crop took the best land, but in the end the farmers do not benefit very much because the terms under which they go into the cultivation of the crops gives the farmers a small share of the produce. Women alleged that even though their spouses used the best land in cultivating cotton, they used the money they received from the sale of cotton in meeting their own needs instead of buying food to supplement their household needs. Additionally, the result of deteriorating biophysical conditions and the cultivation of the new breed of cotton is that women have lost their traditional livelihood activities of cotton spinning because the input requirements of the new variety make it very expensive so local women are not able to buy the raw material to make thread for the production of household clothing

5.3 Resource exploitation and livelihood strategies

The intensive exploitation of agro-ecosystems in the selected communities is both the result of ecological and economic disequilibrium (Cleaver and Schreiber), and a manifestation of the fragile nature of the ecological system (Barbier, 1999). The deterioration of land resources at an unprecedented rate in these communities is related to the nature of land use decisions that do not pay particular attention to its carrying capacity. The most effective land management practice which has adapted most effectively to the ecological conditions of the area are shifting cultivation and bush fallow systems, but they have both become impracticable under current demographic trends. After several generations have consistently depended on the same land resources, it is obvious that these resources can no longer generate maximum returns.

Considering that a large number of the households (70%) in the area are involved in farming activities (Asenso-Okeyere, et al, 1997), but often do not have enough land the absence of resource use techniques that are adapted to the ecological conditions, and which sustain the productive viability of land has been a considerable source of environmental concern. The most problematic issue confronting current land use activities is erosion of the topsoil, which renders the land susceptible to other forms of degradation. The traditional farming practices make extensive use of fire as a tool for preparing the land for cropping, contributes to the lost of biological diversity and particularly soil micro-organisms. These resource constraints are increasingly at the centre of transforming livelihood strategies. Table 4 illustrates the occupations of the research participants. The important element of sustainable livelihood with the context of

community resource exploitation is that the application of inefficient farming technology and reliance on rain-fed farming fails to enhance land productivity and the ability of the households to improve their productivity and nutritional status to make livelihoods more resilient.

Table 4. Occupations of Respondents

	Frequency	Percent	Cumulative Percent
Farmer	34	56.7	56.7
Trader	6	10.0	66.7
Traditional birth attendant	4	6.7	73.3
Herbalist	4	6.7	80.0
House wife	5	8.3	88.3
Health worker	1	1.7	90.0
Brewer	4	6.7	96.7
Weaver	1	1.7	98.3
Teacher	1	1.7	100.0
Total	60	100.0	

Source (Field Work, 2002)

Although household interviews revealed growing concerns about the pervasiveness of ecological problems in the selected communities, this has not caused household members to cut down the intensity of their nature-resource based livelihood activities, owing to the apparent desperation to survive in the face of rankling poverty and a yearly short fall in farm output. The present livelihood commitments are geared towards securing survival for the household, which only comes with greater risk to ecological processes. Under the current level of biophysical deterioration, economic opportunity is diminishing on many fronts and the hopes of eradicating rural poverty even now have to deal with other

challenges such as worsening gender difference in resource access. Community interviews also provided evidence that declining ecological opportunities are manifesting in lower harvest of grain and cereals, higher investment in fertilizers to support plant growth, and diminishing forest sources of activities for women to gain income.

The different livelihood strategies (Scoones, 1998) undertaken by households in the area range from intensive agricultural activities, diversifying livelihood activities into many areas as well as migration to other parts of Ghana. The different combination of these strategies produces different livelihood and environmental outcomes that influence human well-being. The increasing scarcity of land, particularly in Zadantinga and Sakogu, has left households with the only option of intensifying their agricultural activities by both broadening the range of crops they cultivate within an area at one time as well as using all the available land every cropping season. It must be emphasized that extensification is not an option for diversifying livelihoods for households in Sakogu and Zadantinga because there is no fresh forest for the community to clear. According to the respondents, the cultivation of the same piece of land every year requires more energy and time and greater use of inputs such as manure and chemical fertilizer to sustain the productive capacity of the land. They also face the challenge of determining the best combination of crops that will generate reasonable output, as the yields continue to decline year after year. Although some few households in Zaari still have the luxury of embarking on extensive land use, such lands are very limited and fallow periods rarely exceed one year. Land use is also associated with significant fragmentation of land resource ownership, sometimes occurring beyond limits that facilitate sustainable use and management.

Migration has emerged as one of the important mechanisms by which people who are economically challenged in the selected communities seek to gain more income and improve their well-being. There are two categories of migrants: those who go for a short period to provide farm labour to make some money to acquire household items or remittance for food and those who settle permanently on their own farms in other parts of Ghana, mostly in the south. Household interviews revealed that there is a high rate of migration because the young people are not able to survive on the income earned from their on-farm and other activities and this makes it necessary for them to explore other areas of greater opportunities. According to Asenso-Okyere et al (1997:51), migration has been found to contribute positively to reduction in poverty. PRA sessions with community members revealed that migration is easily found as a convenient way of dealing with idleness, which characterizes the long dry season in the area.

It must be emphasized that migration is not limited to only the selected communities but is widespread in northern Ghana, and has been extensively investigated (Ewusi, 1977, 1985). There is a significant involvement of young girls who move into cities to do menial jobs and remit money to their families back home. Women in all three communities acknowledge the significant contribution of female migrants to income, although there have been several incidents of extra-marital pregnancies resulting in serious embarrassment for their families. The out-migration of young girls from their homes also implies that they are not available to assist their mothers in traditional income generating activities such as shea butter making, local soap making and pito brewing. Thus the rate of migration is a source of concern for cultural survival, and the breakdown of community structures.

Among all the livelihood strategies, livelihood diversification is probably one of the most crucial means by which rural households have survived over the years. Household interviews indicated households pursue diversification of livelihoods out of necessity because their present range of livelihood resources and activities are not capable of securing them enough income and food. Risk is an inherent feature of farming activities that results from phenomena such as the weather, pests and diseases, and the market. One common features of farming during the rainy season is the occurrence of dry spells which sometimes last from two to five weeks and heavily impact on the growth and maturing of food crops. When dry spells happen, the reduction of water intake and withering of crops often set the precedence for pest to invade farms. The black caterpillar has been the common pest, which has caused a lot of harm to farmers over the last few years; in two seasons, some farmers were compelled to replant their crops after pest ravaged them.

As a result, livelihood diversification is determined by seasonality, risk strategies, and vulnerability. In fact, people in these communities, unlike other people in the formal employment sector, do not depend on one single activity for their livelihood. Due to the risks and shocks associated with the environment, a wide range of activities and options are being pursued to cope with the unexpected. Household semi-structured interviews revealed that the weather is a great source of risks to household. About 49% of the respondents regarded dry spells as the main source of risk while 31% saw pest and disease as a more serious threat. The combination of livelihood and coping strategies differs at different times of the year and also between men and women. As seen in Table 5, the range of coping strategies which are used as survival responses to risk, include the

sale of fire-wood, the sale of household assets such as goats and sheep, the exploitation of wild sources from the forest and the use of off-farm labour as well as borrowing, both in cash and in kind from friends and relatives. For women the most common combination is fuel wood, wild sources and assets sale while men provide farm labour, food for work as well as the sale of household animals.

Table 5. Coping strategies for shocks and risk

Issue	Frequency	Percent
Sale of firewood	19	31.7
Sales of assets	20	33.3
Exploiting wild sources	8	13.3
Providing labour to others	8	13.3
Borrowing food and money from people	5	8.3
Total	60	100.0

Source (Fieldwork 2002)

Although there is no clear difference in source of risk among the selected communities, there are some differences in the sources of coping strategies in the communities. For women in Zadantinga and Zaari, extraction of fuel wood and forest sources of food resources are very important. With few exceptions, the majority of women in Sakogu engage in activities in the local market. The activities that men undertake do not vary significantly in all three communities. It was noted that the poorer people embark on more diverse range of activities than more affluent households. This is because poorer households do not often have very reliable livelihood activities on which they can depend.

5.4 The state of ecological health

The continuous realization of livelihoods by household members from already degraded ecosystem resources is decreasing the variety of ecosystem services available to them and its impact on well-being of community members is manifesting in various ways. Agro-ecosystem-based challenges in the three communities manifest in the form of poor nutritional status of many households, loss of the traditional sources of livelihood strategies, decline in productivity and the disruption of family and community structures as a result of migration. Indeed, the degradation of marginal lands, destructive farming and harvesting practices, family break up and inability of land to support family livelihoods strategies is considered an important component of ecosystem health and community health (King and Hood, 1999). Interviews and PRA methods in all three communities provided evidence that the expansions of resource extraction into all areas of community natural environment is facilitating widespread degradation of ecosystems.

The community members' understanding of the condition of ecosystem health is embodied in their notion of land "tiredness or exhaustion." This is echoed in an answer given by a respondent regarding the state of natural resources in which the respondent noted that

> The land is now tired/sick and we can no longer get enough food from it. It is tired because our forefathers depended on it for several year and we are still depend on it with our children who also have their own. The soil is exhausted and we harvest less than half of what we got fifteen years ago and it is worsening every year. . We are no longer able to cultivate yam and sorghum which are very important food crops to us

This sentiment captures the general feelings of people in the three communities who depend mainly on natural resource activities and farming for their source of livelihood. The notion of Earth "tiredness" embodies growing barrenness of land and its inability to produce enough food, lack of fish in the rivers, the emergence of strange pests and diseases and farm weeds, many growths developed by some trees and declining rainfall. As has been noted by Bratton (1992), and Callicott (1992), the level of output that land and other resources are able to generate is considered as indicator of health. Land tiredness is also tied to the disappearance of indigenous crop varieties such as yam and guinea corns that only thrive well on regenerated or newly cultivated land. Table Six illustrates responses on the state of natural resources

Table 6. State of natural resources

Issue	Frequency	Percent
Degraded	15	25.0
Highly degraded	42	70.0
Not degraded	3	5.0
Total	60	100.0

Source (Fieldwork 2002)

In the same way that agro-ecosystems are increasingly losing their diverse resource base, these communities are also losing the diverse means by which they have traditionally earned their living. The obvious scenario is that there has been greater human pressure on the dwindling resources and there is considerable evidence that these communities are approaching a threshold of natural resource base exploitation where secure livelihood is

very difficult to attain as hitherto productive land is gradually converted into marginal land. The regenerative capacity of agricultural fields is hampered by persistent cultivation. In the specific case of Sakogu and Zadantinga, respondents revealed concern over the state of health of their livestock and their crops upon which the livelihood of most people is based. The growing decline health of for livestock over the years has resulted from the absence of pastureland and undergrowth on which these animals can feed.

Based on interviews and PRA methods in Zadantinga and Sakogu the research participants are of the view that the forest reserve serves are the only available land on which cattle can graze since tracts of the land available are mostly under cultivation. Unfortunately, it is a yearly occurrence for this forest reserve that serves as a grazing land to be subjected to bush fires, making it very difficult for cattle herders to find enough grass to graze their cattle. It is not a practice for owners of livestock to designate a portion of land solely for the grazing of their livestock, but some part of every community is designed as a corridor for the movement of cattle to areas where they graze. The only land that is usually available for grazing is wastelands that are too rocky or barren to be cultivated. As a result, there is a high livestock mortality rate and the communities have attributed this to the growing decline in pastures. The research participants also claimed that the mortality situation of livestock is becoming more alarming with the drying up of rivers during the dry season since the amount of rainfall is decreasing and most water ponds are silting up. In addition, there has been a decline in the availability of fodder trees, which have traditionally been used to feed cattle during

the dry season. The excessive extraction of the leaves of these trees for fodder over the years has gradually contributed to the demise of such trees.

The intensive use of land has introduced different dimensions of ecosystem health problems. Leaner output of staple crops such as yam, maize, sorghum and millet is the result of the intensification of land use that is not accompanied by measures which sustain the productive capacity of the land. Other signs of agro-ecosystem degradation which the community members have observed over the years are based on quality of fruits and seeds of farm crops, as well as the way certain crops germinate and the number of shoots they produce from the onset. Waltner-Toews (1993), points out that these common negative ecological outcomes make the achievement of socio-ecological sustainability more elusive among rural agricultural communities. In Zadatinga the household interviews pointed to the fact that yam plants now germinate with too many shoots in stead of just one and do not have a strong stem and plant that facilitates the development of a quality yam tuber. Essentially the poor quality of these crops is linked to the declining productively of the available land because such crops thrive well in rich soil

The extensive use of fertilizer and manure from animal droppings and decomposed household refuse epitomizes the current struggles to bring land productivity to par with food requirements of households. One of the indicators of land degradation, which a respondent noted, is the current yearly invasion of farmlands by weeds after one or two rains at the beginning of the farming season. The strigger (*Strylidium calcaratum*) weed, which causes the millet crops to wither, is regarded as an important indicator of declining land productivity. The invasion of these weeds makes it necessary for farmers

to undertake excessive weeding, which is both expensive and energy sapping. There is also evidence that soil degradation is causing stunted growth in maize plants and brings considerable loss to farmers. Consequently, the farmers are more widely resorting to crops that are tolerant to low soil fertility irrespective of whether such crops meet their dietary needs. Under that circumstance farmers have found it wise to grow such crops for sale in order to get money to buy their preferred foodstuff, but they become vulnerable to unstable market prices. The soybean is also widely grown because of its ability to withstand less fertile soil and its nutritional qualities. As measure against the deteriorating condition of their land, participants in semi-structured interviews pointed to the fact that they are more widely resorting to a larger degree of agro-forestry in some portions of their farmland using economic trees such as cashew which commands a good market price for the beans and could be used to purchase others household needs.

Keeping household animals such as sheep, goats and poultry has been a traditional alternative for widening income sources during the long dry season, but these activities are no longer viable ventures because animal mortality has become endemic. In many ways, the mortality of these animals is related to environmental health and the incorporation of new material in the community environment, its inappropriate disposal and the free-ranging method of keeping the animals. One cause of animal mortality has been identified as plastic materials used to package food and other product which are eaten by animals like sheep and goats because of the salt these plastics contain. Such materials do not digest and cause animals to die. High mortality of small livestock and poultry in Sakogu is also attributed to the growing use of body bleaching cosmetics and hair creams among women which are contained in open sewerage that collects from

household bathrooms from which free-ranging fowls and animals drink and become poisoned. There has been no formal study to confirm this and this view is based on the observation of the people. Further, the cultivation of some crop varieties like cotton and soybeans is associated with spraying of pesticides. When livestock grazes from such crop residues they are poisoned and die. Apparently, the high social, public and environmental cost of the use of cosmetic, pesticides and plastic food packaging materials (Waltner-Toews, 1993; Peden, 2000) is a consequence of bad agro-ecosystem management rooted in cultural methods of waste disposal and husbanding of resources.

The household interviews revealed that unequal possession of resources between some households, and between men and women enabled the poor households to appropriate some income through their labour for the wealthy ones, but the worsening economic fortunes of all members, due to declining agro-ecosystems productivity has further worsened the plight of the very poor households. On the basis of this, it becomes necessary for any analysis of poverty-environment relations to be directed towards better appreciation of the erosion of the wealth of better off households and the implication of their impoverishment for ecological and social sustainability of the entire community

The methods of extracting traditional medicinal materials have contributed to undermining the performance and economic potentials of some community resources. Indiscriminate removal of the bark of a trees and extraction of their roots is one problem that caused a decline in their health. According to two respondents in Sakogu the drying of rivers and wetlands is partly the consequence of a tree cutting exercise which was undertaken along major water bodies in the 1960s as part of efforts to eliminate the black fly which transmits the river blindness disease. This government-sponsored exercise set

a bad precedent in creating a notion that those trees and wetlands are a nuisance and the present state of affairs is an indication that the mentality about wetlands as a nuisance still holds. Lastly, community land management practices such as cutting and burning down trees to generate some fertility on farmlands have contributed immensely to the continued degradation of land. Some respondents contended that burning is very selective, focusing on older trees that are not likely to be of any economic value.

5.5 Resource tenures and ecological change

One of the most critical factors determining access to land resources and the sustainability of their management in the study area is the land tenure arrangement. Land ownership in northern Ghana has generally been described as communal (Bakang and Gafforth, 1999). This assertion is highly debatable in the cases of the selected communities in the East Mamprusi District. In the study communities, households have different degrees of access to land resources and this is defined by the sequence of arrival of different clans who settle in the community about 100 to 150 years ago. The first clan to settled in a particular village claimed ownership over uninhabited land and other clans arriving later in that jurisdiction get their land use right from the founding clan whose eldest member becomes the chief. As more clans arrive in the community, there is a continuous process of land distribution from both the chief and other settler clans who have land in excess until the village lands are fully occupied.

In principle, the laws of Ghana vest ownership of community land in village chiefs, but the chief is only a nominal owner since he cannot appropriate a particular piece of land without the consent of the owner. Based on communities' own rules, the village chief owns some strategic resources located within the confines of the village, but this does not extend into bush farms. The boundaries of the village are defined based on the limits of the land that is being cultivated as compound farms or backyard farms. There are certain resources that are communally owned property from which every community member can for instance, graze animals or utilize wood from the fields for various purposes without any restriction, provided that users do not cause any harm that is socially unacceptable. These resources include water, rocky wasteland in the community, cattle corridors and grazing land.

In Zadantinga, the management of common property resources like grazing grounds, village ponds, and wood fuel sources on wastelands is based on cooperation among households in that community. For example, in the designation of a cattle corridor, all those who own land along that route cooperate and cut part of their land for that purpose so long as the designed route cuts across their piece of land. Even though there are no written principles governing resource use, there is an enormous amount of understanding among community members that there are rules which they cannot afford to violate. For instance, in a rocky wasteland located close to the village of Zadantinga, the participants pointed out during a transect walk that there is the understanding that the trees on the piece of land provide protection against winds. It is therefore common knowledge among villagers that trees are not to be cut from that part of the community. These kinds of structures also exist in Zaari and Sakogu. The situation is the same for

water resources and no single individual has the sole right to go to the village river and fish in it.

Within the community river waters, the extraction and hunting of certain animals such as the crocodile is forbidden and it is claimed that where crocodiles live, there is always water and they are often associated with village deities. In essence, such property is vested by community members in the chief who is regarded as the ultimate owner and has the responsibility to take action against any one who violates the rules for the use of such resources. The village leader (chieftain) therefore acts as an institution that regulates the use of communal resources.

As a result of the kind of arrangement that is in place, land is acquired through inheritance and the method of defining land access has facilitated the accumulation of land by the first settlers in the village. The households that have little or no land in the community are those whose ancestors settled much later and received little land. Interviews in Sakogu revealed that many of the landless households are migrant people who moved from other parts of the country in 1930s to settle in the community. Some were originally involved in trading and had nothing to do with land but have now resorted to farming. Land has generally been regarded as sacred among rural communities and is not sold, but this is changing in both towns and villages. In Sakogu for instance, people can acquire land for construction of their own homes from the chief and such would be registered under the Ghana Land title registration Act of 1986.

Good social networks enable members who have no land to obtain land from those who have, most of the time as a gift for a fixed period of time. There are, however, growing instances where land commercialization is facilitating the excessive exploitation

of land beyond the levels of subsistence and it enables outsiders to access land in the community. Previous studies by Zeeuw (1993) in Burkina Faso in West Africa concluded that land borrowing contributes to sustainable land management. This development was permitted by the availability of fertile land elsewhere under low population density. The interest of borrowers was to maintain the fertility of their own land by abandoning it to fallow and to borrow from others who have fertile land. In the case of the selected communities in the East Mamprusi District, land borrowing arrangements contribute to degradation, because when people borrow, it is not meant to facilitate the recuperation of their own land, but it is usually a means by which they access more land to add to what they already have to undertake their agricultural activities. A study by Afikora-Danquah (1996) provides evidence that there are different levels of conservation practiced by land owners and tenant farmers, with land owners practicing more sustainable management systems than tenants.

Those involved are mostly not engaged in farming activities for subsistence and the pressure exerted on the land is not accompanied by management methods that maintain the land because they do not invest in land management. Household interviews in both Sakogu and Zadatinga pointed to the fact that the some farmers use tractors to plough the land and the harrow breaks up the soil as well as the roots of farm trees. PRA discussions also pointed out that access to extra land by poor households with limited financial capital is undermined by commercial interests that are pervading the social networks that they have long benefited from. Also, the fact that a borrower has no right of access to tree products such as the sheanut does not provide any incentives for their protection. Because landholding is diminishing, there is a high level of fragmentation of

ownership among individual members within the extended family and in some case the nuclear family in order to maximize the utilization of the resources and to have control over land use decisions that most meet the best livelihood aspirations of the family.

Indeed, apart from certain resources as mentioned above, land is generally not communally owned as it has been widely interpreted. It is a misconception that the land tenure system is responsible for environmental degradation (Nsiah-Gyabah, 1994) because land is communally owned. However, this research indicates land degradation owes much to excessive fragmentation and exploitation beyond levels that permit regeneration of constituent elements that keep land and its resource at productive levels. This is in line with the findings of Asenso-Okeyere, et al (1997:9), which indicate the effect of land tenure arrangement on household food production and soil degradation.

Land ownership has moved away from being clan property to becoming family property and even individual members of a family have shown greater preference for private ownership. There has been very significant fragmentation of land as a result. About 78% of the respondents described land ownership as private. It could be argued that interpretational differences of what constitute private and common property resources could contribute to this pattern of response, but this illustrates a significant change in trends of ownership that is in line with the present productive orientation of community households. The question that was posed to the respondents read as "what is the nature of land resource ownership and in what ways has that contributed to degradation over the years?"

Okai (1997) has noted that rising land scarcity has created the need to substitute private ownership for communal ownership. It should be pointed out here that increasingly households are moving away from subsistence production to production with profit motives and there is a greater incentive to substitute private ownership for communal ownership. That is because these communities have acquired a taste for consumer goods, and guided by a desire to gain better housing and living conditions, many are no longer content with living in their traditional thatch homes. The quest for such durables as roofing materials for better homes over the past ten years advances a profit motive and a greater incentive to substitute private ownership for communal ownership. PRA discussions revealed that some people in these selected localities migrate to other parts of the country in order to make enough money to acquire such items considered to bring improvement in their living conditions. As a result many tenures are not a deliberate evolution from communal ownership to private ownership but rather economic and ecological trends and forces influenced their evolution.

5.6 Traditional knowledge systems

The local knowledge of rural communities has provided the greatest impetus in the sustainable management of resources over the past generations and that knowledge forms the bedrock from which their current resource management and livelihood practices have evolved. This knowledge has been significantly woven into various aspects of community life and expressed in the areas such as healing, land resource use, childbirth and rural manufacturing.

With respect to land resource use systems, the traditional system of rotational land use, which was and ideally still is practiced in the area, followed a logical sequence based on appreciation of agricultural stresses in order to manage crop placement on the land to conserve the fertility of the soil as much as possible. Newly cleared land is normally used to cultivate fertility-dependent crops, followed in subsequent years by crops with low-nutrient requirements. This confirms the assertion that farming over the years has been guided by extensive knowledge of soils that is appropriate for a particular type of crop (Appiah-Oppoku, 1999). Some participants in response to the question of having traditional knowledge disclosed that the features used by farmers to identify soil quality and type are based on either the colour and particle size or the presence of particular plants that grow on that land. The farmers also take into account their understanding of the underlying biophysical factors that interlock with soil conditions in the particular agro-ecological setting. For instance, under the circumstance of frequent dry spells in the study area, it has generally been understood by farmers that sandy soils are good for groundnut cultivation because in the face of a dry spell, the plant could penetrate into the ground to establish its nuts. It is also known that yam does not do well on clay soils that are subject to inadequate moisture since it does not retain water and is easily dried up.

With the deteriorating biophysical conditions, communities are even growing more reliant on their local knowledge for the best management of agro-ecosystems. It was disclosed during PRA discussions in Zaari that based on observation over the years, the people in the community have concluded that as a result of declining amounts of rainfall and declining soil fertility, cropping needs to be done within the first two rains of the cropping season. They contended that this method allows crops to benefit from the

full complement of nutrients that accumulate during the dry season before they are washed away in the tropical torrential rains associated with the beginning of the rainy season. It also reduces the prospect of the crops being overgrown by weeds that would hamper their productivity. It is apparent that this kind of knowledge has developed as an intuitive response to environmental conditions that remain unpredictable to the people.

Another facet of traditional knowledge is also manifest in soil conservation methods whereby rotational movement of livestock on farmland helps to enhance the fertility of the land to promote crop production. This practice is limited to compound farms and it confines or tethers livestock to a designated spot for up two weeks before they are moved on to another spot. Farmers believe that manure generated from such activity lasts for up to five years and is a more ecologically sound and cost-effective method for regenerating fertility and an added reason for household to own livestock. Additionally, communities undertake controlled burning of bush when grasses are still not very dry in order to minimize the effect of fire on trees such as shea and dawa dawa and to ensure that grasses are not completely burnt for livestock to graze.

As noted by Oppoku-Appiah, et al (1999), some aspects of traditional knowledge are being lost as result of modernization. One of those traditional practices in the Sakogu community was the annual funeral performed for the departed souls of selected trees, which accorded these trees the status of living beings. Even though such practices have ceased in these communities, the knowledge regarding these trees has continued to be present and such trees have continued to be protected, when others have been destroyed. Additionally, the patronage of traditional medicine is shrinking as more people resort to western health service. Herbalists in both Sakogu and Zadantinga believed that the

shrinking patronage of traditional medicine is attributed to the fact traditional systems of medicine sometimes cure illness after a sequence of treatments and there is often a note of uncertainty about the effectiveness of a particular treatment and no one would be patient for such a thing if treatment can easily be identified in the hospital.

Apart from the fact that health services are not adequately provided for the people and are also not affordable to the poor, there are some diseases that have largely been treated by traditional herbalists like dysentery, some types of boils, yellow fever and alcoholism. The medicinal components used by these traditional healers include roots and bark of trees such as mahogany, blackberry, dawa dawa and the mango tree. The use of these materials is based on a good knowledge of their curative properties (Appiah-Oppoku, 1999). This is similar to the claim by a herbalist in Zadantinga that the bark of the mahogany tree is used to cure boils because it has substances that are able to kill bacteria. Interviews conducted with traditional herbalists in Zadantinga revealed that over twenty people suffering from some acute form of dysentery had been treated locally over a period of twelve months after those patients unsuccessfully sought treatment at the hospital. However, the most serious constraint to patronage of traditional medicine is that healers are often reluctant to publicly advertise their expertise for prospective patients to seek their services. It was disclosed through interviews that healing is done in secretand sometimes involves supernatural powers. When a healer in the traditional setting advertises, it is interpreted as boasting about his/her powers and could be challenged spiritually by others. Additionally, the transmission of such knowledge is difficult because it is shrouded in mystery and secrecy and in most cases is associated with deities

and can only be passed on to close relatives. In spite of this traditional healers have been licensed all over Ghana to practice

Another form of traditional knowledge that is closely related to agro-ecosystem management is traditional agroforestry. Agroforestry is a practice with a long history in many parts of northern Ghana. There exist several traditional land use systems in which farmers retain trees on farmland. In northern Ghana, farmers maintain and manage different tree species on croplands. The species usually maintained include *Parkia biglobosa*, sheanuts (*Butyrospermum parkii*) and dawadawa (*Parkia clappertoniana*). Inter-cropping on arable lands of sheanuts and dawadawa is common in all the selected communities. These two tree species are generally not cut and used as a regular source of fuel wood or other timber products; they therefore form the common species on farmland and fallow land. They are selectively preserved by almost all farmers in the community. They provide revenue and food products at times of extreme food scarcity (March to July) each year.

Another traditional method of soil and water conservation is the raising of mounds. Farmers in the area use mounds as a tillage method for cropping. The mounds are usually conical in shape with oval or flat tops. The purpose of the mound building is to improve upon the exploitable volume of soils for the crops. The mounds are normally constructed in straight lines with big gaps and channels between them to encourage optimum runoff. The sizes of the mounds depend on their topographic position along the slope. They are normally located in the middle slopes, and are about 30 cm high, and with a 50 cm diameter at the base. On the lower slopes with heavy textured soils, the mounds are about 1m high with 1.5m diameter at the base. The soils here are subject to

water logging during the rainy season, which is why they are larger. Some mounds are semi-circular in shape, and are placed at the boundaries of the farmer's field to trap runoff water and enhance water availability during dry spells. The upper slope mounds are smaller and are cropped with millet, sorghum and sometimes groundnuts. The middle and lower slope mounds are normally cropped with yam or sweet potato.

5.7 Community health and environmental change

Health has emerged as one of the prime issues in communities' struggle to improve well-being because the improvement in health status is critical to the sustainable management of resources. Unfavourable agro-ecosystem-based factors like poor nutrition resulting largely from poor annual crop harvest have caused disturbing cases of poor health in these communities. The fact that people rely on forest sources of food at certain periods of the year is an indication that they do not have a nutritionally adequate food supplies during those times. In all three communities, respondents indicated that there are variations in household access to nutritionally balanced diet because some are wealthier than others. There is also a considerable reliance on cereals like millet, and grains like maize, for the greater part of their food needs which compromises the blending of nutritionally balanced diets most especially in Zadantinga and Zaare. It was disclosed that the presence of commercial food venders in Sakogu enabled those who could afford it to get better access to food than similar people those in Zadantinga and Zaare. There are also many somewhat affluent households that serves as a key source of mutual support to neighbours and relatives in times of need.

Other agro-ecosystem based factors such as exposure to vector-borne diseases like malaria are the biggest annual source of health risk. Poor housing systems and the expulsion of wastewater from homes that is left to lie in open drains provides the main breeding grounds of the disease vector- mosquitoes. The problem of mosquito breeding is more complex in Sakogu than in the other two communities. There are very large households made up of large numbers of families, which produce large pools of water that provide breeding grounds for mosquitoes throughout the year. This situation becomes worse during the rainy period. Community members in Zadantinga and Zaare observed that they are only subject to mosquito bites during the rainy season when rains create pools of water from which the mosquitoes breed. The debilitating effect of disease on rural communities causes a reduction in the number of days that the people are able to work and reduces the amount of food and income that farm households are able to generate at the end of the farming season. These illnesses disrupt the ability of household members to sustainably manage harvest and process agricultural and other natural resources.

Another obvious source of health risk is the poor access to water and sanitation services. Even though the sources of drinking water which have been provided in these communities such as the hand-pump borehole are regarded as safe, the mode of water collection and storage remains a major source of pollution. Water is carried from pumps to homes in open basins and drums and dust particles and other materials easily find their way into the water during this transfer. Interviews revealed that there are two boreholes working in both Zadantiga and Zagri. The disposal of household garbage is yet another source of health concerns in these communities. Refuse is disposed of in designated

household refuse dams and is a source of houseflies which are a vector for diarrheal disease. Hospital statistics show that malaria was the number one cause of morbidity (608) with diarrhoeal diseases coming second (108) followed by anaemia (24) in 2001 (Gambaga District Hospital, 2001).

Sanitation services are scarcer than water points in these communities. Apart from Sakogu, which had one community pit latrine, the other communities do not have any access to toilet facilities. The people in these villages have therefore been resorting to open defecation. This makes it possible for houseflies to infect food and water sources with faecal material. The overcrowding, poor sanitation, poor living conditions and in some instances, limited access to adequate health care can contribute to an epidemic such as cholera.

Cerebrospinal meningitis is the major cause of anxiety for the inhabitants of Sakogu. The occurrence of the disease has a spatio-temporal dimension because it is a very serious health problem in the northern part of Ghana during the dry harmattan weather. The harmattan weather conditions causes breathing problems because of the dusty weather. From the beginning of February to May the district also experiences excessive heat. Respondents observed that the harmattan weather has grown more hash over the past 10 years producing a notable period of many ailments. A study by Vedros (1987) has noted that CSM has a multi-factorial and complex nature and it is difficult to reach definite conclusions about its causes. It is caused by *Neisseria meningitidis*, a gram-negative bacterium which belong to serogroup A. It is transmitted through direct contact, including respiratory droplets from nose and throat of infected persons. Others like Scott (1965) point out that the cerebrospinal meningitis situation in northern Ghana

is related to the poor housing design which leads to lack of ventilation in the rooms. Household interviews revealed that the worst CSM cases occurred in 1999 when over hundred members of the town died in a period of three months. Sakogu is located in the midst of huge rock formations and communities attribute CSM to the combination of harsh weather and heat generated from rocks.

5.8 Resource management structures and institutions

The management of resources at the community level in Ghana is by far one of the most important issues to have generated development concerns and attracted many NGOs into the Northern Region of Ghana. Various agencies and organizations were identified with resource management in the East Mamprusi District. These included, the Forestry Commission, the Environmental Protection Agency, the Ministry of Agriculture, the District Assembly and non-governmental and community-based organizations. The different ways in which these agencies and organizations are contributing to resources management include the establishment of woods, protection of forest reserves, introduction of soil and water conservation methods, undertaking anti-bushfire campaigns, agro-forest and plantation agriculture and provision of potable water

There are important traditional structures involved in the management of resources at the community level. The institution of chieftaincy enhances resource management by performing the functions of a regulatory body for the use and management of communally owned resources. This institution has the power to impose sanctions for unethical resource use practices. Unfortunately, this management system is

not extended beyond communally-owned resources and government property outside the confines of the village. Other community level resource management structures are the formation of women's groups involved in various activities such as tree planting, vegetable gardening and farming activities. As at the time of this research these groups were just being formed, but women in Zadantinga had begun a vegetable gardening project with the assistance of PARED, a local NGO (discussed below).

At the moment, one of the most important factors affecting the livelihoods of communities in all three study sites is the low productivity of agriculture. The agricultural sector of Ghana, which is the mainstay of the rural people, has been badly affected by the removal of subsidies for agricultural inputs following the introduction of Structural Adjustment Projects in the late 1980s and lack of support for farmers. The role of the Ministry of Agriculture in resource management is executed through the extension service field staffs that are sent out to advise farmers on farming practices, the environment and bush fires.

The focus of interventions by the Agriculture Ministry in the district is the use of farmers' groups and ensures that they are trained on how to nurse seedlings on their own and transplant them. However interviews view agricultural officers pointed to the fact that farmers needs good training and education to make them fully appreciative of the long-term benefits of these measures and initiatives as many of them consider that a difficult and arduous venture which will yield fruit some long time to come. This outreach program is limited to a very few visits in a year, as there are fewer than 10 extension services workers for the whole district. Based on the research interviews, it is revealing to note that there is absolutely no monitoring of any kind of what is going on in

community-managed lands. The crisis in land use in this case study should be viewed as one of poor institutional support for community livelihoods and environmental issues by resource management agencies.

The District Forestry Department which is the lead agency with the responsibility to protect the forest, manage forest resources, and educate the population with regards to the hazards of fires for trees and animals is actually not doings its work. Even though there is a large forest reserve in the East Mamprusi District, the official role of the forestry department has been called into question given that the Forestry Commission has now moved their offices and staff to a neighbouring district from which reserves in East Mamprusi District are administered. The research interviews revealed that the Forestry Department does not deem it necessary to have any field staff in the East Mamprusi District because the tree species in forest reserves do not generate any timber revenue and it is more important to withdraw their staff to southern Ghana where there are timber resources. This problem is partly the result of limited resources in terms of transport and staffing. Obviously, the occasional visit by the only forestry officer in charge of two districts implies that the operation of the District Forestry Office, as far as protecting forest reserves is concerned is not effective.

The assignment of forest guards to protect government designated forest reserves in the district has had little impact and there is a high level of forest reserve encroachment throughout the district. There was an apparent awareness by the District Forestry Office of the extraction of fuel wood for urban sale, but the practice is very difficult to stop because it is happening in all communities located to the reserve and the department has few guards to monitor the reserve. In spite of the change in the administration of forest

resources in the district due to shrinking financial allocation, the forestry department has effectively carried out the planting of woodlots in a number of places in the East Mamprusi District. They have also carried out afforestation and reforestation activities in the reserve where wood extraction has been so severe. The other major problem in the reserves is the constant bush fires, which burn down reserves every year. There is also a problem of livestock grazing in the reserves in communities living close to these forest reserves.

Only now is the Forestry Department beginning to see communities as partners in the management of the forest and a number of interventions have been identified for implementation in communities in some areas of the West Mamprusi District to reduce the impact of their activities on the forest resources. The District Forestry Office is working with the Savannah Natural Resource Management Project (SNRMP) to introduce alternative sources of energy. The aim of the SNRMP is to improve the conservation and management of globally and national significant plant and animal species as well as increase awareness on biodiversity issues. Currently, the SNRMP seek to assist communities to manage their resources through training and education. Selected communities have been put into different livelihood activities groups and introduced to the processing of sheabutter, honey production, animal-rearing. Men are trained to confine animals to reduce their impact on the forest reserves. The Department also works in conjunction with the SERMP to create dams for dry season gardening and allocate portions of the reserves to allow farmers to farm those portions of the forest under strict guidance. Such land is usually given out to the whole community.

The participation of NGOs in resource management has been very crucial to the improvement of living conditions in the East Mamprusi District. The Northern Region Rural Integrated Program (NORRIP), a Canadian International Development Agency (CIDA) and Government of Ghana funded project, has contributed immensely to the provision of potable drinking water to communities throughout the district. The main sources of water are boreholes which were provided in the early 1990s. These water resources are managed by community organisations such as the Village Water and Health Committees (VWHC) with the involvement of women mostly Traditional Birth Attendants (TBA) and Village Health Workers (VHW)

Another organization is the Partnership for Rural Empowerment and Development (PARED), which is a local NGO. PARED identifies the needs of women and provides them with assistance in the form of micro-finance. It operates in Zaari and Zadantinga and has been working to assist communities to improve the trunk road to the market to improve the transportation of farm produce. It also identified key areas to provide assistance for women to engage in group activities such as farming, dry season vegetable gardening and cashew plantations. This NGO began operating in the later part of 2000 and has been able to provide loans to over 60 women in the District with some funding from Actionaid, a British NGO.

The Bimoba Literacy and Farmers Co-operative Union (BILFACU) is another local NGO that is currently operating in Sakogu in the provision of micro-finance. It organises women into groups and provides them with financial support to undertake activities such as pito brewing, trading and sheabutter making. The operations of BILFACU in Sakogu are still in their infancy and activities have not been expanded, but

in other parts of the districts, it is involved in agro-forestry, nursery and distribution of trees to community groups and anti-bush fire campaigns. The most remarkable area of agro-forestry, which was found in Sakogu, is the adaptation of cashew plantations that is proving to be good method of improving household income.

There are other agencies that have failed to execute their functions, which contribute to the present pattern of environmental problems. The Environmental Protection Agency is the key institution that is responsible for the providing initiatives and solutions in natural resource management and conservation and is primarily concerned with forest and wildlife resources management, land resources management, water resources management, and energy resources management. It is also responsible for environmental education and oversight of environmental impact assessment programs. However these functions are not being performed at the East Mamprusi District because the agency does not exist. At the district level the EPA is suppose to work with the District Assembly, the District Environmental Management Committee and Community Environmental Committee to implement resource management and education programs. Field investigations revealed that these committees have not been put in place, the EPA itself was formed in 1994 and has limited funding to carry its responsibilities. The Interviews with personnel of the agency in the based in Tamale, the capital of Northern region also revealed that the operations of the agency are still centralized in Accra.

5.9 Summary

The transformation in livelihoods and environment in the East Mamprusi District of Ghana has been found to be associated with unreliable food production and increasing reliance on practices that tend to add more damage to the environment. The ability of households to gain livelihood is based on access to certain livelihood resources such as land, bullocks that provide farm power, and other livestock which are sold to meet different expenditures, and there is strong bias in livelihood activities towards agro-based activities. The significance of tree crops in their livelihood is highlighted by the multiple use of crops such as dawa dawa and shea. Access to other livelihood activities influences the pursuit of wood fuel collection for sale to make a living. Migration is increasing adapted by men and women to gain extra income in the southern part of Ghana, but it is also contributing to outward migration of the energetic youth, leaving the job of food production for the old. Both community health and that of the ecosystem are showing signs of distress and both need to be addressed through a range of community-based initiatives.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

Environmental issues in Sub-Saharan Africa are intrinsically linked up with people's livelihoods and, contrary to those of developed countries, they are localized in nature. At the same time, there are differences in agro-ecosystems-based resource challenges experienced by people within the same local area. These challenges have triggered resource use behaviours that are not compatible with the current goals for sustainability desired in both economic and ecological systems.

Global capital markets relations are not only weakening the environmental ethos of rural traditional resource and livelihood practices, but national level institutions, while encouraging decentralization of decision-making, have been inefficient in planning and providing support for the livelihood of rural people which to a large extent is related to the character of international influence on national level decisions in the areas of macro-economic and social policy reforms.

Consequently, rural environmental systems are rapidly responding to pressures of demographic and socio-economic trends and the deteriorating state of resources for gaining livelihoods among the study communities is evidence of the growing deprivation which characterizes the lives of majority of the rural population in developing countries. This study has demonstrated that in spite of differences in access to resources experienced by people in rural areas, they are challenged by accelerating ecological crises inherent in the nature of their land management techniques.

This study has highlighted the differences between the three communities in terms of ecological change related to livelihoods and health. The differences in ecological change arise partly from the intensity of land exploitation that emanates from pressure on available land. The nature of rural livelihood construction, which depends to a large extent on environmental resources, contributes to the pattern of deterioration in ecological resources and creates a process of change in socio-economic conditions. In other words, the research has demonstrated through its findings that peoples' livelihoods are still tied to the environment, although there are variations in the degree of this dependence in the three communities and there is significant decline in productivity of land as a result of the intensity of its use, as well as rapid ecological change manifesting in drying up of rivers and environment related illnesses. The different levels of ecological change affect human health, the quality of livestock and livelihoods. This level of decline is responsible for the disappearance of some indigenous crops and any further environmental degradation could cause livelihood sources to shrink. It has also been associated with the loss of traditional livelihood activities for women such as the spinning and production of traditional cotton clothing. Poor soil fertility, declining crop yield and diversity of plants and animal species in the East Mamprusi are evidence of Ecosystem Distress Syndrome.

The research interviews reveal decline in trees that have no traditional economic merit to the farmer, while the economic value associated with some trees such as the shea tree and dawa dawa have enhanced household appreciation of the benefit of ecosystem services, which have provided incentive for their sustainable use and management. Ecological changes resulting from land use arrangements of communities induce agro-

ecosystem-based livelihood problems such as poor nutrition. They also impact on pastures or sources of fodder and the result is reduction in the quality of animals as a source of income and farm power in the case of bullock. Additionally, the ecological problems associated with the use of chemicals in farms and bleaching materials contribute to the death of animals. This situation is typical of communities like Zadantinga and Sakogu where the cultivation of some crops is associated with the application of pesticides. The nature of ecological change affecting livestock in Zaari relates to the lack of water for livestock during the dry season. These three communities differed in the extent to which livelihood sources are gained from forest products: in Sakogu women are more involved in more diverse activities including cottage industry. In Zaari and Zadantinga women collected wood for sale, which is the main contributor to deforestation in a forest reserve. Land resource access and the intensity of its use also vary among these communities. In Zadantinga and Sakogu, households have poorer access to land resources than in Zaari.

It has been understood that in the context of sustainable livelihoods, there are a number of important elements of household livelihoods that have not been given the desired attention. Poverty is a serious problem in the study area and the majority of farm households have very poor access to financial capital to acquire inputs and adopt technologies that enhance productivity. Government policies have led to the removal of subsidies on agricultural inputs, which are no longer affordable to the majority of these farmers. Macro-economic policies have impacted on the economic fortunes of communities and have stimulated individual economic freedom that accounts for

individualization and excessive fragmentation of land use beyond levels that could be sustainably managed.

The ownership of what have been traditionally considered important households assets such as trees, livestock, land and poultry can no longer guarantee adequate livelihoods because these resources are impacted by the ecological health changes. Household access to a narrow range of livelihood resources has also constrained the capacity of most members of the community to engage in livelihood activities that are essentially not based on the exploitation of the ecosystem resources. As a result, the direction of expanding livelihoods has focused mainly on agro-ecosystem activities and they tend not to be sustainable.

The production of cash crops such as cotton and groundnuts has grown to compete with the production of the traditional food crops and the competition for land has intensified. The quest for more land by individuals seeking to expand their production of cash and food crops has introduced various mechanisms of land access that compromise the sustainable use of the land. Household access to land in this new arrangement is determined by the ability to meet the terms of prospective land lenders and the opportunity for poor households to borrow land for free is increasingly threatened. This situation is in contrast to the findings of Zeeuw (1993), which indicated that land borrowing contributes to sustainable land management, and is conditioned by a population density that creases pressure on available land and prohibits the sustainable use of the land through shifting cultivation.

On the basis of these constraints, many households are encircled in poverty, poor nutrition, poor health and lack good housing. The transformation of household environments creates micro-ecological conditions that favour disease incubation and transmission, such as malaria, and the pattern of this disease varies among the selected communities. In spite of their inability to institute measures to address their own resource constraints, the research shows the positive contribution of traditional agro-forestry practice to the protection of the environment and sustenance of livelihood resources. This provides some indication that those agro-ecosystem-based assets make a key contribution to livelihood and that households' capacity to secure livelihood could be enhanced through greater investment in agro-forestry related initiatives.

To conclude, ecosystem change is at the root of many problems related to health and livelihoods in the selected communities. Ecological change continues to be perpetrated by changing tenure arrangements favoring commercial large-scale exploitation that causes land to be intensively cultivated. Because of the benefits that accrue to land owners, there is also the incentive to make land available for use by others, and yet the intensive exploitation is not accompanied by any restorative management measures. Those who are more seriously affected by poor land access are those who lack adequate income and are not able to pay a fee for to use land that belongs to others. In addition, land fragmentation arrangements rooted in the growing quest to have control over land use decisions that most meet the best livelihood aspirations of the individual, contribute to degradation of land, because this arrangement does not facilitate the recuperation of land as it is always under cultivation. It is fair to conclude that land scarcity is partly attributable to institutional intervention in land access through the

creation of forest reserves without critically considering how livelihoods of nearby people are affected. In line with current trends in natural resource management, the livelihood priorities and interests of communities must be integrated in any resource management systems that may be implemented. It means resource management systems must integrate community institutional mechanisms that enable community members to fully participate and share in available resources.

It has to be noted that the attainment of sustainable livelihoods in these communities is related to the effective management of environmental resources. For a start, the agencies entrusted with resource management responsibilities such as the EPA, MOA and FD need to adopt a community centred approach to resource problem solving through increased environment related programs to improve knowledge on the cause and magnitude of the ecological problems. This is necessary because such institutions and organizations currently provide limited support to communities both in terms of educational information and resources to help them manage their land. This cannot be possible without improvement in the capacity of these institutions to implement their programs. In essence, these institutions should be capable of guiding communities to mitigate risk in exploitation of resource and provide assistance in greater diversification of natural resource management initiatives into other areas such as plantation activities such as cashew and sheanut cultivation. The attainment of sustainable livelihood is not reliant only natural resource assets, but the complement of other physical, social and financial capital to support the attainment of sustainable livelihood is lacking

Bridging the gap between rainy season farming and dry season idleness by farmers could take the form of initiating vegetable gardens as is currently being started,

but this option should be explored against the environmental impacts that the creation of small dams may cause to communities. Since the forest reserve is gradually being encroached upon, the Forestry Department could initiate co-management of the forest with community and in areas where the forest has been destroyed, both parties should establish plantations of economic trees in there. By sharing authority regarding the management and control over the forest resources and their benefits, chiefs and community leaders could preside over the resources closer to their jurisdictions, defining the rules of access and duties of the parties. The management systems put in place could help control fires and sanction socially unacceptable behaviours in resource use so that resources can be of maximum benefit to the community.

But there must be an economic and social policy environment that espouses rural development through greater improvement in social services and resources support for rural livelihood activities such as agriculture. In more specific terms, the government needs to invest towards improving rural agriculture by enhancing access to inputs, and credit, while ensuring effective monitoring and supervision of the production outcomes to avoid the waste of resources. At the present level of ecological degradation, much more could be done to save the environment through enforcement of regulations regarding the extraction and marketing of fuel wood. Relatively inexpensive sources of energy such as solar energy and other systems need to be pursued seriously to reduce the current dependence on wood for energy. Effective community resource management must entail community protection of forest resources and lands under government control that serves community interest such as in livestock grazing.

Even though this research has dealt tremendously with the study objectives, it has certainly not been possible to address all the fundamental issues in sustainable livelihood and ecosystem health in these three communities. As a result future research needs to focus on understanding the implications of social structure and community organization for the implementation of sustainable livelihoods approach and environmental improvement. Such research should highlight issues of social equity eminent in the structure of land use rights. On the basis of the present research, the next step to these conclusions that have been drawn from the study in these communities is put the sustainable livelihood approach into practice, while still integrating ecosystem health issues.

Given that the study has identified the productive and important livelihood assets, and the promise for development of cashew, shea and dawa dawa plantations, vegetable gardening and the use of traditional knowledge, the next logical step would require the development of community action plans and the identification of areas for support by the national government and NGOs in terms of policy, investment and credit and market and that of technology. In the practical of implementation of the sustainable livelihood approach, there will be a need for broader visioning of future livelihoods than it is was done in this research. These recommendations in thesis are part of a research report prepared for the International Development Research Centre (IDRC) and copy is attached is attached in appendix II.

Appendix 1: Interview Protocol

Household semi-structured questionnaire

A. Personal information

1. Age 2 Sex M F

3. Education (a) Primary (b) Secondary (c) None

4. Occupation

B. Natural resources, health and livelihood

5. What is the state of natural resources from which you derive your livelihood and how is this situation affecting livelihood?

6. What is the nature of land resource ownership and in what ways has that contributed to degradation over the years?

7. What are your most important assets and there been any deterioration of such assets?

8. Does resources access differ among people in the community?

9. How does changes in environment affect health and human well-being?

10. Have any livelihood opportunities have been lost because of natural resource degradation in your community?

11. What indigenous crops and medicinal plants that have been lost as a result of resource over extraction?

12. What measures have been adapted to address these resource problems (and save livelihoods)?

13. What alternative sources of livelihoods can be explored in the community?

14. What opportunities and resources are necessary for exploring alternative sources of livelihood in the community?

15. What is the role of agencies responsible for agriculture and environmental activities in improving resource management?

16. Do you have traditional knowledge? What is it?

17. How do you apply your traditional knowledge in resource management as well as livelihood and health?

18. What constrains makes it difficult for traditional knowledge to be used to improve human well being?

19. What are the various sources of risk in your environment?

20. What strategies do you embark upon to cope with drought, pest outbreak and low productivity? (Note difference in gender coping strategies) to these risk

21. What are your most common health problems and how does environmental changes impact on your health?

22. What is the trend in disease occurrence in your household?

23. What element of health problems is contributed by resource degradation?

Questions for Agencies and Organizations

1. What agencies are involved in addressing community livelihood and environmental problems?

2. What are the focal areas of intervention of the Ministry of agriculture in community agricultural production?

3. How is a land use activity in communities monitored?

4. What do you consider to be the most appropriate measures to deal with livelihood environmental problems?

5. How effective has community-based institutions in facilitating promoting improved livelihood and environmental management

APPENDIX II: Research Report

Ecosystem Health and Sustainable Livelihoods: Exploring the Prospects in Community-Based Resource Management in the East Mamprusi District, Ghana

Submitted to the International Development Research Centre (IDRC), Ottawa

Abstract

Institutional processes, social and economic trends play a role in defining the outcomes of people's interaction with and use of their ecosystems. The resource use decisions of households influence the livelihood and health dimensions of ecological change. This paper uses the ecosystems approach to human health to study the relationship between ecosystem and human health by examining how agro-ecosystem based resource use systems influence community environmental change and vulnerability to health and livelihood problems. It identifies community assets and activities and examines how they both affect human and ecological health and productivity and community sustainability. Decline in quality and abundance of assets such as livestock, arable land and economic trees that have been a source of wealth and for meeting expenditures such as medical expenses, food and school fees is attributed to the transformation of community resource tenures and polices, increasing incidence of animal mortality resulting from chemicals used in farms and the decline in grazing land, while household wastewater is a source of breeding grounds for mosquitoes that transmit malaria. Agro-ecosystem based livelihood activities have introduced environmental changes that have contributed to decline in food production and poor health resulting from poor nutrition. It is argued that improvements in health (both human and ecosystem) and the sustainability of livelihoods have to focus on the creation of livelihood and environmental opportunities which enable communities to adapt to weather risk and expand their livelihoods and prosperity beyond simple dependence on the shrinking natural resource base.

Key words: Sustainable livelihoods, ecosystem health, traditional knowledge and community-based resource management

Introduction

Rural livelihoods are increasingly challenged by the growing need to achieve a balance between the declining productivity of agro-ecosystem resources and increasing demands for adequate nutrition and healthy environment. Natural systems and resources

constitute the primary assets of the health and sustainability of any human community (De Kruijf and Vuuren 1998) and the mounting stress on the diversity of those resources and the biophysical environment resulting from livelihood activities poses a threat to the health and well-being of rural people.

Among the ecological zones of Ghana, the savannah and semi-arid regions are experiencing a wide range of environmental problems and studies by Babier (1999), and Lopez (1997), points to the role of agricultural and economic policies in contributing to ecological and social distress in these regions. Land degradation is a key challenge of ecosystem health in Ghana which has been cited in declining food production, increasing poverty and malnutrition (Asenso-Okeyere, et al, 1997). Rapid socio-economic and environmental change affecting livelihoods and health exacerbates pressure on natural resources resulting in extensive extraction of fuel wood, expansion of shifting cultivation/agricultural land, and livestock overgrazing. It is essentially not just a problem of population expansion, but also social and economic changes such as the Structural Adjustment Programs (SAP), which cause the sustainable exploitation of resources to become elusive to rural natural resource dependant people in Ghana (Awumbila, 1997). The scale and speed of ecosystem depletion raise concerns about the future of those whose livelihoods are based on the exploitation of land, water and vegetation assets (Cleaver and Schreiber, 1994). The formulation of strategies that enable the poor to reduce and adapt to environmental changes, which stems from the degradation of local ecosystems would be a clearly focused complement to sustainable development in this region (UNCED 1992; UNDP 1997).

The problem also stems from heightened vulnerability resulting from poor access to credit, poor social services and support which expose communities to hazards and risks, and reduce their capacity to cope and recover from economic, social and natural shocks and stress. For example 33% of the extreme poor come from Northern Ghana and it is argued that the conservation of the environment is difficult at the current level of poverty (Al-Hassan et al 1997). This is premised on the notion that poor people, by virtue of their limited access to alternative means of livelihood are compelled to exploit their limited stocks and a vicious circle of human need, environmental damage and more poverty ensues (UNCED 1993).

The East Mamprusi District provides the setting to investigate the livelihood and health dimensions of ecological change resulting from human activities. It focuses on institutional as well as ecological sustainability issues within the context of ecosystem health and livelihoods. The objective of this paper is to identify agro-ecosystem-based resource use systems and investigate the institutional and socio-economic trends and processes influencing community resource management and vulnerability to health and livelihood problems. Furthermore, it explores traditional knowledge systems that promote ecosystem and community health.

The growing interest in community-based initiatives in natural resources in recent decades is part of the methods for the implementation and promotion of sustainable development. Community property resources are often central to the livelihood of the poor (Beck and Nesmith, 2001), which makes their sustainable management more crucial. Institutional structures in local resource management involving different groups of people within the community are responsible for differences in access to natural

resources such as land, forest and water resources and have significant implications for people's livelihood security (Mancusi-Materi 2000). Thus, the Sustainable Livelihood concept is based on the need for the components of a livelihood to enhance resource productivity on a long-term basis. A "livelihood is sustainable when it can cope with, and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Carney, 1998:5).

Societies' concern over natural resource degradation and the sustainability of natural resources has necessitated the application of the health concept to ecosystems (Nielson, 1991). Ecosystem health and Sustainable Livelihoods are intrinsically linked by the fact that they are both concerned with the features of resilience, adaptation and recovery from shock and stress. For the purpose of this paper, ecosystem health is defined as a system's capacity to maintain a level of diversity and self-organization that enhances its stability and resilience to keep the system vibrant and from falling into distress.

Study Area and Research Methods

The fieldwork for this study was carried out in three communities in the East Mamprusi District of Ghana, a distance of about 700 kilometers from Accra, which shares boundaries with the northwestern part of the Republic of Togo. The district lies in the northeastern part of Ghana, specifically, between latitude 10° 20" and 10° 45" and longitude 0° 10"E and 0° 40" W. This area of the Savannah woodland ecosystem located on top of the Gambaga scarp supports semi-subsistence rain-fed agricultural activities and cattle rearing. The ecosystem of the area is highly influenced by agricultural activities, wood extraction, bush fires and the presence of household animals that browse and trample on plants. The entire stretch of the scarp is demarcated as a forest reserve with the altitude reaching about 358 metres above sea level. Most of the District is very gently undulating, with broad, poorly drained valleys. The crest of the Gambaga scarp forms the northern boundary of the Nasia Basin, another major river that flows into the Volta River (Dickson and Benneh, 1987). The geographical area of the East Mamprusi District is characterized by tropical continental climate, which has a single rainy season extending from May to October followed by a prolonged dry season. Like other parts of the Northern Region of Ghana, two dominant air masses -- the tropical maritime or the moist monsoon, and the tropical continental or dry Harmattan -- dictate the climatic conditions in the area

Total annual rainfall is about 1000–1300 mm per year. The peak rainfall period is usually late August or early September. About 60% of the rainfall occurs within three months (July to September), with torrential rains creating serious drainage problems (Liang, 1994). Dry spells, which sometimes lead to drought, have become an important

constraint to traditional agriculture in the district. These dry spells occur during the cropping season resulting in the depletion of soil moisture and rendering the soil less able to support traditional rain fed agriculture. The Harmattan weather (December to March) is a period of extreme dryness when dusty winds from the Sahara blow across the district causing some respiratory problems for many people. The mean annual temperature is about 28° C. The vegetation cover typical of the area consists of mixed formations of fire resistant trees and shrubs. The vegetation also consists of grasses such the *Andropogon gayanus* (Gamba grass) and trees such as the *Parkia clappertoniana, Butyrospermum parki, Adansonia digitata* and *Acacia spp* (Liang, 1994).

The East Mamprusi District was chosen for the study because of its long history of human settlement and population concentration in northern Ghana, and a documented record of environmental degradation (Dickson and Benneh, 1977). The communities in the study area were chosen following consultations with local leaders, governmental and non-governmental agencies in the district. The three communities which were selected for the study, were Zadantinga, Sakogu, and Zaari.

The Study Methods

The broad focus of this study was on livelihood and health dimensions of ecological change and the prospects for addressing livelihood and health issues through a strategy of institutional and resource management change. The choice of the three communities was to provide an opportunity for the comparison of resource use, prevailing livelihood and resource constraints, institutional processes and health issues under different socio-economic settings. This study relied considerably on the use of both primary and

secondary data. The study methods included extensive collection of secondary data from books, journals, government publications and census reports in Ghana and Canada. Primary data were gathered through field studies involving the use of Participatory Rural Appraisal methods, semi-structured and key informant interviews with members in the selected communities, governmental agencies involved in resource and environmental issues and Non-Governmental Organizations (NGOs). Interviews dealing with livelihood, environment, health and resources management were conducted in three communities. In addition health statistics were obtained from the Gambaga Health Centre to cross check communities' claims about health issues. The data collection for this research was carried out over a period of four months from December 2001 to March 2002.

Different sets of semi-structured interviews were administered to individual household members on the one hand and community organizations, governmental and Non-Governmental Organizations (NGOs) and professionals involved in resource management on the other hand. The organizations/professionals included two forestry officers, two agricultural officers, one officer of the Environmental Protection Agency (EPA) of Ghana, the District planning officer and representatives of two NGOs, namely Bimoba Literacy and Farmers Co-operative Union (BILFACU), the Partnership for Rural Empowerment and Development (PARED). They were asked about environmental and livelihood issues and the issues of resource management. The semi-structured and key informant interviews were tape recorded to permit the transcription of key sections of the interviews.

A total of 60 households were involved in the interviews in the three study communities. The sample size was determined bearing in the mind the time involved in administering the semi-structured interviews and the fact that other research tools such as Participatory Rural Appraisal will complement the data. The respondents were chosen from a wide range of livelihood activities such as farming, hunting, gathering, trading, weaving, those in involved in cottage industries such as pito brewing and production of sheabutter as well as those involved in the extraction of firewood and charcoal. It is necessary to state here that this research was conducted with rural people and there was a need for research methods to be appropriate to their context. According to Chambers, (1997:162) "many poor peoples' realities are local, complex, diverse, dynamic and unpredictable ... participation, empowerment and mutual respect enable lowers and poor people in general to express and analyze their individual and shared realities."

Results

Household assets and livelihood activities

Rural productive resources such as the rich and diverse types of vegetation and land that constitute the ecosystem provide the basis for rural livelihoods. This study explored the state of these resources from which rural livelihoods are constructed and the results demonstrates that environmental resources still play a key role in providing daily food and other needs and therefore make significant contributions to livelihood of the household, but the availability of these resources is generally on the decline as a result of their intensive use and environmental deterioration. Such resources are also a source of

medicines, household equipments, building materials and material for agricultural and other equipments.

Household assets of the community members were identified as livestock, land and its resources, and human capital such as labour and social networks. The data derived from the household interviews indicate that access to livestock and land are considered a very important means of gaining a livelihood. Livestock has traditionally been a means of keeping wealth as well as providing a means for meeting expenditures such as medical expenses, school fees and dowry payments. Household interviews in all three communities indicated that trees constitute an important component of people's assets because the wide variety of tree products enhances the household's capacity to secure a livelihood and income to meet critical household needs. Important economic trees in these communities such as the Sheanut tree (*Butyrospermum parkii*) and the Dawa dawa (*Parkia clappertoniana*) provide a crucial income source through the processing and sale of the nut or beans, and are also a significant source of domestic cooking oil and for the production of local detergents. Chalfin (2000) has found that over 21,000 tonnes of shea valued at US $4.5 million were exported from Ghana in 1996 and this comes mainly from the savannah zone. There are variations in key assets between the communities as respondents mainly in Sakogu counted houses and motorcycles, milling machines and vehicles. The diverse composition of important livelihood assets of the households in Sakogu signifies the capacity of most members of that community to engage in livelihood activities that are essentially not based on the exploitation of the ecosystem resources.

The size of land owned by households varied among the three selected communities. In Zadantinga, the average size of land was about 3-5 hectares, and about 3-10 hectares in Zaari. In Sakogu, there were some households that did not have land, but the average size of land holding was between 1-5 hectares. Based on this data, land is more accessible to households in Zaari than in Sakogu and Zadatinga, even though there are also significant variations in size of holdings among different households in Zaari. This divergence of views should be understood against the background that both Sakogu and Zadantinga have had part of their farmland absorbed into a forest reserve.

The livelihood activities that people undertake to earn a living in the study area include both natural resource-based and non natural resource-based activities. Natural resource based livelihood activities include livestock keeping, the cultivation of food crops and non-food crops, hunting, collection and gathering of food and wood products from the forest and woods and weaving. Non natural resource-based activities include trade involving the marketing of farm output and inputs, the processing of shea nut into oil, the processing of peanuts into various products such as paste, cooking oil and cake, the brewing of local beer, rural manufacturing such as blacksmithing, tailoring, as well as repair of bicycles, and vehicles.

The kind and intensity of livelihood activities pursued in a community is most often determined by the socio-economic circumstances of the community and the livelihood options from which they can choose. In all three communities natural resource-based livelihood activities are widely practiced. The gathering of wood products was more intense in both Zadantinga and Zaari and than it was Sakogu. The collection of firewood in these two communities occurred all year round, but it was more intensive

during the period of food scarcity (from March to July) than other times of the year. The participation of women in intensive collection and sale of fuel wood is a primary indication of the lack of other options from which to make a livelihood. On the other hand, some women indicated that collecting fuel wood at certain times of the year, particularly after crop harvest, was often meant to build a buffer of income against the lean period. Among men in Zadantinga and Zaari hunting was a more important livelihood activity and is more intensive during the dry season when men have little work to engage them

Women in Sakogu had a broader range of non-natural-resource-based activities to choose from because of the additional activities that could be undertaken at the local market. Although women do not own land, they are able to collect forest products such as shea trees and dawa dawa, but the right to the collection of these products depend on the type of land on which the trees are growing. If the piece of land is not under cultivation, there is normally no restriction on collection of these products, but products cannot be collected on a piece of land that is under cultivation. Livelihood activities of women in Sakogu also included trading, tailoring and sale of food and consumer items in kiosks.

Nearly 50% of all cultivated land is devoted to the cultivation of groundnuts. The respondents complained that much of the predicament in having enough land for cultivation is the result of the intensified cultivation of groundnut. As a result, there is diversion of resources from food crop cultivation into groundnuts, but much of the income from it is used to meet other needs than buying food. Therefore market prices of these crops have mediated the intensified use of land. It is apparent that not only has

population growth affected resource exploitation, but also the commercialization of rural livelihood activities has affected the exploitation of land resources, diverted attention away from food production and changed consumption.

Among the selected communities, Zadantinga was the only place where cotton is widely cultivated. This crop is grown on contract for the Ghana Cotton Company. It was noted that the indigenous variety of cotton is no longer being cultivated because of the impoverished nature of the soil. The new variety, which has been introduced by the Ghana Cotton Company, requires fertile land and enormous attention. As a result the cultivation of the crop took the best land, but in the end the farmers do not benefit very much because the terms under which they go into the cultivation of the crops gives the farmers a small share of the produce. Women alleged that even though their spouses used the best land in cultivating cotton, they used the money they received from the sale of cotton in meeting their own needs instead of buying food to supplement their household needs. Additionally, the result of deteriorating biophysical conditions and the cultivation of the new breed of cotton is that women have lost their traditional livelihood activities of cotton spinning because the input requirements of the new variety make it very expensive and local women are not able to buy the raw material to make thread for the production of household clothing

Risk is an inherent feature of farming activities that results from phenomena such as the weather, pests and diseases, and the market. One common feature of farming during the rainy season is the occurrence of dry spells which sometimes last from two to five weeks and heavily impact on the growth and maturing of food crops. When dry spells happen, the reduction of water intake and withering of crops often create the

conditions for pests to invade farms. The black caterpillar has been the common pest, which has caused a lot of harm to farmers over the last few years; in two seasons, some farmers were compelled to replant their crops after pests ravaged them.

As a result, livelihood diversification is determined by seasonality, risk strategies, and vulnerability. In fact, people in these communities, unlike other people in the formal employment sector, do not depend on one single activity for their livelihood. Due to the risks and shocks associated with the environment, a wide range of activities and options are being pursued to cope with the unexpected. Household semi-structured interviews revealed that the weather is a great source of risks to household. About 49% of the respondents regarded dry spells as the main source of risk while 31% saw pest and disease as a more serious threat. The combination of livelihood and coping strategies differs at different times of the year and also between men and women. The range of coping strategies which are used as survival responses to risk, include the sale of fire-wood, the sale of household assets such as goats and sheep, the exploitation of wild sources of plants for food from the forest and the sale of off-farm labour as well as borrowing, both in cash and in kind, from friends and relatives. For women the most common combination is fuel wood, wild sources and assets sale while men engage in farm labour, food for work as well as the sale of household animals.

Although there is no clear difference in source of risk among the selected communities, there are some differences in the sources of coping strategies in the communities. For women in Zadantinga and Zaari, extraction of fuel wood and forest sources of food resources is very important. With few exceptions, the majority of women in Sakogu engage in activities in the local market. The activities that men undertake do

not vary significantly in all three communities. It was noted that the poorer people embark on more diverse range of activities than more affluent households. This is because poorer households do not often have very reliable livelihood activities on which they can depend.

Ecological change and health

Successful exploitation of natural resources requires a sustained management system that maintains the variety of ecosystem services produced to support livelihoods. The continued realization of livelihoods by household members in these communities from deteriorating ecosystem resources is decreasing the ecosystem services available to them and its impact on well-being of community members is manifesting in various ways. Health has emerged as one of the prime issues in communities' struggle to improve well-being because the improvement in health status is critical to the sustainable management of resources. Unfavourable agro-ecosystem related factors like poor nutrition resulting largely from declining annul crop harvest are a cause of poor health among many households in the selected communities. In these communities, interviews revealed other agro-ecosystem-based livelihood challenges in the form of loss of the traditional sources of livelihood strategies, decline in productivity and the disruption of family and community structures as a result of migration. The research participants reported that considerable variation in food availability with the seasons caused nutritional status to decline especially in the months of May to July. During that period, reliance on bush sources of food materials tends to increase. There is also a considerable reliance on

cereals like millet, and grains like maize, for the greater part of their food needs which compromises the blending of nutritionally balanced diets most especially in Zadantinga and Zaare. Indeed, the negative effects of inadequate nutrition are regarded as features and components ecosystem health and community health (King and Hood, 1999) as they affect the very fabric of the rural society. Interviews and PRA methods in all three communities suggest that the primary expansion of resource extraction into all areas of community natural environment facilitates widespread ecosystem change and hinders the creations and expansion of livelihood opportunities.

Other agro-ecosystem related factors such as exposure to vector-borne diseases like malaria are the biggest annual source of health risk. Poor housing systems and the expulsion of wastewater from homes that is left to lie in open drains provides the main breeding grounds of the disease vector- mosquitoes. The problem of mosquito breeding is more complex in Sakogu than in the other two communities. There are very large households made up of large numbers of families, which produce large pools of water that provide breeding grounds for mosquitoes throughout the year. The mosquito bites and malaria transmission become more serious during the rainy period when large pools of water collect around rock surfaces and produce more mosquitoes. Community members in Zadantinga and Zaare observed that they are only subject to mosquito bites during the rainy season when rains create pools of water from which the mosquitoes breed. The debilitating effect of disease on rural communities causes a reduction in the number of days that the people are able to work and reduces the amount of food and income that farm households are able to generate at the end of the farming season. These

illnesses disrupt the ability of household members to sustainably manage harvest and process agricultural and other natural resources.

Another obvious source of health risk is poor access to water and sanitation services. Even though present sources of drinking water such as the hand-pump borehole are not known to have been affected by ecosystem change and are regarded as safe, the mode of water collection and storage remains the major source of pollution. Water is carried from pumps to homes in open basins and drums and air-borne particulate, dust and other materials easily find their way into the water during this transfer. The disposal of household garbage remains yet another source of health concern in these communities. Refuse is disposed in designated household refuse dams and is a source of houseflies which are a vector for diarrheal disease. Hospital statistics show that malaria was the number one cause of morbidity (608) with diarrhoeal diseases coming second (108) followed by anaemia (24) in 2001 (Gambaga District Hospital, 2001).

Cerebrospinal meningitis is the major cause of anxiety for the inhabitants of Sakogu. The occurrence of the disease has a spatio-temporal dimension because it is a very serious health problem in the north part of Ghana during the dry harmattan weather. The harmattan weather conditions cause respiratory problems because the weather becomes dusty. From the beginning of February to May, the district also experiences excessive heat. Respondents observed that the harmattan weather has grown more hash over the past 10 years and it is notable period of many ailments. A study by Vedros (1987) suggests that CSM is multi-factorial and complex in nature and it is difficult to reach definite conclusions about its causes. It is caused by *Neisseria meningitidis*, a gram-negative bacterium that belong to serogroup A. It is transmitted through direct

contact, including respiratory droplets from nose and throat of infected persons. Others like Scott (1965) point out that the cerebrospinal meningitis situation in northern Ghana is related to the poor housing design, which leads to lack of ventilation in the rooms. Household interviews revealed that the worse CSM cases occurred in 1999 when over hundred members of the community died over a period of four months. Sakogu is located in the midst of huge rocks and discussions with a medical officer attributed the CMS situation in the community to the combination of harsh weather that makes respiratory problems rife, coupled with excessive heat generated from the rocks which together favours the transmission of the disease.

The community members' understanding of the condition of ecosystem health is embodied in their notion of land "tiredness or exhaustion." This is echoed in an answer given by a respondent regarding the state of natural resources in which the respondent noted that

> The land is now tired and we can no longer get enough food from it. It is tired because our forefathers depended on it for several year and we still depend on it with our children who also have their own. The soil is exhausted and we harvest less than half of what we got fifteen years ago and it is worsening every year. We are no longer able to cultivate yam and sorghum which are very important food crops to us.

This sentiment captures the general feeling of people in the three communities who depend mainly on natural resource activities and farming for their source of livelihood. The notion of land "tiredness" embodies growing barrenness of land and its inability to produce enough food, lack of fish in the rivers, the emergence of strange pests and diseases and farm weeds, and declining rainfall. As has been noted by Bratton (1992) and Callicott (1992), the level of output that land and other resources are able to generate

is considered an indicator of health. Land tiredness is also tied to the disappearance of indigenous crop varieties such as yam and guinea corn that only thrive well on regenerated or newly clearly land. The obvious scenario is that there has been greater human pressure on the dwindling resources and there is considerable evidence that these communities are approaching a threshold of natural resource base exploitation where secure livelihood is very difficult to attain as hitherto productive land is gradually converted into marginal land.

In both Zadantinga and Sakogu, interviewees reported that forest reserve lands are utilized as grazing fields for livestock since tracts of the land available are mostly under cultivation. Unfortunately, it is a yearly occurrence for this forest reserve to be subjected to bush fires, making it very difficult for cattle herders to find enough grass to graze their cattle. It is not a practice for owners of livestock to designate a portion of land solely for the grazing of their livestock due to land scarcity, but some part of every community is designed as a corridor for the movement of cattle to areas where they graze. The only land that is usually available for grazing is wastelands that are too rocky or barren to be cultivated. As a result, the respondents attribute poor health in livestock partly to the growing decline in pastures. There is also great concern that livestock health is linked to ecological change resulting from the drying up of water sources and a decline in the availability of fodder trees which have traditionally been used to feed livestock during the dry season. With limited preparation of hay, the excessive extraction of leaves from trees for fodder coupled with bush fires over the years has gradually contributed to the demise of these fodder trees.

In many ways, the mortality of livestock is also related to environmental health and the incorporation of new material in community environment, their inappropriate disposal and the free-ranging method of keeping the animals. Interviews uncovered that one cause of livestock mortality is the plastic materials that are used to package food and other product which are later eaten by animals like sheep and goats because of the salt these plastics contain. The inability of these animals to digest the plastics often causes them to die. High mortality of small livestock and poultry in Sakogu is also attributed to the growing use of body bleaching cosmetics and hair creams among women which are contained in open sewerage that collects from household bathrooms from which free-ranging fowls and animals drink and become poisoned. There has been no formal study to confirm this and this view is based on the observation of the people. Furthermore, the cultivation of some crop varieties like cotton and soybeans is associated with spraying of pesticides. When livestock graze from such crop residues they are poisoned and die. Apparently, the high social, public and environmental cost of the use of cosmetic, pesticides and plastic food packaging materials (Waltner-Toews, 1993; Peden, 2000) is a consequence of bad agro-ecosystem management practice rooted in the cultural methods of waste disposal and husbanding of resources.

The communities have embarked on intensive land use systems in the cultivation of staple crops such as maize, sorghum and millet, but these methods are not accompanied by measures that can sustain the productive capacity of the land. The intensive land use approach is a sharp contrast to the traditional shifting cultivation system where abundant land facilitated sustainable management of land through the integration of fallow periods. On the basis of these ecological changes, the community

members have observed features or signs of deterioration in agro-ecosystem-based resources based on quality of fruits and seeds of farm crops, as well as the pattern of germination and growth of specific crops like yam. Waltner-Toews (1993) points out that these common negative ecological outcomes make the achievement of socio-ecological sustainability more elusive among rural agricultural communities. In Zadatinga the household interviews pointed to the fact that yam plants now germinate with too many shoots instead of just one and do not have a strong stem and plant that facilitates the development of a quality yam tuber. Essentially, the poor quality of these crops is linked to the declining productivity of the available land because such crops thrive well on rich soil

In all three communities, households are now resorting to the extensive use of fertilizer and manure from animal droppings and decomposed household refuse and that epitomizes the efforts being made to match land productivity with the expanding household food needs. One of the indicators of land deterioration, which respondents noted, is the current yearly invasion of farmlands by weeds after one or two rains at the beginning of the farming season. The strigger (*Strylidium calcaratum*) weed, which causes the millet crops to wither, is regarded as an important indicator of declining land productivity. The invasion of these weeds makes it necessary for farmers to undertake excessive weeding, which is both expensive and energy sapping. Consequently, the farmers are more widely resorting to crops that are tolerant of low soil fertility irrespective of whether such crops meet their dietary needs. Under that circumstance farmers have found it wise to grow such crops for sale in order to get some income to buy their preferred foodstuff, but they become vulnerable to unstable market prices. The

soybean is also widely grown because of it ability to withstand less fertile soil and its nutritional qualities. In response to deteriorating condition of the land, participants in semi-structured interviews pointed to the fact that they are more widely resorting to a larger degree of agro-forestry in some portions of their farmland using economic trees such as cashew which command good market price for the beans and could be used to purchase others household needs.

PRA tools and interviews revealed that the extraction of traditional medicinal materials especially the removal of the tree bark and root, has been indiscriminately done in the communities such that it leaves scars on trees which eventually cause them to dry up. Lastly, community land management practices such as cutting and burning down trees to generate some fertility on farmlands has contributed immensely to the continuous degradation of land. Some respondents contended that burning is very selective, focusing on older trees that are not likely to be of any economic value.

Resource tenures and ecological change

One principal factor determining access to land resources and the sustainability of their management in the study area is the land tenure arrangement. Land ownership in northern Ghana has generally been described as communal (Bakang and Gafforth, 1999). In principle, the laws of Ghana vest ownership of community land in village chiefs, but the chief is only a nominal owner since he cannot appropriate a particular piece of land without the consent of the owner. PRA tools provided information that communities' own rules permit the village chief to own some strategic resources located within the

confines of the village, but this does not extend into bush farms. Cooperation among different household members within the community is a feature of commonly owned resources like grazing land, village ponds, and wood fuel sources on wastelands. Interviews revealed that in the designation of a cattle corridor for example, all those who own land along that route cooperate and allocate part of their land for that purpose so long as the designed route cuts across their piece of land.

Rules pertaining to uncultivated land located away from the community are different as they permit individuals outside the land owing family to gain access to resources such as fuel wood, wood products, fruits, vegetables and grazing access, but this does not mean that such lands are open access land. Such land is a major source of forest food for the poor because of the products that are gathered. Indeed, land is generally not communally owned as it has been widely interpreted. It is a misconception that the land tenure system is responsible for environmental degradation (Nsiah-Gyabaah, 1994) because land is communally owned. However, this research indicates that current land deterioration owes much to excessive fragmentation and exploitation beyond levels that permit regeneration of land and its resource to sustain meaningful production levels. This is in line with the findings of Asenso-Okeyere, et al (1997:9), which indicate the effect of land tenure arrangement on household food production and soil degradation.

Household land tenure rules facilitate land commercialization and excessive exploitation beyond the levels of subsistence use and it enable outsiders to access land in the community. Good social networks in the past enabled members who had no land to obtain land from others in the community, most often as a gift for a fixed period of time. The current practice of land acquisition for use in large-scale production is eroding this

age old arrangement and it deprives less affluent households or individuals from accessing land for free because of monetary terms applied to using a piece of land. Previous studies by Zeeuw (1993) in Burkina Faso in West Africa concluded that land borrowing contributes to sustainable land management. This development was permitted by the availability of fertile land elsewhere under low population density. The interest of borrowers was to maintain the fertility of their own land by abandoning it to fallow and to borrow from others who have fertile land. In the case of the selected communities in the East Mamprusi District, land borrowing arrangements contribute to degradation, because when people borrow, it is not meant to facilitate the recuperation of their own land, but is usually a means by which they access more land to add to what they already have to undertake crop cultivation or because they have non. A study by Afikora-Danquah (1996), provides evidence that there are different levels of conservation practiced by land owners and tenant farmers, with land owners practicing more sustainable management systems than tenants.

Household interviews in both Sakogu and Zadatinga pointed to the fact that large-scale land use production is associated with the use of tractors for ploughing the land which cause damage to the shallow topsoil as tractors dig deeper than the bullock-drawn plough. Also, the fact that a borrower has no right of access to tree products such as the sheanut does not provide any incentives for their protection. Because landholding size is diminishing, there is a high level of fragmentation of ownership among individual members within the extended family and in some cases the nuclear family in order to maximize the utilization of the resources and to have control over land use decisions that most meet the best livelihood aspirations of the individual or family.

In the view of Okai (1997), rising land scarcity has created the need to substitute private ownership for communal ownership. The broader picture created from PRA tools and interviews points to the fact that, increasingly, households are moving away from subsistence production to production with some money motives and there is a greater incentive to substitute private ownership for communal ownership. That is because these communities have acquired a taste for consumer goods and are guided by a desire to gain better housing living conditions and many are not content with living in their traditional thatch homes. The quest for such durables as roofing materials to improve housing conditions over the past ten years advances money considerations and a greater incentive to substitute private ownership for communal ownership and more intense resource exploitation. As a result many tenures are not as a result of deliberate evolution from communal ownership to private ownership but rather economic and ecological trends and forces influence their evolution.

Traditional knowledge systems

The local knowledge of some communities has provided a great impetus in the sustainable management of resources over the past generations and that knowledge forms the bedrock from which their current resource management and livelihood practices have evolved. This knowledge has been significantly woven into various aspects of community life and expressed in the areas such as healing, land resource use, childbirth and rural manufacturing.

One facet of traditional knowledge is manifest in soil conservation methods whereby rotational movement of livestock on farmland helps to enhance the fertility of

the land to promote crop production and the efficient management of the land. This practice is limited to compound farms and it confines or tethers livestock to a designated spot for up two weeks before they are moved on to another spot. The respondents indicated that manure generated from such activity lasts for up to five years and is a more ecologically sound and cost-effective method for regenerating fertility and an added reason for households to own livestock. Additionally, communities undertake controlled burning of bush when grasses are still not very dry in order to minimize the effect of fire on trees such as shea and dawa dawa located outside the farmland and to ensure that grasses are not completely burnt for livestock to graze.

PRA tools and interviews in Zaari and Zadantinga revealed that based on observation over the years, the people in the community have concluded that as a result of declining amounts of rainfall and declining soil fertility, cropping needs to be done within the first two rains of the cropping season. They contended that this method allows crops to benefit from the full complement of nutrients that accumulate during the dry season before they are washed away in the tropical torrential rains associated with the beginning of the rainy season. It also escapes the prospects of the crops being overgrown by weeds that would hamper the productivity of those crops. It is apparent that this kind of knowledge has developed as an intuitive response to environmental conditions that remain unpredictable to the people.

Apart from the fact that health services are not adequately provided for the people and are also not affordable to some individuals, there some are diseases that have largely been treated by traditional herbalists such as dysentery, some types of boils, yellow fever and alcoholism. The medicinal components used by these traditional healers include

roots and bark of trees such as mahogany, blackberry, dawa dawa and the mango tree. The use of these materials is based on a good knowledge of their curative properties (Appiah-Oppoku, 1999). One herbalist in Zadantinga claimed that the bark of the mahogany tree is used to cure boils because it has substances that are able to kill bacteria. This interview in Zadantinga provided information that over twenty people suffering from some acute form of dysentery had been treated locally over a period of twelve months after those patients unsuccessfully sought treatment at the hospital. However, the most serious constraint to patronage of traditional medicine is that healers are often reluctant to publicly advertise their expertise for prospective patients to seek their services. It was disclosed through interviews that healing is done in secrecy and sometimes involves supernatural powers. When a healer in the traditional setting advertises, it is interpreted as boasting about his/her powers and could be challenged spiritually by others. Additionally, the transmission of such knowledge is difficult because it is shrouded in mystery and secrecy and in most cases is associated with deities and can only be passed on to close relatives

Another form of traditional knowledge that is closely related to agro-ecosystem management is traditional agroforestry. Agroforestry is a practice with a long history in many parts of northern Ghana. There exist several traditional land use systems in which farmers retain trees on farmland. In northern Ghana, farmers maintain and manage different tree species on croplands. The species usually maintained include *Parkia biglobosa*, sheanuts (*Butyrospermum parkii*) and dawadawa (*Parkia clappertoniana*). Inter-cropping on arable lands of sheanuts and dawadawa is common in all the selected communities. These two tree species are generally not cut and used as a regular source of

fuel wood or other timber products; they therefore form the common species on farmland and fallow land. All farmers in the community selectively preserve these trees. They provide revenue and food products at times of extreme food scarcity (March to July) each year and this accounts for the high retention rate of these farms during land preparation and clearance.

Resource management structures and institutions

The management of resources at the community level in Ghana is by far one of the most important issues that have generated development concerns in the Northern Region of Ghana. Various agencies and organizations were identified with resource management in the East Mamprusi District. These include the Forestry Commission, the Environmental Protection Agency, the Ministry of Agriculture, the District Assembly and non-governmental and community-based organizations. The different ways in which these agencies and organizations are contributing to resources management include the establishment of woodlots, protection of forest reserves, introduction of soil and water conservation methods, undertaking anti-bushfire campaigns, agro-forest and plantation agriculture and provision of potable water

At the community level, the institution of chieftaincy enhances resource management by performing the functions of a regulatory body for the use and management of communally owned resources, backed by the power to impose sanctions for unethical resource use practices. Other community level resource management structures are the women's groups involved in various activities such as tree planting, vegetable gardening and farming activities. At the time of this research these groups

were just being formed, but women in Zadantinga had begun a vegetable gardening project with the assistance of Partnership for Rural Empowerment and Development (PARED), a local NGO.

At the moment, one of the most important factors affecting the livelihoods of communities in all three study sites is the low productivity of agriculture. The agricultural sector of Ghana, which is the mainstay of the rural people, has been badly affected by the removal of subsidies on agricultural inputs following the introduction of Structural Adjustment Projects in the late 1980s and lack of support for farmers. The role of the Ministry of Agriculture (MOA) in resource management is executed through the extension service field staffs that are sent out to advise farmers on farming practices, the environment and bush fires.

The focus of interventions by the Agriculture Ministry in the district is the use of farmers' groups and it ensures that they are trained on how to nurse seedlings on their own and transplant them. This outreach program is undertaken on a limited scale each year, as there are fewer than 10 extension service workers for the whole district. Based on the research interviews, it is revealing to note that there is no monitoring of any kind of what is going on in community-managed lands. The crisis in land use in this case study should be viewed as one of poor institutional support for community livelihoods and environmental issues by both policies and government structures.

The District Forestry Department is the lead agency with the responsibility to protect the forest, manage forest resources, and educate the population with regard to the hazards of fires for trees and animals. Even though there is a large forest reserve in the East Mamprusi District, the official role of the forestry department has been called into

question given that the Forestry Department has now moved their offices and staff to a neighbouring district from which reserves in East Mamprusi District are administered. The reduction in the number of field staff and forest guards is blamed on limited financial resources leading to large-scale encroachments in which the communities of Sakogu and Zadantinga are involved. In spite of the change in the administration of forest resources in the district due to shrinking financial allocation, the forestry department has carried out the planting of woodlots in a number of places in the East Mamprusi District. They have also carried out afforestation and reforestation activities in the reserve where wood extraction has been so severe. The other major problem in the reserves is the constant bush fires, which burn down reserves every year. There is also a problem of livestock grazing in the reserves in communities living close to these forest reserves.

The District Forestry Department (FD) is currently working with the Savannah Environmental Resource Management Project (SERMP), which is a joint Ghana Government World Bank project to introduce alternative sources of energy. SERMP seek to assist communities to manage their resources through training and education. Selected communities have been put into different livelihood activities groups and introduced to the processing of sheabutter, honey production, animal-rearing. Men are trained to confine animals to reduce their impact on the forest reserves. The Department also works in conjunction with the SERMP to create dams for dry season gardening and allocate portions of the reserves to allow farmers to farm those portions of the forest under strict guidance. Such land is usually given out to the whole community.

Other local NGOs such as the PARED, and the Bimoba Literacy and Farmers Co-operative Union (BILFACU) identify the needs of women and provide them with

assistance in the form of micro-finance. PARED currently operates in Zaari and Zadantinga and has been working to assist communities in Zaari to improve the trunk road to the market to improve the transportation of farm produce. It also identified key areas to assist women to undertake group activities in farming, dry season vegetable gardening and cashew plantations. This NGO began operating in the later part of 2000 and has been able to provide loans to over 60 women in the District with some funding from Actionaid, a British NGO. BILFACU currently operate in Sakogu by supporting women's groups with financial capital to undertake activities such as pito brewing, trading and sheabutter making. The operations of BILFACU in Sakogu are still in their infancy and activities have not been expanded, but in other parts of the districts, it is involved in agro-forestry, nursery and distribution of trees to community groups and anti-bush fire campaigns.

The Environmental Protection Agency (EPA) is the key institution that is responsible for providing initiatives and solutions in natural resource management and conservation and is primarily concerned with forest and wildlife resources management, land resources management, water resources management, and energy resources management, as well as environmental education and oversight of environmental impact assessment programs. Limited financial resources have inhibited the establishment of this agency at the East Mamprusi District. Interviews with personnel of the agency based in Tamale, the capital of Northern region revealed that the operations of the agency are still centralized in Accra.

Discussion

This study has highlighted the differences between the three communities in terms of ecological change related to livelihoods and health. The differences in ecological change arise partly from the intensity of land exploitation that emanates from pressure on available land. The nature of rural livelihood construction, which depends to a large extent on environmental resources, contributes to the pattern of deterioration in ecological resources and creates a process of change in socio-economic conditions. In other words, the research has demonstrated through its findings that peoples' livelihoods are still tied to the environment, although there are variations in the degree of this dependence in the three communities and there is significant decline in productivity of land as a result of the intensity of its use as well as rapid ecological change manifesting in drying up of rivers and environment related illnesses. The different levels of ecological change affect human health, the quality of livestock and livelihoods. This level of decline is responsible for the disappearance of some indigenous crops and any further environmental degradation could cause livelihood sources to shrink. It has also been associated with the loss of traditional livelihood activities for women such as the spinning and production of traditional cotton clothing. The views expressed about land exhaustion indicate the failure in the capacity of such land to sustain productivity. Within the context of ecosystem health, poor soil fertility and crop yield constitute important indicators of the ecological function.

The research interviews reveal decline in trees that have no traditional economic merit to the farmer, while the economic value associated with some trees such as the shea tree and dawa dawa has enhanced household appreciations of the benefit of ecosystem

services, which have provided incentive for their sustainable use and management. Ecological changes resulting from land use arrangements of communities induce agro-ecosystem-based livelihood challenges such as poor nutrition. They also impact on pastures or sources of fodder and the result is reduction in the quality of animals as a source of income and farm power in the case of bullock. Additionally, the ecological problems associated with the use of chemicals in farms and bleaching materials contribute to the death of animals. This situation is typical of communities like Zaari and Sakogu where the cultivation of some crops is associated with the application of pesticides. The nature of ecological change affecting livestock in Zaari relates to the lack of water for livestock during the dry season. These three communities differed in the extent to which livelihood sources are gained from forest products: in Sakogu women are more involved in more diverse activities including cottage industry. In Zaari and Zadantinga women collected wood for sale, which is the main contributor to deforestation in a forest reserve. Some of these livelihood activities are not ecologically sound and yet the pursuit of such activities has become necessary to earn a means of survival. Land resource access and the intensity of its use also vary among these communities. In Zadantinga and Sakogu, households have poorer access to land resources than in Zaari.

On the basis of these constraints, many households are encircled in poverty, poor nutrition, poor health and lack good housing. The transformation of household environments creates micro-ecological conditions that favour disease incubation and transmission, such as malaria, and the pattern of this disease varies among the selected communities. The research shows the positive contribution of traditional agro-forestry

practice to the protection of the environment and sustenance of livelihood resources. This provides some indication those agro-ecosystem-based assets make a key contribution to livelihood and that households capacity to secure livelihood could be enhanced through greater investment in agro-forestry related initiatives.

To conclude, ecosystem change is at the root of many problems related to health and livelihoods in the selected community. Changing tenure arrangements favoring commercial large-scale exploitation that causes land to be intensively cultivated perpetuates ecological change. Because of the benefits that accrue to land owners, there is also the incentive to make land available for use by others, and yet the intensive exploitation is not accompanied by any restorative management measures. Those who are more seriously affected by poor land access are those who lack adequate income and are not able to pay a fee for to use land that belongs to others. In addition, land fragmentation arrangements rooted in the growing quest to have control over land use decisions that most meet the best livelihood aspirations of the individual, contribute to degradation of land, because this arrangement does not facilitate the recuperation of land as it is always under cultivation. It is fair to conclude that land scarcity is partly attributable to institutional intervention in land access through the creation of forest reserves without critically considering how livelihoods of nearby people are affected. In line with current trends in natural resource management, the livelihood priorities and interests of communities must be integrated in any resource management systems that may be implemented.

It implies that resource management systems must integrate community institutional mechanisms that enable community members to fully participate and share

in available resources. For a start, the agencies entrusted with resource management responsibilities such as the EPA, MOA and FD need to adopt a community centred approach to resource problem solving through increased environment related programs to improve knowledge on the cause and magnitude of the ecological problems. This is necessary because such institutions and organizations currently provide limited support to communities both in terms of educational information and resources to help them manage their land. This cannot be possible without improvement in the capacity of these institutions to implement their programs. In essence, these institutions should be capable of guiding communities to mitigate risk in exploitation of resource and provide assistance in greater diversification of natural resource management initiatives into other areas such as plantation activities.

But there must be an economic and social policy environment that espouses rural development through greater improvement in social services and resources support for rural livelihood activities such as agriculture. In more specific terms, the government needs to increase investment in rural agriculture by enhancing access to inputs, and credit, while ensuring effective monitoring and supervision of the production outcomes to avoid the waste of resources. At the present level of ecological degradation, much more could be done to save the environment through enforcement of regulations regarding the extraction and marketing of fuel wood. Relatively inexpensive sources of energy such as solar energy and other systems need to be pursued seriously to reduce the current dependence on wood for energy. Effective community resource management must entail community protection of forest resources and lands under government control that serves community interest such as in livestock grazing. This requires that co-operation between

the forestry department and the rural communities go hand in hand with education on resources and the environment. It has to be noted that the attainment of sustainable livelihoods in these communities is related to the effective management of environmental resources. In essence, bridging the gap between rainy season farming and dry season idleness by farmers could take the form of initiating vegetable gardens as is currently being started, but this option should be explored against the environmental impacts that the creation of small dams may cause to communities. Furthermore, there are good prospects for livelihoods and well being to be considerably enhanced from increase investment and management of plantation activities involving tree crops such as shea and cashew, which have are emerging source of income for communities in the district.

On the basis of the present research, the next step to these conclusions which have been drawn from the study in these communities is put the sustainable livelihood approach into practice, while still integrating ecosystem health issues. Given that the study has identified the productive and important livelihood assets, and the promise for development of cashew, shea and dawa dawa plantations, vegetable gardening and the use of traditional knowledge, the next logical step would require the development of community action plans and the identification of areas for support by the national government and NGOs in terms of policy, investment and credit and market and that of technology. In the practical of implementation of the sustainable livelihood approach, there will be a need for broader visioning of future livelihoods than it is was done in this research.

Figure 4. Sketch map of Community Natural Resources in Sakogu in Ghana

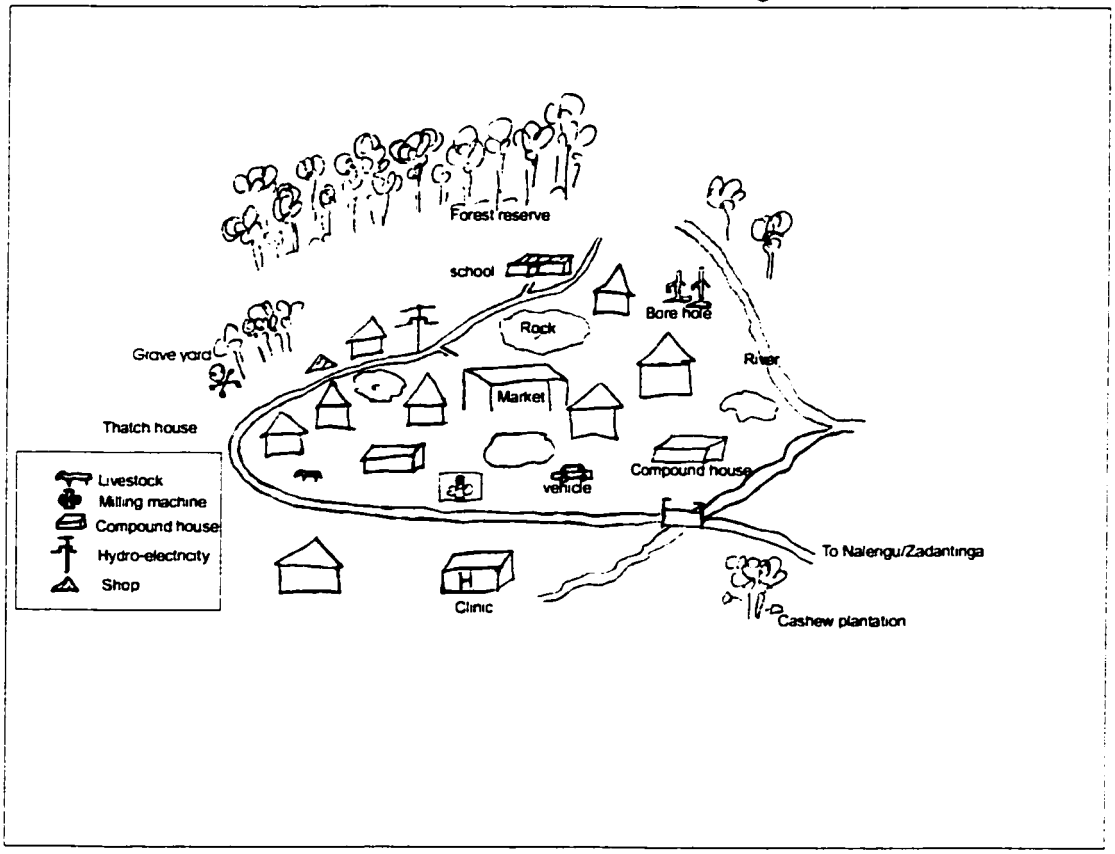
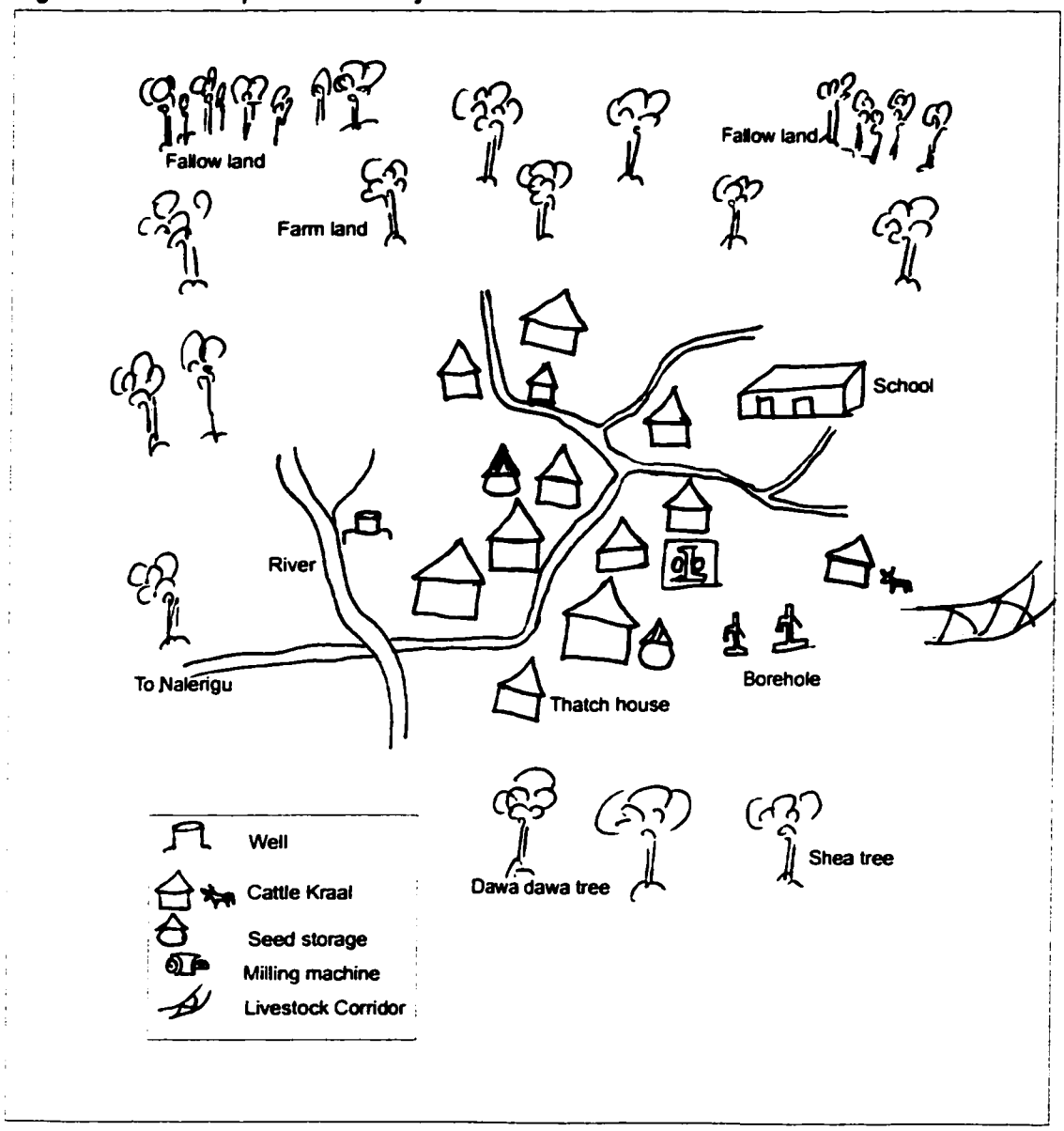


Figure 5. Sketch map of Community Natural Resources in Zaari



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