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Human-wildlife conflict management around Kakum Conservation Area, Ghana

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ABSTRACT OF THESIS submitted by:
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Human-wildlife conflicts (HWC) around Kakum Conservation Area (KCA) negatively affect biodiversity conservation, farmers' livelihoods, food security, tourism and rural development. This study assessed perceived effectiveness of conflict management measures at reducing incidence and impacts of HWC by interviewing local farmers. It showed that traditional techniques widely used in bordering communities are thought to significantly remedy farm raiding by non-charismatic species e.g. rodents, ungulates, primates and hogs. Alternative chilli-based techniques were thought to be effective against elephants, though levels of adoption of these methods were very low. Barriers identified to pepper technique use included financial constraints and insufficient knowledge about methods. This was despite extensive promotional efforts by the Wildlife Division and external donors. Legal concerns about the use of some traditional techniques were raised. Further, it was uncertain whether continued elimination of problem animals could be sustained over time. Though low-tech, the installation and maintenance of pepper fences was beyond the means of average farmers, and therefore deemed unsuitable for the local setting. However, since they were the desired mode of conflict management, the introduction of subsidies for fence inputs would boost adoption levels. Land-use planning, which is a long term solution to HWC, was absent from management practice. Since no provision for payment of compensation for animal damage was made under national legislation, none was offered by the Wildlife Division. However, enforcement of legislation protecting wildlife species was not rigorous. Additional research in HWC management was recommended. Increased budgetary support of Wildlife Division could also reduce future conflicts.

Keywords: Human-wildlife conflict, Kakum, Ghana, elephant, traditional management techniques, chilli pepper, wildlife policy, barriers, sustainability

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Table of Contents

CHAPTER ONE – INTRODUCTION

1 INTRODUCTION

According to WWF SARPO (2005), "... any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment" is classified as a human-wildlife conflict (HWC). These confrontations not only degrade the environment and threaten wildlife conservation efforts, but they may also negatively impact on human life, health, safety, livelihood, property, culture and recreational activity (Elliott and Kube 2008; WWF International 2006). Key underlying causes of these conflicts worldwide include land-use changes driven by increased human populations on one hand, and increased spatial requirements for growing wildlife populations thriving because of successful conservation efforts on the other hand (Distefano 2005; Madden 2004; Barnes 1997; NCRC 2008; Braimoh 2006).

1.1 PROBLEM STATEMENT

In Ghana, communities bordering Protected Areas have been identified as being most vulnerable to human-wildlife conflicts, and over the years efforts have been made by government agencies and Non-Governmental Organizations (NGOs) to mitigate such conflicts (Lamarque *et al.* 2009). Theoretically, several management measures are in place; varying with local cultural differences as well as with the expertise of respective external program implementers. What remains largely unclear is the extent to which the various management measures are being used in practice, and whether they have reduced HWC over time.

Lamarque *et al*. (2009) reported a high incidence of HWC in communities around the Kakum Conservation Area (KCA) in Ghana. This problem was undermining food security, exacerbating local poverty, and retarding wildlife conservation efforts on which tourism revenues were highly dependent (Max 2008). Under the auspices of the government of Ghana, three major projects were carried out in 50 fringe communities to mitigate HWC in those areas. Funding for these projects was from external donor organizations: FAO and Conservation International from 2003 to 2005, World Bank Small Grant in 2006, and International Fund for Animal Welfare from 2008 to 2009.

It is on the premise of the aforementioned problems, coupled with the efforts which have been made to address them, that the present study tracks post-project progress of HWC around KCA. This thesis assesses the perceived effectiveness of various measures at reducing conflicts and their prospects of long-term sustainability among affected communities. An opportunity also exists to assess whether on-the-ground HWC management practice is in accordance with national legislation or policy guidelines.

Assessing to what degree conflict mitigation techniques introduced by the projects have been adopted by communities, and to what degree these measures are perceived to have reduced HWC over the period they have been in place is important because it will inform future legislative and policy amendments. Information generated from this study will also guide technology transfer to other conflict affected areas in the country and sub-region.

1.2 AIMS

This thesis primarily aims at evaluating the perceived effectiveness (in terms of reduced incidence of HWC) and prospects for long term sustainability of conflict management practices around the Kakum Conservation Area of Ghana, with particular focus on new techniques

introduced by three projects implemented between 2003 and 2008. Secondly, an assessment of the correlation between national wildlife policy and HWC management practice around KCA is made.

1.3 OBJECTIVES

1. Investigate the incidence of HWC around KCA within the last decade.
2. Establish what traditional management techniques are being used in affected communities.
3. Determine to what extent communities have adopted new (non-traditional) management measures introduced by the three projects.
4. Assess the perceived effectiveness of management techniques at reducing / resolving conflicts around KCA.
5. Evaluate the long term sustainability of measures in place.
6. Determine the existing legislative/policy framework for HWC in Ghana and analyse the relation between national policy and local HWC management practice around KCA.

CHAPTER 2 - LITERATURE REVIEW

2 Preamble

According to WWF SARPO (2005), "... any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment" is classified as a human-wildlife conflict (HWC). Within the context of this thesis, the use of the term 'wildlife' is limited to undomesticated animals. Further, the scope of this study is limited to HWC that occurs in rural communities surrounding Kakum Conservation Area of Ghana because impacts there are likely to be quite severe due to heightened vulnerability of the poor (Agyare 1995). It is worth noting however that conflicts do occur in urban areas too, albeit with less frequency, involving smaller sized fauna (usually insects, birds and snakes), and consequently accompanied by less severe impacts (Distefano 2005; Elliott and Kube 2008).

2.1 HWC INCIDENCE AND ITS MANAGEMENT GLOBALLY

2.1.1 Nature, causes and consequences of conflicts

HWC may take place on land (e.g. livestock depredation by lions as commonly occurs in Kenya) or in water (e.g. crocodiles destroying fishing gear in the Egyptian Nile) – wherever the manner of natural resource use of humans and animals is incompatible (Lamarque *et al.* 2009; Madden 2004; Distefano 2005). It may involve one or more humans and one or more animals of the same or different species. Common 'problem animals' cited in literature include elephants (WWF SARPO 2005), rhinos (Williams 2005), large carnivores (Kissui 2008; Elliott n.d.), crocodiles (Elliott and Kube 2008), primates (Goodall 2001), ungulates (Ogra 2008), and many others. WWF International (2006) asserts that conflicts occur and have been recorded in various

countries on different continents. Research into the nature of these conflicts, and possible solutions for reducing them, has been carried out by a host of individuals and organizations within the last decade: globally – WWF International (2006), in India – A Rocha India (2008) and Ogra (2008), in Malaysia – Chong and Dayang Norwana (2005), in southern Africa – WWF Southern African Regional Programme Office (2005), in West and Central Africa – Bush Meat Task Force (2007), in Africa - Lamarque *et al.* (2009), to mention but a few.

The nature and extent of damage incurred by human-wildlife conflicts varies with the type of conflict that ensues as well as the species and number of animals involved (Distefano 2005). When humans are the perpetrators of HWC, losses to wildlife may be in the form of dead and injured animals as well as encroached, degraded or fragmented habitats leading to reduction in available food, water and species' territorial home ranges (Elliot and Kube 2008; AREAS 2007). Traditional migratory routes and access to foraging grounds and water sources may also be encroached or cut off, making survival of animals in the wild more difficult (Adjewodah *et al.* 2005). Where land is converted from forest or savanna into farmlands, human settlements and/or infrastructure, the loss of habitat may be quite sudden and permanent, giving wildlife little chance to adapt to changing environments (WWF International 2007; Braimoh 2006).

Deforestation not only destroys habitats, but it also opens up areas to opportunistic poachers wishing to earn extra money in selling game or simply killing to feed their own appetites for exotic bushmeat (MEA 2005; Rayden *et al*. 2006). This problem of poaching and illegal bushmeat (game) trade is particularly pronounced in West Africa where it has degenerated into a condition known as the 'Empty Forest Syndrome' (BMTF 2007). This condition leaves only plants and very small animals in many of the West African forests since excessive poaching eliminates all large animals.

Elliott and Kube (2008) demonstrate that in livestock depredation, carnivores attack and kill sheep, goats, poultry, cattle etc. that may be grazing in open fields, or even resting in kraals (night shelters). Depredation occurs regardless of whether domestic animals are found in large herds or in isolation. A single predator can kill one or a few domestic animals during one raid, but may cause more severe loss when repeated raids are made over a period of time. More livestock loss may be recorded when more than one predator is involved in the raids (WWF International 2006). It follows that while protecting their flock, pastoralists may injure or kill attacking wild animals, or may kill other innocent individuals of that species in retaliation for previous attacks (Lamarque *et al*. 2009; Elliott n.d.). In the process, livestock, wildlife and human health, safety and life may be compromised. Ogra (2008) also points out that opportunity costs are high; the time spent by Indian women in protecting livestock from predators represents an opportunity loss for performing other vital household chores or income generating activities.

Similarly, agronomists may put themselves at risk while warding off wildlife that may be raiding their field or destroying stored produce. Troop raids which are common among primates may be more costly since their synergistic damage is higher than that incurred by individuals separately. Warding off primate troops becomes more challenging because individuals are emboldened when they are found in groups (Lamarque *et al.* 2009; WWF SARPO 2005). Successful raids incur heavy crop losses to farmers, whereas unsuccessful raids may cost wild animals their lives when they are caught in traps or killed by farmers.

Destruction of infrastructure such as houses, water tanks, electricity poles and telecommunication lines may also occur in cases involving large animals such as elephants. Structures may be broken down completely, though relatively little injury is sustained or can be

inflicted on elephants due to their large size and thick, nearly-impenetrable hide (Distefano 2005; WWF SARPO 2005).

Although economic losses due to HWC may appear insignificant when regarded at sub-regional or even national levels, they may represent major setbacks to businesses and individual farmers together with their dependent households (WWF International 2006). Antagonism to wildlife and any programmes that support the protection of wildlife is the normal response when people experience losses of investment capital or destroyed livelihoods (Distefano 2005). As Wood (1995) explains, these feelings may stem from perceptions that contemporary wildlife conservationists place greater importance on animal rights than on human welfare. Crop and livestock losses due to conflicts compromise food security, and thus exacerbate existing poverty (Ogra and Badola 2008). Death or injury of breadwinners in conflict affected households can halt the formal education of children because disposable incomes of affected households will subsequently be greatly reduced (Lamarque *et al.* 2009). It can also hamper the active participation of victims and their immediate families in religious and socio-cultural elements within communities (Ogra 2008).

It can be surmised from the above discourse that human-wildlife conflict is a crosscutting issue of global concern since it involves environmental, cultural, economic and political sectors of human society. In order to foster sustainable development as espoused in the Brundtland Report (WCED 1987), several ingenious means of resolving HWC have been developed and implemented in recent times. Since the nature of conflicts vary with geographic location, species of suspected problematic wildlife and local circumstances of communities involved in the conflicts, management methods employed need to be chosen carefully to suit each particular case (Distefano 2005). This variability also affects technology transfer from region to region,

necessitating the trial and testing of management measures to ascertain their suitability for prevailing local conditions. Globally, some HWC management measures have proven more successful than others. These constitute a core set of options called 'International Best Practice' (IBP). In the section below, the most common preventive, protective and mitigative IBP measures are briefly discussed according to their mode of functioning.

2.1.2 Summary of HWC management International Best Practice

1. **Exclusion**: In this approach, man-made and natural barriers are used to separate areas of land for different uses. The erection of fences (wooden, wicker, wire-mesh, mortar, concrete), planting of thick and prickly hedgerows (cactuses, thorn bushes, brambles), digging of trenches, and the delimitation of borders using natural divides (streams, rivers, gully's, mountain ranges) can be used to prevent wild animals from straying out of their designated habitats into surrounding lands (Distefano 2005). The barriers are also beneficial in that they prevent domestic animals from straying and grazing in wildlife habitat areas, thus reducing the possibility of chance meetings and carnivore depredation. One advantage of this technique is that it involves low costs since many of the materials used to raise the barriers are available locally at affordable prices. In addition, repair and maintenance of these barriers can easily be carried out by members of the local community.

   However, due to the large sizes of protected areas involved, it is often financially impractical to fence off reserves. Instead, fences are erected around farms and homesteads in HWC affected communities to prevent wildlife from entering these specific zones (Lamarque *et al.* 2009). Unfortunately, in India and Zimbabwe some

animals such as baboons and large carnivores which have the ability to climb or jump over these fences reportedly undermine the exclusion efforts (Distefano 2005). Elephants may trample over weak fences, while warthogs and wild boars may burrow beneath them; therefore this method is not entirely fool-proof (Weston 2009; Chong and Dayang Norwana 2005). The incorporation of wire-mesh roofs to erected walls significantly increases their protective capacity, especially when constructed over night shelters/kraals for livestock (Elliott n.d.; Butler 2000). A more expensive alternative is to put up electric fences which are very effective at preventing wildlife cross-over (Elliott and Kube 2008). A regular supply of power is a pre-requisite when using this technique, rendering it inappropriate for certain locations where electricity is unavailable or too expensive to use continuously. Elliott and Kube (2008) also noted that specialised labour, which is needed for regular maintenance of electric fences to ensure that they remain in good working order, is usually not readily available in poor communities.

2. **Deterrence**: Traditionally, farmers of livestock have employed night patrolling as a means of deterring wildlife attack on their flocks. This method is made more effective when guards are accompanied by well trained dogs (Distefano 2005). To complement guarding techniques, loud noises are made by banging on tin drums or by detonating locally-made bamboo 'boom blasters' to scare off advancing animals (WWF International 2007; Adjewodah *et al.* 2005). Distefano (2005) points out that night patrollers need to be strong and brave since they may have to engage in direct combat with wildlife, if other deterrents fail. Daytime guards may be used to protect crop farms from marauding bands of monkeys, rampaging elephants, wild boars, rice birds, or other

suspected species of wildlife which forage by day (Twine and Magome 2008; Hoare 2000).

Where guards are not readily available or in areas that are undermanned, booby trap devices are set up to trigger effects that may ward off advancing wildlife. According to FAO (2008b) and WWF International (2007) mini bells hung on ropes around fenced areas can act in two ways: first as early warning systems to farmers when wildlife try to cross the lines, and second as noise triggers to deter further advances. Movement activated guard devices and electronic training collars are costly but innovative high technology examples of mechanised deterrent measures that have been tested on predators such as North American wolves and black bears with varying success (Distefano 2005). Additional disadvantages of mechanised devices are that their use is complicated, and technologies employed require a wide range of randomly sequenced stimuli in order to prevent habituation of wildlife to stimuli (McComb 1996). Many variants of these mechanised devices are under development, though the testing phase involves long term research and monitoring of animal behaviour (Conservation Committee 2009; Schulte *et al.* 2007).

3. **Repulsion**: It is well established that many wildlife species (including elephants) have highly sensitive olfactory organs, therefore it is possible to repel them from an area using substances that are disagreeable to their senses (Chong and Dayang Norwana 2005). A variety of techniques employ the use of fresh, dried or powdered hot chilli peppers to repel elephants (Parker *et al*. 2007). Chilli smeared ropes have been successfully used in India by simply winding them round farm perimeters to ward off elephants (A Rocha India 2008). Alternatively, one may plant unpalatable chilli, sisal, ginger or tobacco as a

boundary hedge around farms cultivated with more palatable crops (Osborn and Parker 2002b; FAO 2008b). Chong and Dayang Norwana (2005) report that in Africa coating wooden fences with chilli is a cost-effective method of immediately reducing crop raiding on farms. Chilli techniques are reportedly easily applicable, relatively cheap, and quick to install (A Rocha India n.d.). They also yield very high positive results at repelling advancing animals (FAO 2008b). Maintenance practices include periodic re-coating of fence posts or re-soaking of ropes to keep the chilli smell potent. Growing fresh chillies may also be a way of simultaneously protecting fields from raids while diversifying cultivated crops in order to provide alternative income sources (FAO 2008b; Parker *et al*. 2007).

4. **Separation**: Another possible method of reducing human-wildlife conflicts is to separate human and wildlife populations so that by putting space/distance between the two groups there can be a reduction in their natural resource use overlap (Distefano 2005). Translocating animals may however be very risky and expensive, with no guarantee of success as exemplified by experiences in Southern Africa (Lamarque *et al*. 2009). Another school of thought has it that relocating wildlife is not really a solution, merely moving the problem to a different geographic area (Parker *et al*. 2007; WWF SARPO 2005). Voluntary or involuntary resettlement of human communities may also be challenging since it is difficult to find a socio-culturally acceptable alternative settlement area which is spatially remote from the conflict zone but offers the same (if not better) resource accessibility (FAO 2008b).

5. **Elimination**: When other methods have failed to produce desired results, killing of problem animals may be considered as a conflict management technique (Elliott and

Kube 2008). Elimination of problem animals is usually left as a last resort since it involves the permanent destruction of wildlife and has produced mixed results when used in various locations globally (Lamarque *et al.* 2009). Culling and sports hunting are legal but controversial means of reducing overpopulation of wild animals in protected areas (Arcese and Sinclair 1997), while illegal retaliatory hunting and poaching may cause more harm than good in conflict situations (FAO 2008b). International treaties such as CITES (Convention on International Trade in Endangered Species [of Wild Fauna and Flora]) which protect animals limit the use of elimination techniques in contemporary times. This restriction may be perceived by some farmers as an infringement of their right to protect their property (Nyhus *et al.* 2005).

6. **Toleration**: Much time has been invested in the education of fringe communities with the hopes of increasing tolerance for animal damage as a way of preventing and reducing conflicts. By helping locals to appreciate ecosystem services rendered freely by nature (Costanza *et al.* 1997) and by elucidating benefits of coexistence with wildlife (Madden 2004), community members learn to accept the consequences of living side-by-side with wildlife. Compensation and insurance schemes have been proposed and used as an incentive to boost participation of locals in conservation efforts, and to ease negative impacts of conflicts (Ogra and Badola 2008; Anthony and Wasambo 2009). Results of such schemes have varied globally (Lamarque *et al.* 2009; Parker *et al*. 2007).

7. **Combinations**: Due to the complexity of human-wildlife conflicts, there is no panacea for its resolution. Poole (1996) points out that since local circumstances are always changing, and animals are continually evolving and adapting to changes, management solutions need to be adaptive. Thus, a technique which produced good results at one time

may not be equally effective at a future time or in a different place. Distefano (2005) postulates that when the problem is tackled by combining several techniques, conflicts stand a higher chance of being remedied. For instance barriers erected to exclude browsing wildlife can be complemented by repulsion techniques such as planting unpalatable boundary crops alongside (FAO 2008b). Similarly, resettlement of communities goes hand-in-hand with land-use planning to prevent recurrence of conflicts in hotspot areas (Lamarque *et al.* 2009). Improved information flow and transparent communication between stakeholders increases trust, and goes a long way to foster the development of tolerance for wildlife. Education should therefore be integral to all conflict management programmes (Madden 2004). Finding the most suitable set of techniques for conflict zones is greatly enhanced by local capacity building because this ensures greater participation of affected locals in the entire conflict management process – from the planning phase through to post-implementation phases (Ogra and Badola 2008; MES 2002; Manu and Oduro 2008).

2.2 WILDLIFE MANAGEMENT IN GHANA

Ghana has demonstrated its long-standing commitment to issues of biodiversity conservation by being a signatory of all the international treaties listed in Box 1 below. Though apparently enthusiastic about environmental issues by ratification of the above-mentioned conventions, MES (2002) argues that there has not been commensurate integration of these ideals into Ghanaian legislation. This has made the implementation of international agreements very difficult in practice. Manu and Oduro (2008) advocate for greater collaboration with (and participation of) civil society groups in the translation of both national and international policies into practice. This ensures that legislation will be widely upheld.

Box 1. Some Conventions Related to Biodiversity Conservation to which Ghana is Signatory

1. African Convention on the Conservation of Nature and Natural Resources: September 1968
2. Convention Concerning the Protection of the World Cultural and Natural Heritage: November 1972
3. Convention on International Trade in Endangered Species of Wild Fauna and Flora: March 1973
4. Convention on the Conservation of Migratory Species of Wild Animals: June 1979
5. Convention on Biological Diversity: June 1992

Source: MES 2002 (with amendments)

2.2.1 National wildlife legislative and policy framework

Act 43 is the abridged name for "The Fourty-third Act of the Parliament of the Republic of Ghana entitled 'The Wild Animals Preservation Act, 1961'" (FC 2009a). It is the parent law on wildlife issues in the country, vesting Presidential authority over wild animals into the hands of Ministers who also devolve power to Game Officers. It makes provision for the establishment of special land areas to serve as protected habitats for wildlife, and issues directives on procurement and possession of animal or animal parts (trophies) by listing techniques of capture which may or may not be used. The Act however makes allowance for the use of wildlife for scientific purposes, though animals may not be unduly disturbed in the wild. It lists animals under various protective schedules and spells out penalties for contravention of the law. The implementation of Act 43 is currently expressed in two Legislative Instruments (LI's) as described below.

Wildlife Conservation Regulation, 1971 L.I. 685 (LI 685 for short) provides the legal framework that governs hunting activities, game licenses, game and trophy export permits, and provides general exemptions permissible under law (Brodie-Mends 1971a). It's first three schedules place specific animals under whole or partial protection from hunting either during the closed/breeding season (1st August to 1st December each year) or throughout all months of the year. Protected animals include various species of large and small mammals, reptiles, birds and some rodents. Breech of this law is punishable with fines and/or jail terms.

The second legal instrument (LI 710) called 'Wildlife Reserves Regulation, 1971' designates specific geographic areas in Ghana as Protected Areas in which entry and natural resource use is limited according to specifications under the law (Brodie-Mends 1971b). National Parks, Game Production Reserves, Wildlife Sanctuaries, and Resource Reserves are different types of PA's under this legal instrument, and flouters of the law are liable to serve jail sentences and/or pay fines. Forest Reserves are also PA's but are governed by different policies administered by the Forest Services Division of the Forestry Commission (FC 2009b).

Several amendments have been made to Act 43 and the LI's as described by FAOLEX (n.d.) and De Klemm and Lausche (1986). One of the most recent revisions to LI 710 is the addition of Kakum National Park and Assin Attandanso Resource Reserve to the official gazette (WD 1996). Currently, there is no national policy provision mandating the payment of compensation for damage caused by wildlife (Agyare pers. comm.; Sam pers. comm.; Nateg pers. comm.). No payment of royalties or land compensation is made to communities or dispossessed land-owners after the establishment of protected areas because Wildlife Division policy states that lands is duly acquired and fully paid for prior to the establishment of reserves (Wiafe pers. comm.)

Wildlife Division at Kakum however has an internal policy of assisting the re-building of any structures which are broken down by wind-fall trees from within or close-to the boundaries of KCA (Anie pers. comm.). Wind-falls occur occasionally during severe rainstorms, and damage caused by falling trees can be substantial since trees within KCA may reach heights of 40m and above (Adomako and Laing 1999; Asase pers. comm.).

2.2.2 Wildlife Division of the Forestry Commission of Ghana

All wildlife in Ghana, both in-situ and ex-situ, is managed by the Forestry Commission of Ghana (FC). FC has oversight responsibilities over the utilization and conservation of wildlife, forest and timber resources through its Wildlife, Forestry Services and Timber Industry Development Divisions respectively (Manu and Oduro 2008). It is in turn regulated by the Ministry of Lands, Forestry and Mines (formerly Ministry of Lands and Mineral Resources) which also reports periodically to Parliament. Even though the Wildlife Division is challenged by financial and logistical constraints, its national, regional and local staff work assiduously to enforce the above-mentioned wildlife laws (Nateg pers. comm.; Ewur pers. comm.; Sam pers. comm.). Inadequate policy backing also constrains their resource conservation efforts e.g. low fines are currently ineffective at deterring poachers (Wiafe pers. comm.; WD 1996).

By extension, all issues of human-wildlife conflict and its management in Ghana are addressed by the Wildlife Division. Due to the above-mentioned constraints WD is not the sole repository on knowledge on wildlife issues. Through close collaboration of the Wildlife Division with several individuals and institutions, extensive studies of wildlife related subjects have been carried out. Some research into seemingly unrelated human socio-economics, ecology and wildlife behaviour have inadvertently exposed HWC occurrence throughout Ghana (Ortsin pers. comm.). Among such studies are those carried out by the following: A Rocha Ghana (2004 and

2009), Barnes (1993 and 1997), Monteiro dos Santos (2005), Danso and Agyare (1994), Eden Conservation Society (2003), Sam (1998 and 2000), Agyare (1995), WWF-WARPO (n.d.), Ekpe (2008), Murphree (2000), Oates (2006), and many others.

Several of these studies identify areas of high biodiversity concentration e.g. National Parks as focal points for human-wildlife conflicts, though off-reserve areas also experience their fair share of HWC. Several conflict zones coincided with areas of high human population density (Agyare pers. comm.; Bukari pers. comm.). One such conflict hotspot identified by the above-mentioned researchers, and by environmental experts consulted during this study, is the Kakum Conservation Area (Manu pers. comm.; Mombu pers. comm.).

2.3 Kakum Conservation Area

Kakum Conservation Area (KCA), comprising Kakum National Park (KNP) to the south and Assin Attandanso Resource Reserve (AARR) to the north, is one of 15 gazetted protected areas in Ghana (WD 1996). It falls under the local administrative domains of the Twifo Heman Lower Denkyira and Assin Districts of the Central Region of Ghana (CRCC 2007; Sarfoh pers. comm.). The joint PA covers about 350 km^2 and is located 33km north of Cape Coast (a historical coastal town along the Atlantic Ocean) and 170km west of the capital city of Accra, lying between latitude 5^o - 5^o30" North and longitudes 1^o - 1^o30" West (GT 2008; NADC 1995). KCA has been managed by the government of Ghana through the Wildlife Division of the Forestry Commission since 1989, though the Central Region Development Commission (CEDECOM) and Ghana Heritage Conservation Trust (a local NGO) have assisted in managing the tourism aspect of KNP since 1995 (Mettle pers. comm.). The dual mission of KCA is to protect the rainforest ecosystem within the boundary area while promoting the economic development of villages around its periphery (KNPVC 2010; WD 1996). Prior to its establishment, all land covered by KCA was

duly acquired by the Government from traditional authorities in accordance with traditional land tenure systems prevalent in 1989 (Agyare 1995). With the advent of new management, and by accepting payment for the land, communities relinquished their property rights over the land. Subsequently, payment of royalties by Forestry Division (previous administrators of KCA) ceased (WD 1996).

The vegetation within KCA is that of a typical tropical lowland rainforest, though specifically it is classified as a Moist Evergreen – Moist Semi-deciduous forest intergrade (Adomako and Laing 1999). It forms part of the remnants of the Upper Guinea Forest, an eco-region recognised as a globally important biodiversity hot-spot (KNPVC 2010). KCA is home to more than 105 species of vascular plants, half a million insect species including 600 butterfly species (*Diopetes kakumi* was discovered in the park in 1994), 300 species of birds (including rare species such as the white-breasted guinea fowl - *Agelastes meleagrides* and the threatened yellow-throated olive bird - *Criniger olivaceus*), 100 mammals (including those listed by IUCN as 'endangered species' e.g. African forest elephant – *Loxodonta africana cyclotis*, Bongo – *Tragelaphus euryceros*, Geoffrey's black-and-white colobus monkey - *Colobus vellerosus*), and numerous reptiles and amphibians (Kruse 2004; Dogbevi 2008; Roell *et al*. 1993; WD 1996). KCAs rich biodiversity and famous 40m above-ground canopy walkway (one of only 6 worldwide) attracted over 136,000 tourist visitors in 2008 (GNA 2009). Thus ecotourism at KCA contributes significantly to the generation of national revenue, local development, and poverty reduction (CI 1999; Ghana-net n.d.).

With more than 52 major agrarian communities, and numerous scattered homesteads and hamlets to be found around its boundaries (WD 1996; Agyare 1995), KCA is encompassed by human settlements causing it to be referred to as a "protected area island in a sea of farms" (Sam pers.

comm.). KCAs boundaries are said to be ‘hard’ because there is no buffer zone around the protected area; land-use changes very abruptly from protected forest to open farmland within a few meters of the boundary lines (Fig. 1). This condition has resulted in wildlife populations within the reserve being isolated from other populations, spelling possible future collapse of species due to limited exchange of genetic material needed for the continual evolution and adaptation of offspring (WD 1996). There are four Forest Reserves (FR) adjacent KCA: Bimpong FR to the north, Ajueso and Assin Apimanim FR to the east, and Pra Suhien II FR to the south-west (Fig. 2). These FR allow the possibility of limited animal migration, though intensive logging activities permitted within the three reserves exposes animals to poaching pressures. The Accra-Takoradi railway line (which passes through the northern tip of Assin Attandanso Resource Reserve), and busy first-class roads (which join Cape-Coast, Twifo Praso and Assin Fosu) separate KCA from the Forest Reserves (Fig. 3). These transportation lines also pose additional dangers to migrating animals (Nateg pers. comm.).

Figure 1. *'Hard' boundaries of Kakum Conservation Area*

(Foreground: vegetable farm, centre: small citrus plot, hind: abrupt beginning of KCA)

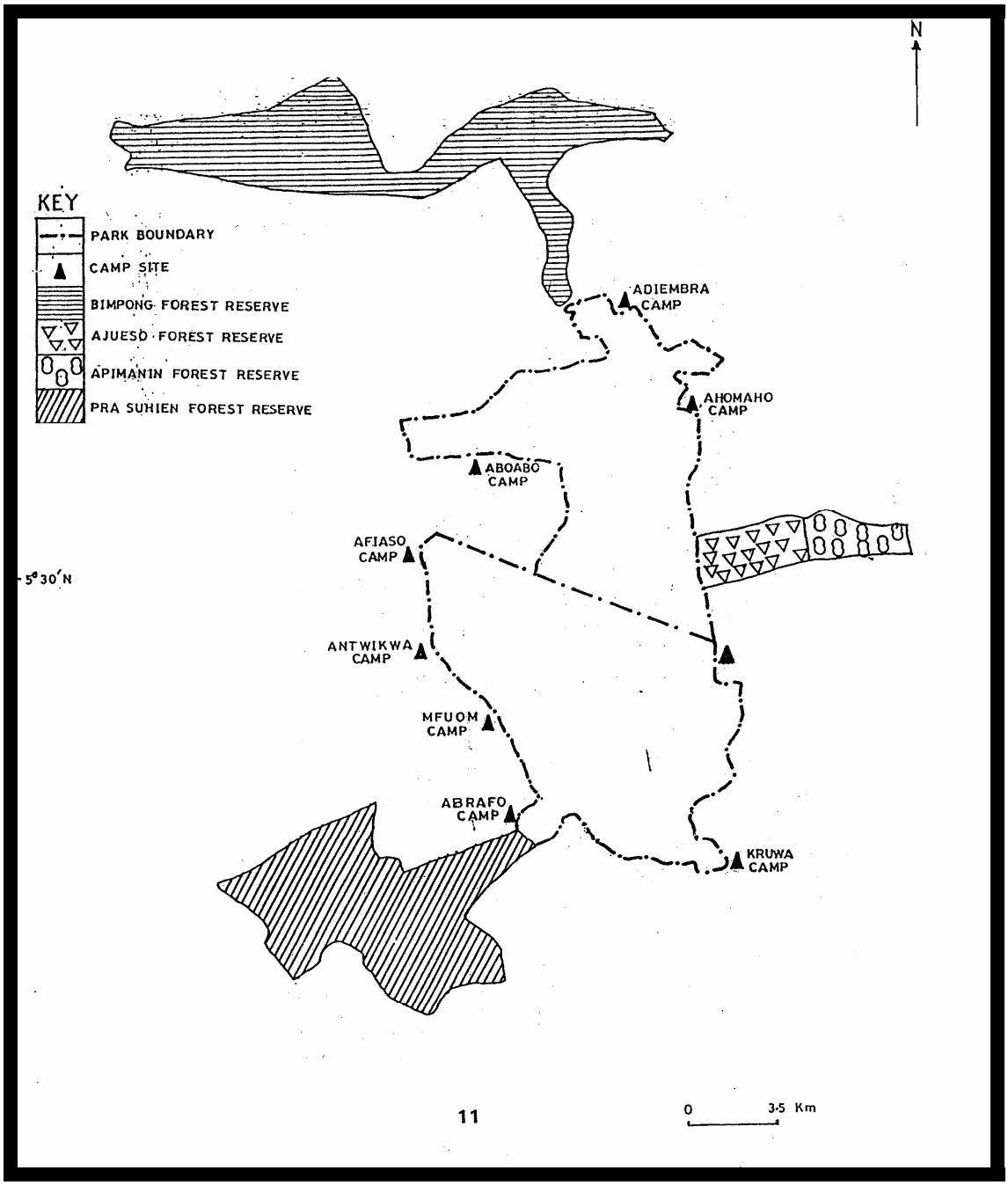

Figure 2. Map of Kakum Conservation Area and adjoining Forest Reserves

(Source: WD 1996)

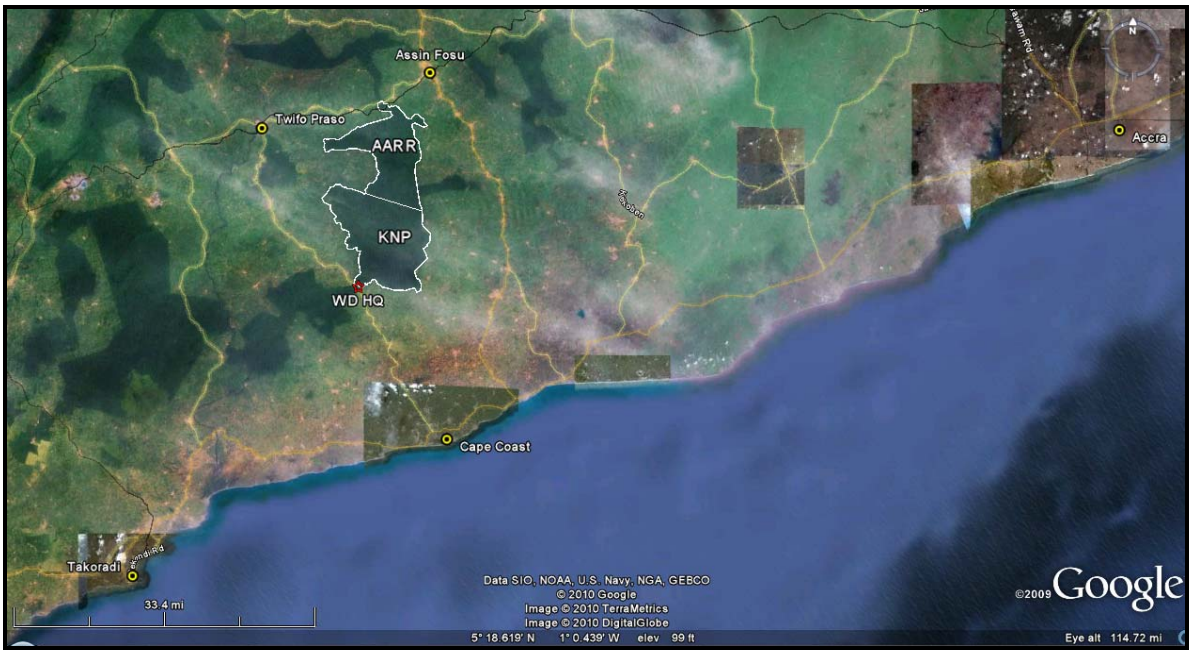

Figure 3. Map of the southern coastline of Ghana showing Kakum Conservation Area and surrounding transport network connecting key urban area

Fisher and Christopher (2007) postulated that communities surrounding biodiversity hotspots around the world are usually poor; a case that is sadly true for communities bordering KCA. Rain fed mixed cropping agriculture (on shifting cultivation basis) is the primary occupation of locals in these communities; crops cultivated are cash crops (cocoa, citrus, oil palm [Fig. 4]) and subsistence crops (maize, yam, plantain, etc) (WD 1996). Rearing of livestock (poultry, goats, sheep) is carried out on a small scale to supplement income and serve the dietary protein needs of households. It is estimated that 60% of the population in the two districts are employed in the agricultural sector, earning an annual average of US$ 612 per 4-person household (CRCC 2007; TUC 2004). Prior to the 1989 management regime change, hunting and gathering of non-timber forest products were also major income-generating activities (WD 1996).

Figure 4. *Oil palm plantation close to Kakum Conservation Area*

Some factors which hamper local development and perpetuate poverty in fringe communities include low levels of literacy, limited access to potable water, electricity and healthcare, poor roads (making transportation of farm produce from communities to surrounding market centres very difficult), etc (CRCC 2007; Agyare 1995). It is further indicated that excessively high levels of crop raiding by forest elephants have historically been a leading cause of low productivity and poor annual crop yields within these communities (Lamarque *et al.* 2009; Boafo *et al*. 2004; Barnes *et al*. 1995). Using various sampling methods, A Rocha Ghana (2004) and Monteiro dos Santos (2005) estimate that 200 - 300 African forest elephants reside in KCA (Fig. 5).

Figure 5. African forest elephant in Kakum National Park

(Source: http://ghanatoursonline.webs.com/Dumbo%20elephant.jpg)

2.4 History of HWC management around KCA

Several researchers studied the problem of crop raiding around Kakum Conservation Area in the 1990's. Nchanji (1994), Barnes *et al.* (1995) and Dickinson (1998) all reported elephants as being the most challenging problem animal which caused appreciable damage to farms in fringe communities. The former Game Control Unit at Goaso (presently WD) engaged in elephant culling to reduce farm raiding in the 1980's (Manu and Oduro 2008; Nyame pers. comm.). According to Parren and de Graaf (1995) about 20 elephants (of which 6 belonged to the Kakum population) were culled between 1986 and 1988. With the establishment of KCA in 1991, culling ceased but crop raiding continued.

An estimated 500 farmers (and by extension members of their households also) were affected by crop raiding in 1997 around KCA (Dickinson 1998). WD responded by deploying armed rangers to fire warning shots above the heads of elephants to scare them from farmlands. This method of controlling HWC was discontinued because elephants became habituated to the noise, the technique wasted a lot of live ammunition, and the method was labour intensive since squads of rangers needed to camp indefinitely at reserve borders (Nateg pers. comm.; WD 2000).

Traditional methods reportedly used alongside WD interventions of managing conflicts were similar to those employed by communities in Zimbabwe (Osborn and Parker 2002a). They included guarding farms at night, burning tyres or noxious herbs close to farm-reserve boundaries, and noise-making by beating drums or metal gongs (Azika 1992). Because crop raiding problems persisted into the 21st century despite the use of all the above-mentioned methods, new solutions were sought by WD. Steps taken within the last 10 years to mitigate conflicts are briefly outlined below.

2.4.1 2000 – 2002: Elephant biology and management project

Conservation International in conjunction with WD undertook a study to identify root causes of human-elephant conflicts in communities around the reserve. Accordingly, specialists from the "Elephant biology and management project" which was carried out between 2000 and 2002 opined that conflicts stemmed from 'a lack of proper landscape management', advising that short term measures to mitigate HWC ought to be put in place as soon as possible (Binlinla 2006).

'Pepper bomb' techniques from East Africa tried out during this study were found to be inappropriate for tropical forest areas. The dense growth of trees deflected pepper bomb capsules which were launched, and also prevented accurate targeting of elephants (Sam pers. comm.; Ayiku pers. comm.). In addition, the technology was too complex for local manufacture and its import from foreign countries would have involved great costs which were beyond the means of WD (Nateg pers. comm.). Park management continued to seek alternative solutions which were more appropriate for the local setting.

2.4.2 2003 – 2005: FAO and Conservation International

Shortly thereafter, the Government of Ghana (through WD) appealed for support from the FAO Technical Assistance Programme to carry out a pilot project in conflict management. Dialogue culminated in the TCP/GHA/2905 (A) "Ensuring farmers' livelihoods and food security around Kakum's Conservation Area" project implemented by Conservation International from 2003 to 2005 (Yapi pers. comm.; Osei-Owusu pers. comm.). The short term aim of the project was to protect communities and farms from elephants while minimising crop losses by using chilli based technologies, while the long term aim was to introduce land-use planning that would prevent future recurrence of the problem (FAO 2008a; FAO 2008c).

Capacity building for 70 farmers from 10 communities (out of 40 settlements found within a 5km radius around park boundaries) in the most raid-prone North Western section of KNP was

carried out (Kruse 2004; FAO 2008c; FC 2006). The project used expertise from a specially trained cadre of Ghana WD park officers and a Zambian elephant control specialist (Nateg pers. comm.). Low-technology chilli-based repulsion techniques which had successfully been developed and piloted in Zimbabwe were introduced to local farmer trainees at Kakum (Kruse 2004; FAO 2008b).

2.4.3 2006: World Bank Small Grant

Based on positive feedback following the completion of the above-mentioned pilot project, additional funding was sourced to replicate it in other conflict affected communities. Chilli techniques were thus introduced to 51 additional farmers from 20 other fringe communities around KCA under the "High Forest Biodiversity Project" sponsored by a World Bank Small Grant in 2006 (FC 2006). As with the previous pilot project, demonstration sites were set up in each of the 20 beneficiary communities to provide hands-on training in the application of techniques. The demonstration sites were also as models to be emulated by other farmers who were not included in formal training under this project. Additionally, 20 officials (5 District Assembly members, 6 Ministry of Food and Agriculture field staff and 9 WD field staff) were also trained in the application of chilli-based techniques. This was aimed at turning out local trainers among field staff to continue disseminating the new technology throughout conflict affected regions.

2.4.4 2008 – 2009: International Fund for Animal Welfare

Similar to the two preceding projects, a third source of funding was secured from the International Fund for Animal Welfare (IFAW) to carry out further capacity building of farmers in 20 communities bordering KCA which had not been reached by the previous projects (Wiafe pers. comm.). IFAW aimed to reduce human-elephant conflicts due to crop raiding in order to

safeguard the conservation of African forest elephants within the reserve. It promoted the adoption of previously developed chilli-based techniques. The anti crop raiding activities were a spin-off from an IFAW sponsored acoustic study of elephants in the reserve conducted by a team of American bioacoustic researchers (Thompson *et al.* 2009).

2.5 Synopsis

Literature sources reviewed indicate that HWC is a commonly occurring global phenomenon with serious implications for human society as well as wildlife species. In Ghana, it is an issue of great concern to conservationists, politicians and the local communities directly affected by conflicts. Several attempts were made within the last two decades to remedy crop raiding around KCA using both traditional and non-traditional management techniques. The rest of this thesis mainly explores local perceptions on the management of HWC in KCA fringe communities.

CHAPTER THREE - METHODOLOGY

3 Overview

This research employed both primary and secondary data as sources of information. Primary data was solicited through interviews carried out in communities bordering Kakum Conservation Area. Permission to carry out research at KCA was granted by WD Head Office in Accra (see Appendix 1, Fig. A). Specialist opinions in urban centres were also sought. Secondary data in the form of published documents was also consulted. This study therefore mainly employed qualitative / descriptive analytical techniques. Limited statistical analysis was carried out with the aid of statistical package software (SPSS 18).

3.1 STUDY AREA

Communities which were visited during this study are Aboabo, Abrafo, Adiembra, Afiaso, Afiaso-Nsuntem, Antwikwaa, Bediako, Bobi, Gyahare, Gyaware, Homaho, Kruwa, Mesomagor, Mpentembua, Nyamebekyere, Onomakwa, Seidukrom and Tawiah-Nkwanta (see Figure 6). These communities were selected based on WD internal records of reported conflicts, the proximity of each community to park boundaries, and their accessibility by motor vehicle or foot. Among communities visited were many of those which were identified as conflict hotspots by officials interviewed prior to field visits. All communities visited had benefited from capacity building under one of the three previously mentioned anti crop-raiding projects sponsored by FAO-CI, WBSG and IFAW (see Chapter 2).

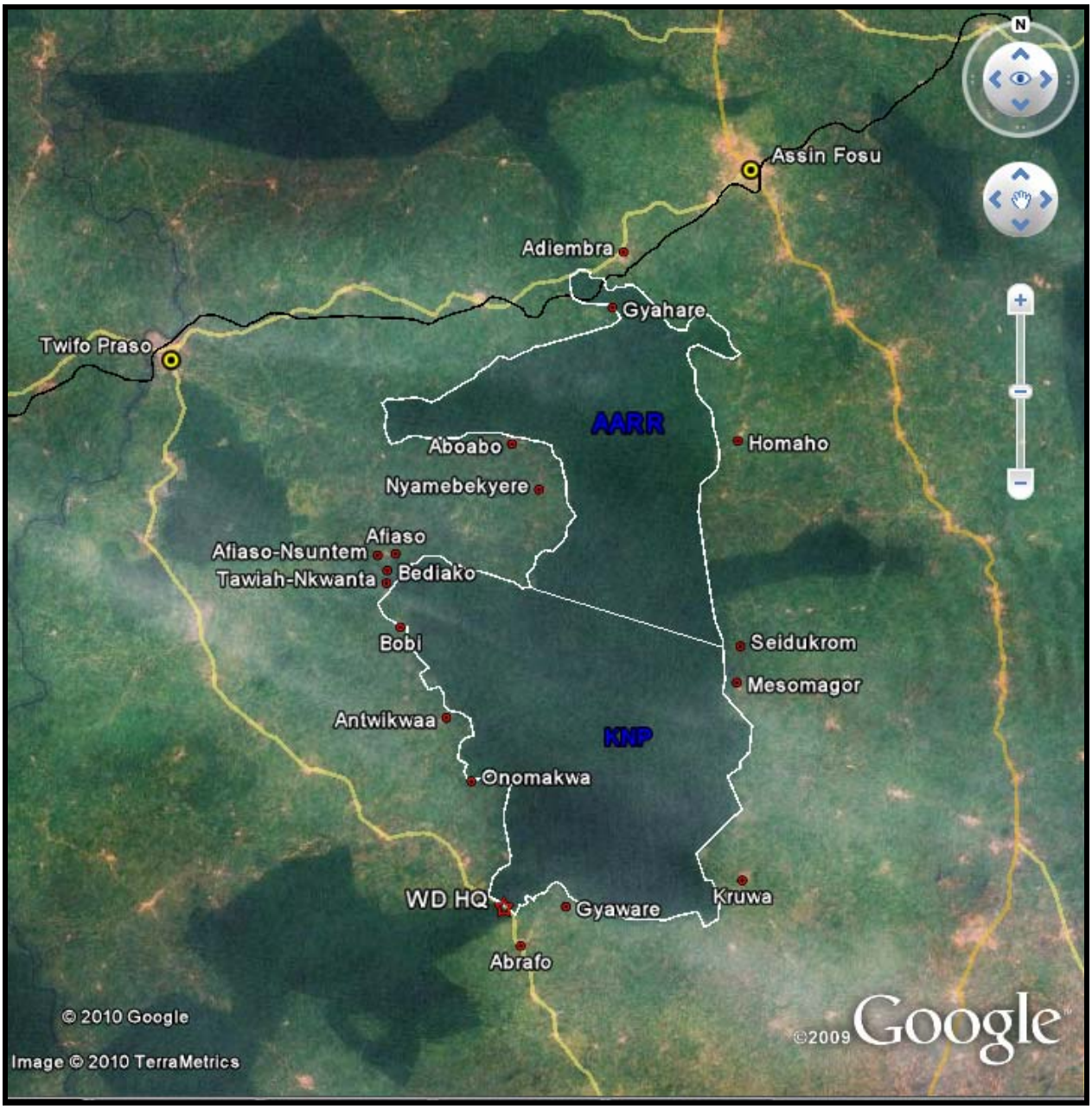

Figure 6. Map of the study area showing KCA (comprising AARR and KNP), district capitals (yellow dots), study communities (red dots), WD Headquarters at Kakum (red star), first class roads (yellow lines), railway line (black line) and 4 adjacent Forest Reserves (dark green areas in the north, east, and south-west of KCA).

3.2 METHODS

3.2.1 Secondary data collection

This research project was carried out between February and May 2010. In February, an initial desk survey of published literature sources was undertaken to establish the existing legislative and policy framework of human-wildlife conflict (HWC) management in Ghana. Data was also sought on the recorded incidence of conflicts throughout Ghana, though those reported for KCA were of particular interest.

3.2.2 Primary data collection

To complement information obtained in the desk review, consultations were held with several stakeholders from various government agencies, non-governmental organizations and KCA fringe communities in March and April 2010. They were:

i. National policy makers: Wildlife Division of the Forestry Commission (in Accra, Takoradi and Abrafo), Ministry of Mines and Natural Resources, Ministry of Environment, Environmental Protection Agency.

ii. Local representatives of International NGOs and national environmental NGOs:

   a. Food and Agriculture Organization of the United Nations
   b. Conservation Alliance Ghana (formerly Conservation International)
   c. UNDP Global Environment Facility / Small Grants Program (GEF/SGP)
   d. World Wildlife Fund
   e. International Union for Conservation of Nature
   f. UNDP Africa 2000 Network
   g. Friends of the Earth
   h. Nature Conservation Research Centre
   i. Ghana Wildlife Society
   j. A Rocha - Ghana

iii. Kakum Conservation Area stakeholders: Ghana Heritage Conservation Trust, District Assemblies, WD – Kakum, and KCA fringe communities.

3.2.3 Questionnaires and semi-structured interviews

In order to elicit HWC data as recommended by Distefano (2005), Lamarque *et al*. (2009) Eden Conservation Society (2003) and WWF SARPO (2005), questionnaires were designed for local community members (see Appendix 2). Its contents were as follows:

- Questionnaire 1 was designed for the local community members in settlements around Kakum Conservation Area. The questions aimed to elicit local perspectives on the type of conflicts occurring within their villages, and impact experienced. Local views on conflict management techniques were also solicited. Finally, any ideas about additional measures that could complement currently used techniques to reduce future conflicts were sought from community members.

Specialist opinions were sought from experts in the environmental field as well as from representatives of various stakeholder organizations listed in Section 3.2.2 above. This was done through semi-structured interviews held in Accra, Takoradi, and Cape-Coast, as well as the Twifo Praso. Officials were questioned on the scope and impact of HWC in Ghana, possible causes of conflicts, mitigation measures employed nationally, the existing legislative/policy framework for wildlife conflict management, as well as specifics related to the 3 projects carried out at Kakum within the last decade. Specialist views were incorporated into Chapters 2 and 5. A complete list of all 25 specialists is provided in the 'Personal Communications' section of this thesis.

3.2.4 Local community interviews

In most cases, face-to-face interviews were conducted to administer the questionnaires. Follow-up telephone calls and play-backs of audio recorded conversations were used to obtain omitted details or to clarify areas of further interest to the researcher.

Figure 7. Research team conducting 'central-point' interviews at Afiaso

During the field study, 250 respondents from 18 fringe communities were interviewed in the predominant Akan language (Twi and Fante dialects). With the help of 4 field assistants, and 1 local guide from each community, farmers in were consulted on voluntary basis either by assembly at a central point e.g. village square (Fig. 7) or on door-to-door basis (Fig. 8) within each community. Research was carried out in a non-discriminatory manner; all willing participants were included in the survey regardless of their gender, age, social role and educational or religious background (Fig. 9). Data transcription on questionnaire sheets was made directly in English (using translators where necessary). Some data was gathered by field observations, some by direct measurement using a GPS and an audio recorder, while other data

was from the Wildlife Division, District Assembly and Census records (Ghana Statistical Services 2005).

Figure 8. Researcher conducting a door-to-door interview at Gyaware

All primary and secondary data obtained was compiled in April and May 2010. A final round of e-mail and telephone interviews was conducted with respective organizations and individuals to iron out apparent contradictions between field and literary data.

SPSS (Version 18.0) software package was used for analysis of primary data. The use of correlation coefficients to analyse for the degree of association and their statistical significance was carried out. The use of the chi square, which is a non-parametric test, allowed the researcher to evaluate the extent of dependence between the variables of interest. Further confirmatory tests such as Phi and Cramer's V were used to affirm whether association were positive or negative, low or high. These additional tests made estimates more robust.

3.3 Limitations

Several challenges were encountered during the course of this study. During primary data collection, several communities were not sampled because they were less accessible to the research team than others which were visited. Sample size in each community was not equal because community sizes varied, and willingness of people to participate in each community also varied. Because of time constraints, the survey could not capture information from settlers whose homes were far from the centre of each village. Efforts were made to capture the widest possible audience by arriving at communities before farmers left for work or late in the afternoon when they had returned from their farms. Overnight visits to the remotest communities were also undertaken. Since farms tended to be some distance away from settlements, it was not possible for researchers to capture visual representations of all the management techniques in use around KCA. Pictorial illustrations are therefore limited to those in Section 4.2 of Chapter 4.

The research team encountered hostilities in some communities, and were compelled on a number of occasions to truncate their visits. These hostilities were mainly because some members of society were disappointed that previous surveys conducted in their communities had not yielded any tangible results. Some would-be respondents refused to grant interviews when they realised that there was no financial gains to be made by participating. A common misconception voiced was that researchers would use information gleaned from communities to access donor funding, which would then be retained by the research team instead of being shared with communities.

With regards to secondary data collection, it was not possible for the researcher to incorporate WD records of conflicts into the research. This was because the majority of records were in long-hand, and the researcher had limited time to extract relevant information from the extensive

material available. WD was however in the process of digitizing these reports, and the researcher was able to access those for 2007 (see Section 5.1 in Chapter 5). Comparisons between perceived crop-raiding trends and actual reports filed to WD could therefore not be made within the current study.

3.4 Synopsis

Both primary and secondary sources of information were sought for this study. Chapter 2 reviews most secondary data obtained. The present chapter (Chapter 3) outlines methodology employed in detail. Subsequent sections present synthesised data results and their analysis (Chapter 4), discussion of results (Chapter 5), conclusions and recommendations (Chapter 6). Appendices 1 to 4 provide samples of letters of interest, questionnaires, additional statistical data, and additional photographs respectively.

CHAPTER FOUR - RESULTS

4 SOCIO-ECONOMIC CHARACTERISTICS

A total of 250 respondents were interviewed from 18 communities bordering the Kakum Conservation Area. Of these, one third (33%) were female (Fig. 9) and the rest were male. About two-thirds of respondents were aged between 20 to 49 years (see Table A in Appendix 3).

Figure 9. Researcher interviewing a female farmer en route to Aboabo

Among respondents, 42% occupied leadership roles within their societies (traditional elders, clan/family heads, religious elders, and other opinion leaders). Christianity was the dominant religion (76% of respondents), with Islam and Traditionalism accounting for 18% and 3% respectively. In terms of the level of education attained, 30% of respondents said they did not receive any formal education at all, while an equal number were reported to have received some primary education. Those who had received post-secondary training accounted for less than 2%

of respondents. The majority of respondents (77%) were engaged in farming as their sole occupation while the rest combined farming with secondary income-generating activities such as trading, masonry, basketry (Fig. 10), carpentry, teaching, provision of healthcare, etc.

Figure 10. Research assistant interviewing farmer engaged in basketry at Antwikwaa

The total area of land under cultivation by respondents was 3,798.5 acres. Farm sizes ranged from 0.4 to 640 acres, but the average farm size was about 10 acres per individual (Fig. 11; also see Table B in Appendix 3). Cocoa, oil palm and oranges were the major cash crops grown by farmers. Crops cultivated for subsistence included plantain, cassava, yam, maize, cocoyam and vegetables (tomato, okro, garden eggs, chilli pepper). These subsistence crops were intercropped in accordance with the traditional mixed system of farming. Other fruits/crops cultivated were pineapple, pawpaw, avocado pear, sugarcane and coconut.

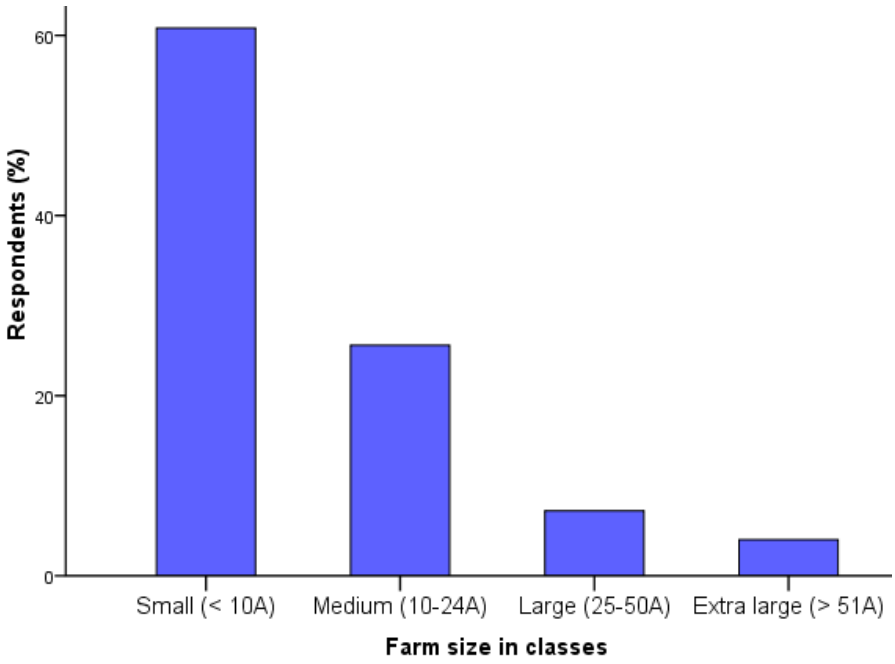

Figure 11. Distribution of farms sizes among respondents

4.1 HWC Incidence

Of all the respondents, 99% confirmed that human-wildlife conflicts had occurred in their respective communities within the last decade. Only 1% of respondents claimed they had personally not experienced problems with elephants within the last decade. Figure 12 offers a graphic representation of the problem animals identified by respondents.

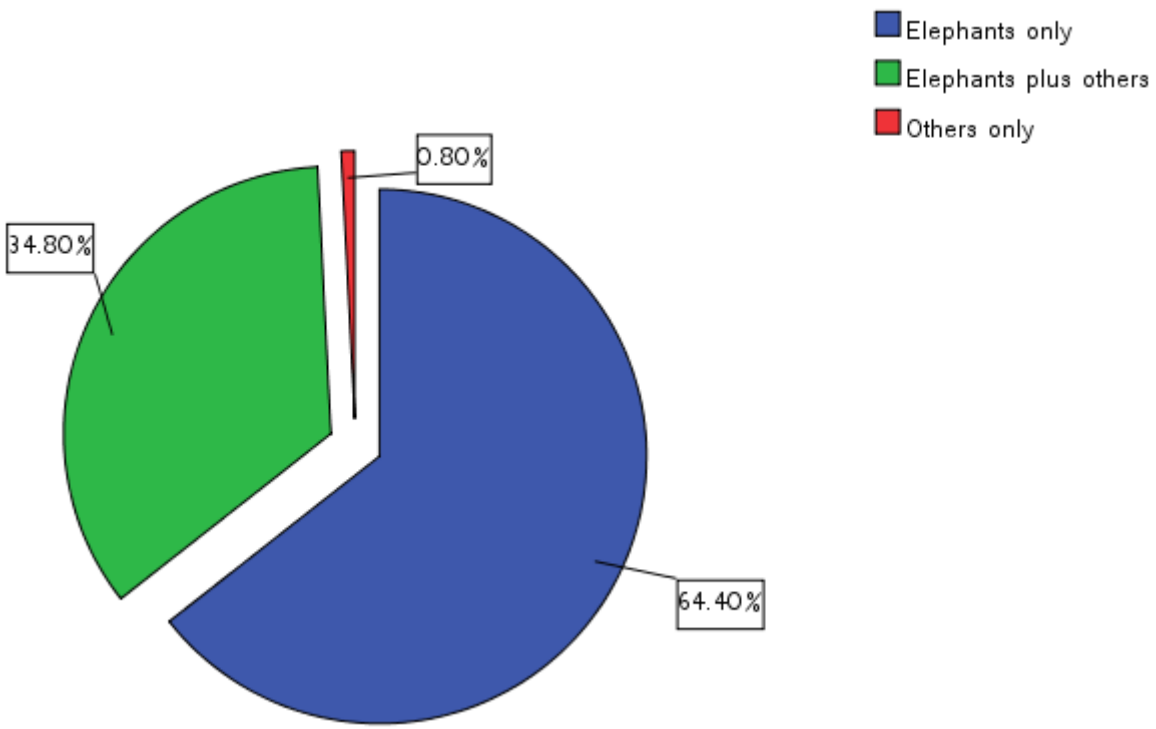

Figure 12. Problem animal identification by respondents

Roughly sub-divided into 7 groups, 17 species were implicated to be in conflict with farmers. They are:

1. Elephants – 99%: African forest elephant (*Loxodonta africana cyclotis*)

2. Rodents – 22%: Grasscutter (*Thryonomys swinderianus*), Pygmy squirrel (*Myosciurus pumilio*), Ground squirrel (*Xerus sp.*), Brush-tailed porcupine (*Atherurus africanus*)

3. Primates – 14%: Lowe's monkey (*Cercopithecus campbelli lowei*), Spot nosed monkey (*Cercopithecus petaurista*), Bush baby (*Galago sp.*)

4. Antelopes – 8%: Bush-buck (*Tragelaphus scriptus*), Duiker (*Cephalophus sp.*), Bongo (*Boocercus eucrycerus*)

5. Hogs – 4%: Red River Hog (*Potamochoerus porcus*)

6. Birds – 2%: Rice birds (*Quelea quelea*), Weaver birds (Family Ploceidae), Francolin (*Francolinus sp*.)

7. Felines – 1%: African civet (*Viverra civetta*), Cusimanse mongoose (*Crossarchus obscurus*)

When asked what type of problems the animals caused, 86% of respondents reported 'crop raiding only', 12% reported 'crop raiding plus damaged infrastructure' and the rest reported crop raiding with other problems (see Table C in Appendix 3). Frequency of crops reportedly raided were as follows: cassava (*Manihot esculenta*) – 77%, plantain (*Musa spp*.) – 69%, cocoa (Theobroma cacao*)* – 64%, maize (*Zea mays*) – 63%, yam (*Dioscorea spp*.) – 41%, cocoyam (*Xanthosoma sagittifolium*) – 40%, other fruits – 8%, orange (*Citrus spp*.) – 5%, oil palm (*Elaeis guineensis*) – 4%, vegetables – 4%, rice (*Oryza sativa*) – 2%.

4.2 HWC management practices

4.2.1 TRADITIONAL METHODS

Of those interviewed, 98% confirmed that they had used traditional means of protecting their farms from wild animals within the last decade. These traditional means were noise-making – 63%, fire/smoke – 38%, guarding – 34%, killing – 14%, trap setting – 8%, traditional fences – 7%, hunters/chain-saw operators – 3%, scarecrows – 1%, boundary clearing – 1%. Figure 13 and Figure 14 offer pictorial representation of some traditional methods in use around KCA.

Figure 13. Traditional bamboo fence used to keep some rodents off farms

Figure 14. Scarecrow used to ward off antelopes from vegetable farm at Kruwa

4.2.2 NEW TECHNOLOGIES

Two new non-traditional methods were introduced into communities by the FAO-CI project: the use of 'pepper fences' and growing alternative or boundary crops (chilli peppers and ginger) on farms.

As demonstrated in Table 1 below, non-traditional methods had not been widely adopted. Of those who had tried the new techniques, one quarter (25%) had discontinued the use of pepper fencing while more than half (52%) had discontinued alternative/boundary cropping. Farmers who had never used pepper fencing gave the following reasons for non-use: method was too expensive – 24%, lack of sufficient knowledge – 23%, waiting for external inputs – 18%, no need for farm protection – 16%, technique was ineffective – 13%, no reason – 6%. Reasons given for not planting alternative/boundary crops were: technique was ineffective – 32%, lack of knowledge – 32%, lack of space on farms – 10%, no reason – 10%, lack of money for appropriate planting material – 7%, crops suggested were inappropriate for locality – 4%, no need to protect farm – 3%, poor market for alternative crops – 3%.

Table 1. Adoption of non-traditional management techniques

NON-TRADITIONAL MANAGEMENT TECHNIQUES EMPLOYED

		Respondents (%)
Pepper fence technology	No	62.0
	Yes	38.0
	(of which discontinued)	25.26
Alternative/boundary crops cultivation technique	No	70.8
	Yes	29.2
	(of which discontinued)	52.05

4.2.3 COMPARISON OF TECHNIQUES

When asked to compare traditional methods of conflict management with non-traditional methods, 60% of respondents believed that pepper fencing (specifically) was more effective than traditional technique at warding off elephants from farms (Fig.15).

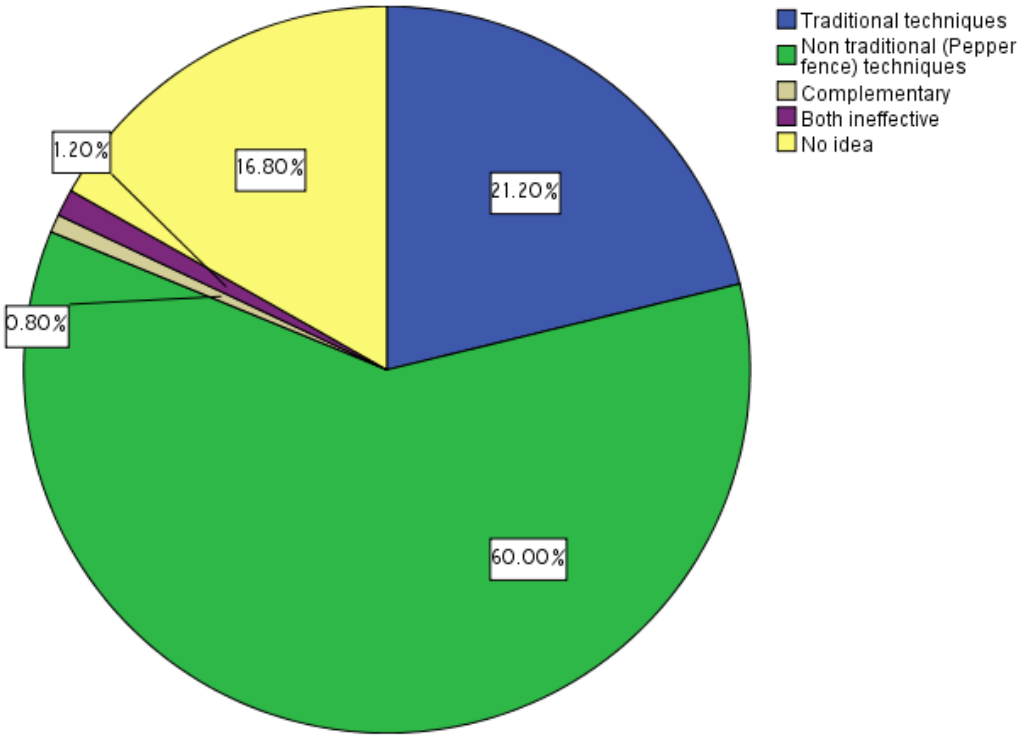

Figure 15. Comparison of conflict management techniques

4.3 CROP RAIDING TRENDS IN THE LAST DECADE

More farmers believed that crop raiding had not decreased, but had rather increased in frequency and intensity within the last decade (Fig.16). Those who believed in an increasing trend attributed it to the following reasons: animal population increase – 20%, scarcity of wild food in the park – 13%, wildlife laws were over-protecting animals – 11%, animals had lost fear for humans – 7%, lack of protective means – 7%, animals now preferred farm crops to wild food – 4%, crop raiding was a natural phenomenon – 3%, number of boundary farms had increased –

1%. Conversely, decreasing crop raiding trends were explained by: effectiveness of erected pepper fences – 24%, increased number of communities closer to the park boundaries – 4%, and God's grace which had kept animals away – 2%.

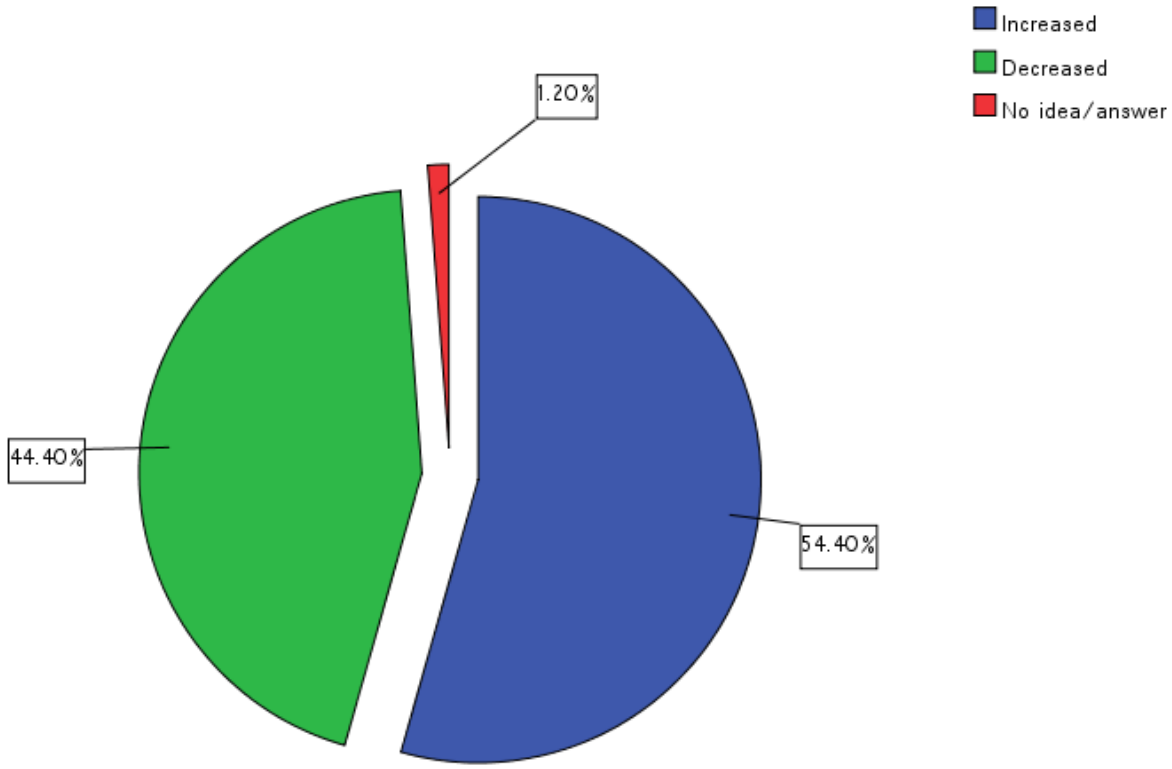

Figure 16. Perceived trends in crop raiding within the last decade

4.4 COLLABORATION WITH WD

The majority (88%) of farmers admitted to having reported crop raiding cases to WD staff during the last decade (Fig. 17). However, 4% of these categorically stated that they had stopped alerting WD staff because reports made did not yield any (expected) results. Also see letter from farmers at Nyamebekyere in Appendix 1.

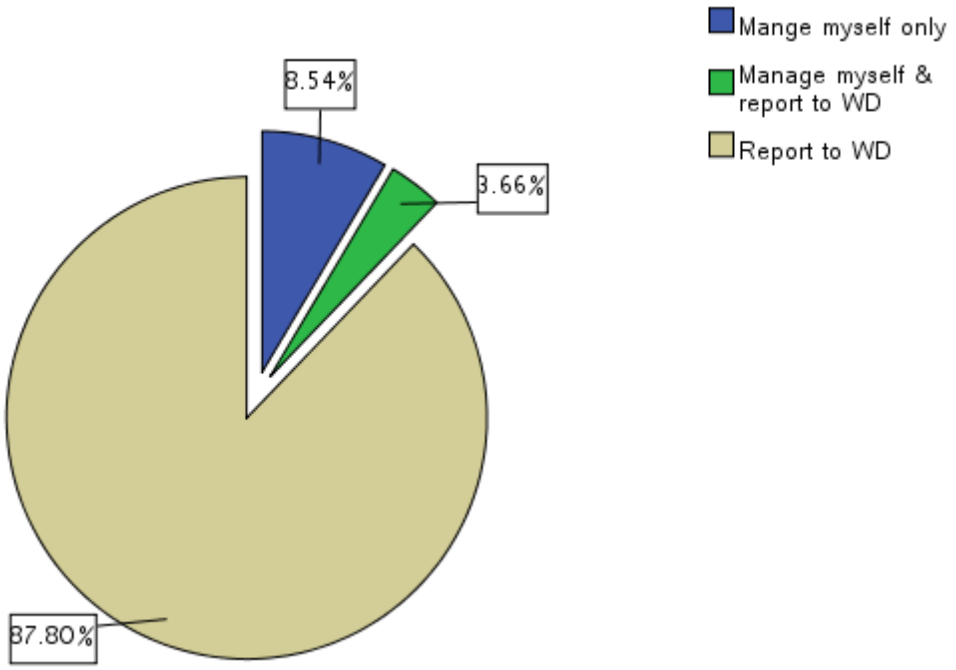

Figure 17. Collaboration with WD staff / Line of action taken to manage conflicts

4.5 MAIN CHALLENGES IN MANAGING CONFLICTS

Of the 166 respondents who were able to identify challenges they faced while managing conflicts, 46% said they felt discouraged by the lack of response to reported conflicts and an additional 6% explicitly mentioned that lack of compensation as a problem to them (Fig. 18). Further, 36% of respondents claimed they lacked money for purchasing items needed for adopting the non-traditional techniques introduced, while 1% cited a total lack of knowledge of new techniques. Health problems associated with using traditional methods of management were reported by 5% of respondents while the rest complained that conflict management hampered their livelihoods by wasting their time.

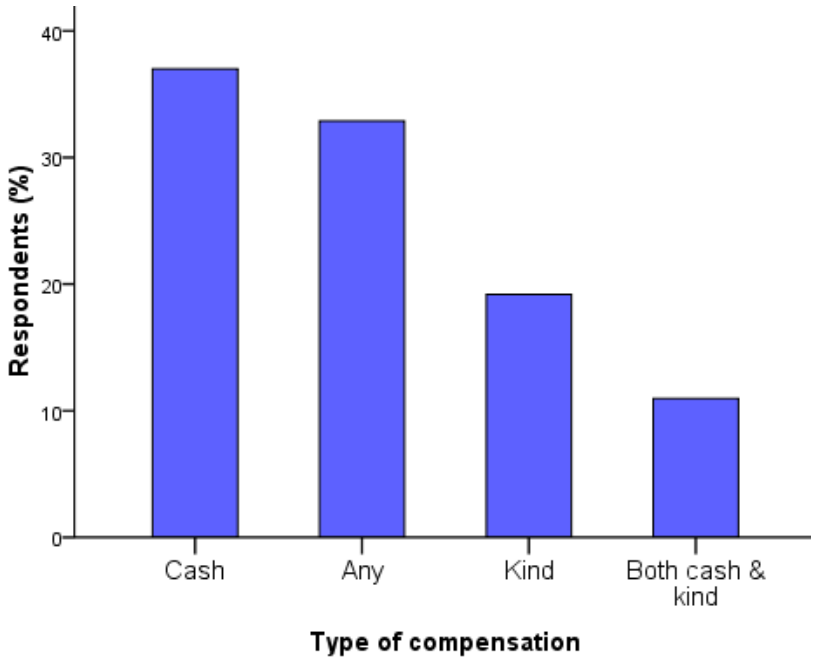

Figure 18. Expected compensation expressed by raided farmers for crop raiding

4.6 RECOMMENDATIONS

In order to reduce or resolve conflicts in future, farmers made 8 recommendations as follows:

1. Adoption of pepper fence (45%)
2. Government should come up with a new solution / management technique (12%)
3. Kakum Conservation Area should be fenced by WD (12%)
4. Killing elephants as a method of conflict management should be re-introduced (8%)
5. Border farms should be abandoned / relocated (6%)
6. Anybody who can help should teach farmers how to protect their farms (6%)
7. Promises made by Central Region Development Commission (CEDECOM) should be fulfilled (3%)
8. Portions of the protected forest should be cultivated to feed animals (1%)

4.7 Results from statistical analysis

Cross tabulation of socio-economic variables against other variables yielded several degrees of association. Pearson's chi-square analysis at 5% confidence limit in conjunction with other correlation coefficients revealed that there were significant relations as shown in Appendix 3. The most significant of these correlations (substantial to very strong linear relationships) were between the following variables:

- Name of community vs trap setting (traditional management technique)

  Only 6 communities used trapping techniques. 5 of these communities are located in the south-eastern corner of KCA.

- Name of community vs killing animals (traditional management technique)

  7 communities reportedly used killing techniques to manage conflicts. Two of these communities were in the south eastern corner of KCA while the rest were located on the western side of the reserve.

- Name of community vs perceived conflict trend

  The three communities where all respondents believed that conflict trends were increasing were in the north-eastern corner of KCA, while those in which all respondents believed the trend was decreasing were located on the western side of KCA.

Within Appendix 3: Table D portrays perceived conflict trends as they relate to each village visited, Table E shows statistical correlations between variables, Tables F and G in Appendix 3 summarise results of the survey in the context of various communities visited.

CHAPTER FIVE - DISCUSSION

5 Overview

The results of this study buttress assertions by various researchers to the effect that human-wildlife conflicts are indeed occurring in communities around KCA as highlighted in Chapter 2. Results also confirm literary sources mentioned in Chapter 2 which claim that human-elephant conflicts are the most frequently occurring type of HWC in the area. Results that confirmed opinions of specialists consulted during this study are highlighted within this chapter. Traditional methods of conflict management are reported to be effective at reducing conflicts involving animals such as rodents, antelopes and primates; though ineffective against elephants. Concerns about the legality of employing these methods are raised by the researcher in this chapter.

Lack of knowledge about non-traditional techniques is a leading reason why there are low levels of adoption of non-traditional techniques introduced by the FAO-CI project. This is despite the fact that two subsequent projects have been implemented to upscale the use of these techniques in the region, the majority of respondents specifically believe pepper fences to be more effective at managing human-elephant conflicts than all other traditional means, a substantial number of farmers recommended the adoption of pepper fences as a means of managing crop raiding problems in future. I therefore express the need to further investigate barriers to technology adoption in the discussion below.

Unfulfilled farmer expectations of perceived appropriate responses by the Wildlife Division are considered to be a significant issue of concern which retarded the adoption of non-traditional techniques, and threaten to undermine collaborative resource and conflict management at KCA. These and other points are further amplified within this chapter.

5.1 The incidence of HWC around KCA

Though it was clear from literary sources that in the past human-wildlife conflicts were a problem to farmers around the Kakum Conservation Area (Lamarque *et al.* 2009; Dickinson 1998), it became more apparent that conflicts still occurred all around the reserve because every community visited during the survey had been affected (Fig. 4). It was however unanticipated that 99% of respondents would personally have suffered from crop-raiding within the last decade, some respondents even reporting multiple raids annually. Though the peak crop raiding season is June to August (Nateg pers. comm.), WD records demonstrated that farm raids are not limited to these months (Fig. 19). Accordingly, a number of raids had already reportedly taken place earlier in the year 2010 and even on the morning of one of the field visits in April (Fig. 20). These supported the enormity of the challenge posed by HWC to poor communities bordering the reserve, supporting the Governments' notion that "Human wildlife conflicts [have] become accentuated and more frequent" (GoG 2009, 15).

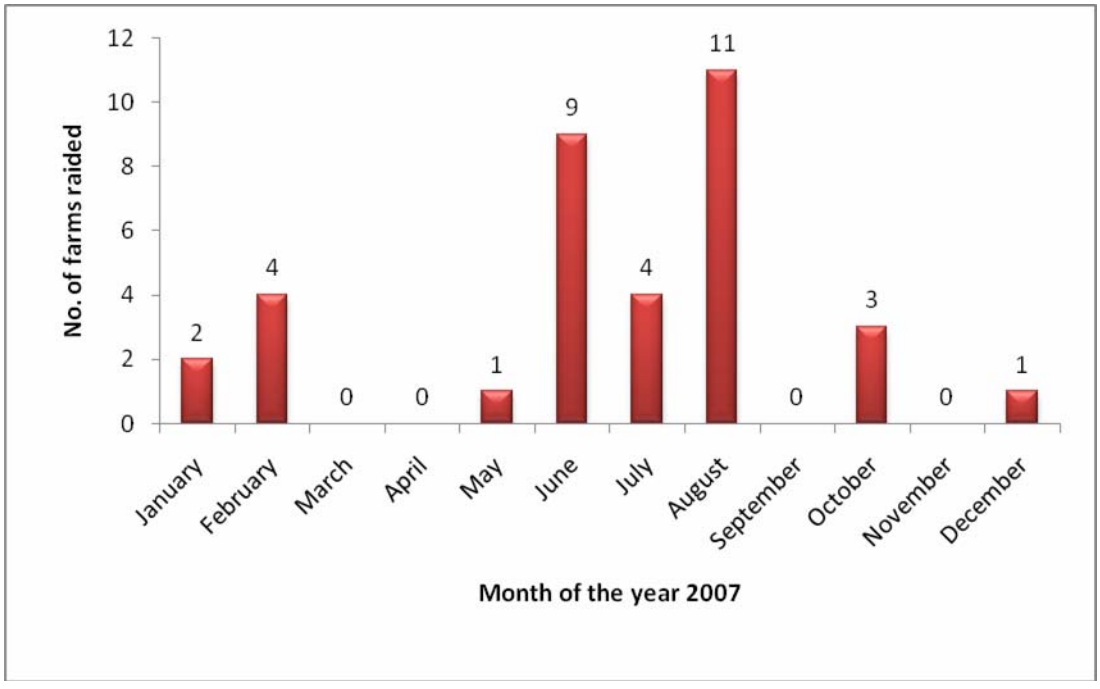

Figure 19. Confirmed crop raiding reports filed to WD Headquarters at Abrafo

Figure 20. Fresh elephant footprints on a maize farm at Kruwa, April 2010

Of the 17 species identified earlier by respondents as problem animals, elephants were ranked first as 99% of farmers had personally encountered problems with them within the last decade. Beyond elephants, rodents (particularly grasscutters/cane rats) and primates (particularly monkeys) ranked high on the nuisance list. Respondents were however reluctant to name other problem animals beside elephants since they [farmers] felt that traditional methods were capable of managing conflicts involving such animals (unlike the elephants against which they felt helpless). This was reflected in the absence of official complaints filed at WD headquarters in Abrafo implicating other species in conflicts around KCA, and was also confirmed by WD Management (Wiafe pers. comm.; Ewur pers. comm.). Such discriminatory reporting tendencies are perceived by the researcher to be problematic because without further investigations a false impression is created that conflict with other species are non-existent or insignificant. This sentiment and finding is similarly expressed by Ekpe (2008), Oteng-Yeboah (pers. comm.),

Ottou (pers. comm.) and Owusu (pers. comm.) whose studies of conflicts in other parts of Ghana revealed that significant problems with uncharismatic species went largely unrecognised, un-researched and consequently un-remedied due to under-reporting by affected individuals.

Conflict affected respondents unanimously complained that crop raiding was the main impact adversely affecting many facets of their lives. As noted earlier (Chapter 4), the main subsistence crops damaged were cassava, plantain and maize; three very important staple food crops whose loss seriously compromised food security. Respondents bemoaned having to purchase food items from nearby market towns; food items they had planted but lost because of crop raiding. They were justifiably aggravated at being forced by circumstances to spend money on food crops instead of being able to sell their own excess produce for profits. Crop damage to cocoa, the main traditional cash crop cultivated in this region, represented a threat to farmers' livelihoods and culture. Using 2007 data records from WD Headquarters at Abrafo, it was estimated that on the average, 33% of cultivated crops are destroyed per farm raid. To the 77% of respondents who are solely dependent on farming for their household income, a loss of one third of their expected harvest is devastating.

In addition to raiding of crops on fields, damage to stored produce was also experienced. Harvested crops are usually temporarily stored in palm-frond covered heaps by the roadside awaiting transportation to market centres (Fig. 21). These heaps frequently become easy targets for animal destruction. Elephants reportedly trample over such stored produce rendering them unmarketable and in most cases unsalvageable for private household consumption as well. Archaic post-harvest storage practices can be blamed for facilitating animal destruction of stored farm produce, but delayed conveyance of harvested produce to market centres also plays a major part in creating ideal conditions for animal damage. Poor road networks and lack of suitable

transport vehicles can therefore be said to encourage HWC. It can be deduced from the above that issues of infrastructure development must be central to all discussions of conflict management around KCA.

Figure 21. Harvested oranges heaped by the roadside awaiting transportation to market

In order to boost the national economy so that Ghana attains 'middle income status' by 2020, the government is promoting the development of sectors such as tourism and agriculture. Respondents of this survey recount promises made by Central Region Development Commission in the 1990s to improve infrastructure around KCA so as to facilitate rural ecotourism. Since very little changes to local transport networks has been experienced since then, some farmers are calling on the local government (through CEDECOM) to redeem promises made to them (see recommendation #7 in Chapter 4). The benefits of improved transportation extend beyond agriculture, affecting tourism and biodiversity conservation.

All of the above mentioned challenges make farming as a profession a less attractive career option for local youth, reportedly leading to their out-migration to urban centres in search for 'greener pastures'. Addressing HWC could contribute to curbing rural-urban drift in affected villages such as Antwikwaa and Gyaware (see Table E in Appendix 3).

It was however very encouraging to note that no direct human injury or death was attributed to HWC by respondents in any of the communities visited. It was however confirmed that one poacher had lost his life while attempting to kill an elephant inside the reserve Ewur (pers. comm.). These findings starkly contrasted those reported by Lamarque *et al*. (2009, 6) who reported several deaths around KCA within the last decade. Having recognised that the present research was limited in coverage; the researcher concludes that even though apparently contrasting, both findings did not necessarily contradict each other.

Finally, civets and mongooses were identified as problem animals Kruwa and Afiaso. These carnivorous animals were however not reported to prey on poultry or livestock as expected, but rather were reported (surprisingly) to raid cocoa farms. This point of intrigue may warrantee future research by interested parties into feline behaviour at KCA as well as feline-human conflicts reportedly occurring in these communities.

5.2 Challenges with traditional management techniques

5.2.1 CONFLICTS WITH ELEPHANTS

Traditional methods being used to control elephant raiding are noise-making, setting fires that emit noxious smoke / smells, [men] sleeping on farms to guard crops at night, hiring of legal and illegal expert 'elephant hunters' to kill animals, and using the noise made by chain-saw operators

and local hunters accompanied by dogs to drive animals deeper into the forest. The general complaint is that these techniques are ineffective at protecting farms against elephants. Similar to findings by Barnes (2002), Anthony and Wasambo (2009), and WD (2000), noise-making is not an effective long-term solution because elephants can have become habituated to it. According to respondents, the use of fires and noxious smells is undesirable because the smoke chokes farmers and results in ill health. Guarding farms is tiring, disruptive of normal social interactions, and only effective as long as the farmer is physically present on the field. Since it is not possible for farmers to guard indefinitely, elephant reportedly take the opportunity to raid farms when sentinels return home.

Respondents narrated accounts of times past when culling was employed to control farm raiding by elephants. Thy recounted that communities would enjoy 3 or 4 years of respite from elephant raiding after one or more of them were killed. Even though this method was discontinued by WD in 1989, communities persisted in hiring special 'elephant hunters' from Damongo (a town in northern Ghana) to kill problem animals in the 1990's. As a result of heightened prosecution of perpetrators of such illegal activities, and in light of current international (as well as national) legislation which forbids the killing of elephants, traditional conflict management techniques such as hunting and chain-saw noise methods are no longer applicable. It is against this backdrop that 8% of respondents advocated for wildlife laws protecting elephants to be repealed. This is a request that WD is however not in a position to grant since it involves the violation of international treaties signed by the government (see Box 1 in Chapter 2).

All the above-mentioned challenges virtually render farmers helpless to protect their farms from elephant raids. This subsequently causes feelings of resentment against WD staff who are perceived to offer protection to animals with very little regard for the harm inflicted by these

animals on farms' livelihoods. Contrary to findings by WD (1996) that conflicts between farmers and WD staff were on the increase, there was little evidence of such animosity between the parties during the present survey. It was reported that angry farmers who confronted Wildlife Division staff following farm raids were calmed down quickly (their anger was assuaged) by the sympathetic encouragements given them by WD staff. With the exception of a few complaints voiced by some community members at Gyaware, Bediako and Bobi, the majority of respondents reported cordial relations between the parties. This was evidenced by the large proportion of respondents (91%) who willingly approached WD staff to report HWC (see Chapter 4). Even though sympathy was not the desired response expected from WD staff, it succeeded in building respect between the parties. Peaceful coexistence was attributed to continuous dialogue and the adoption of collaborative approaches to conflict management by WD staff (Aboagye pers. comm.; Padi pers. comm.; Amankwa pers. comm.).

5.2.1 CONFLICTS INVOLVING OTHER ANIMALS

Currently used traditional methods of managing crop raiding involving animal species other than elephants has proved satisfactorily effective to farmers. By setting traps, constructing bamboo fences, erecting scarecrows, killing animals found on farms, and clearing farm boundaries, farmers have been able to reduce crop damage by other animals to a tolerable level. These solutions are particularly favoured because wild animals caught serve as game/bushmeat that can either be consumed privately or sold at appreciable prices in nearby urban areas. As previously noted in Chapter 2, the preference and demand for bushmeat is a significant problem to wildlife conservation (MEA 2005; Rayden *et al*. 2006; BMTF 2007). Around KCA, bushmeat trade encourages illegal hunting within the reserve (Adam pers. comm.; Seidu pers. comm.; Nyame

pers. comm.). Frequent incursions by poachers into core forest areas is thought to disturb animals (A Rocha Ghana 2004; Monteiro dos Santos 2005), forcing them to move away from core forest areas towards park boundaries where farms are located, inadvertently promoting crop raiding.

5.3 Sustainability of traditional measures

Traditional management measures are popular among farmers because they are low-tech, and can easily be manufactured, installed and maintained at low costs to the farmers since many of the inputs required are available in the wild. It was noted that the use of traditional techniques has become an integral part of farm culture, being passed on to succeeding generations through oral tradition and informal household-level training.

As laudable as it may be that farmers can prevent some conflicts from occuring, critical analysis of traditional techniques reveals that some are in direct contravention of existing national wildlife laws. With the exception of grasscutters, which are prolific breeders (capable of producing litters of up to 6 young every 5 months) and can be hunted at any time without permits, all other species identified as problem animals by respondents are listed as wholly or partially protected under the three schedules of LI 685 (Jori *et al.* 1995; Brodie-Mends 1971a). Several of the animals are also present on the IUCN list of endangered species. It is doubtful that any of the farmers interviewed have a hunting license since none of the respondents identified themselves as being hunters by profession or even admitted to engage in hunting as a secondary activity. Unlike cases where animals are killed in human self defence (which is a case that can be exempted under the law), animal elimination in crop raiding cases merits no exemption from prosecution. This greatly contrasts wildlife laws in Malawi which were amended to permit farmers to kill animals in the protection of their lives, farms and property (Anthony and

Wasambo 2009). By induction, these arguments imply that hundreds of farmers using traditional anti crop raiding techniques are guilty of breaching wildlife laws and therefore liable to arrest and prosecution. In the researchers opinion, it would be impractical (and perhaps also undesirable due to logistical constraints) to attempt such large-scale law enforcement, though letting the matter slide defeats the whole essence of establishing protected areas and setting up a WD to enforce laws that are not upheld in practice. The situation is further complicated by the fact that conflicts involving animals other than elephants are not officially reported, and attempts to monitor this category of 'illegal' activity would be impossible since carcasses of small animals are quickly disposed of, leaving no clues to be followed up by WD staff. The use of traditional methods of problem animal control may thus jeopardise the conservation of uncharismatic species.

5.4 Effectiveness and adoption of non-traditional management measures

The above-mentioned dilemma – 'to protect or not to protect' – is a double-sided burden for farmers and WD staff alike. Several options are in use all over the world to control elephant crop raiding. These include (but are not limited to): live capturing and translocation of elephants (Hoare 2001); experimental deterrents such as alarm, acoustic and olfactory systems (Parker *et al.* 2007); non-intervention (Balfour *et al.* 2007); chilli-based methods of repulsion (Osborn 2002); integrated community-based approaches (Osborn and Parker 2003); etc.

Conflicts around KCA could possibly be partially resolved by the widespread adoption of non-traditional chilli-based techniques first introduced by the FAO-CI project. These new chilli based techniques repel animals without eliminating them completely. Negative impacts on wildlife are limited to temporary physical irritations of body parts that are exposed to the chilli and ginger,

ensuring that there is no breach of law. These techniques are mainly effective against elephants (effectiveness against other species is not presently known), but since elephants are the major problem animals reported around KCA, the pepper fencing method in particular would go a long way to reducing elephant crop raiding in the area. Additionally, construction of pepper fences around water sources and crop storage areas will prevent their damage by elephants.

Considering that three consecutive projects have been implemented to promote the use of these new chilli based techniques (reputed to be low-tech low-cost alternatives to traditional techniques), and since the majority of respondents believe these new techniques are more effective at reducing elephant crop damage than traditional methods, it is surprising to find that very few people are actually using them (see Chapter 4). About one quarter of the respondents who believe that crop raiding has decreased within the last decade attribute this trend to the effectiveness of pepper fencing techniques, yet a significant number of farmers also admit that they have discontinued use of pepper fencing. It would be wise for all stakeholders to invest time in critically analysing reasons for low adoption of techniques reported to be highly effective at remedying the most critical factor affecting livelihoods and food security in the region. A brief exploration of possible causes of this conflicting trend is made below, albeit within the limited context of data gathered during this field research. It is stressed that the succeeding discussions are not comprehensive but rather are indicative of possible avenues worth further investigation in future.

5.4.1 Barriers to the adoption of pepper fencing techniques

For pepper fencing, almost a quarter of those who had never used the technique cited financial constraints as the leading reason for their decision (more about costing is discussed in section 5.5

below). Lack of knowledge of this technique was cited as the second most common reason for non-use of pepper fences, while the third reason was that farmers were waiting either to receive raw materials for the construction of fences from WD or they were waiting for the WD to come and install the fence for them on their individual farms. From further probes into the latter two reasons stated, it became clear that the idea of 'demonstration farms' that were set up by WD as training centres were misunderstood, raising false expectations among farmers. Also, it appears that the concept of peer training by those farmers who had benefited directly from project training was either not taken up and practiced, or if practiced had been rejected because fellow farmers preferred to learn directly from WD staff. WD staff in turn had not trained as many farmers as expected because they mainly offered technical assistance on request. Since setting up pepper fences was entirely optional, WD staff could not force their knowledge on farmers, and farmers themselves had been slow in stepping forward to ask for capacity building assistance.

Also, as reflected in farmer recommendations #2 and #3 (see Chapter 4) made for future conflict management, there is a prevailing discouraging notion among farmers that managing the crop raiding problem is the responsibility of the Government / WD since the park and all the wildlife within it are the property of these parties. It is opined that until farmers 'own' the problem, and accept the responsibility of defending their livelihoods and property by all legal means possible, there will be no motivation for exhibiting proactivity.

5.4.2 Barriers to the adoption of boundary or alternative cropping techniques

Boundary/alternative crops are not widely grown because one-third of respondents believe this technique is ineffective, another third do not know about this technique, and about one-tenth claim they do not have space on their farms for new crops. Claims of ineffectiveness may be

because farmers are using a mild local variety of pepper (and/or ginger) which can be tolerated by elephants (several respondents complain that “elephants simply trample over and destroy pepper/ginger grown”). It is noted that a further 7% of farmers claim they do not have money to buy the right planting material, thereby indicating that chilli seeds needed for this technique are of a different variety than locally available ones.

Further probing established that several farmers have incorrectly intercropped the chilli peppers and ginger according to normal traditional practice instead of planting them as distinct boundary around the perimeter of their farms. It is thought that incorrect planting may be because of ignorance of planting techniques, or because of cultural difficulties in adopting non-traditional farming methods. This latter reason may also account for those who claim they had no space on their farms i.e. they are so used to growing traditional crops such as cocoa and oil palm that the transition to planting different crops altogether is very difficult for them to make.

This is however not the case at Antwikwaa where many farmers have voluntarily abandoned the prevailing custom of oil palm cultivation. Because of significant crop losses due to elephant raiding, farmers in this community have switched to planting rubber as an alternative crop (Fig. 22). To further minimise losses from cleared palm plantations (Fig. 23), farmers engage in palm wine tapping (Fig. 24), a process of extracting sap from palm trees that have been cut down. This fresh palm wine is supplied the local brewery where it is fermented and distilled into a local gin called ‘Akpeteshie’ (Fig. 25).

Figure 22. *Alternative cropping: Rubber replaces oil palm near Antwikwaa*

Figure 23. *A cleared palm plantation showing palm wine tapping (blue containers under cut trees)*

Figure 24. The palm wine tapping process showing sap being collected into a plastic container

Figure 25. Local 'Akpeteshie' gin distillery showing fermentation drums

Despite the fact that considerable efforts have been put into capacity building within the last 5 years, 'lack of knowledge' is the second most important reason for low adoption of both new

non-traditional chilli techniques. Since the three capacity-building projects cited in Chapter 2 covered 50 out of the 52 major settlements around KCA, limited scope of coverage for technology dissemination appears unlikely to be a cause for low levels of knowledge reported. This suggests that there might be a fundamental problem with either the teaching methods employed during capacity building, or with the learning ability of trainees. It may also point to poor information dissemination among farmers, exposing a possible weak link in intra-community communication processes. In order to gain clarity on the underlying problem, it would be worthwhile for stakeholders to invest into retrospective analysis of barriers to teaching or learning. This information will guide future technology transfer.

5.5 Sustainability of non-traditional measures introduced

A very high proportion of respondents who previously adopted non-traditional techniques have since discontinued their use. Rates of discontinuity of chilli-based technologies are as follows: 25% for pepper fencing and 52% for alternative/boundary cropping. Of the 25% who are no longer using pepper fencing on their farms, the majority claim that it is too expensive to maintain. A few complain that the technique has become ineffective over time. Ineffectiveness, upon further probing, was found to be because of inappropriate use of the technique. Some farmers have soaked the slender nylon threads themselves in chilli oil and have strung the bare thread on wooden poles around their farms without hanging pepper covered cloths on them because they allegedly cannot afford to buy the used clothing required. Others have hung dry rags on the nylon lines without prior soaking in chilli. This is also allegedly because they cannot afford to purchase pepper powder and grease / used oil. Some farmers have constructed the pepper fence only on the sides of their farms directly bordering the reserve, leaving other sides unprotected because they allegedly cannot afford to fence their entire farms. Still others correctly

fenced their entire farms initially but have since neglected to renew pepper and grease in the rags. This omission is either because they do not know they must to re-apply chilli periodically, or because they claim they cannot afford to keep regularly renewing pepper/grease in the rags. In the final analysis, both absolute non-use (discussed in a previous section) and discontinued use boils down to the unavailability of sufficient money. It is claimed by some that their current financial difficulty is as a direct result of losses incurred by crop raiding in previous years. An attempt is made below to estimate costs involved in setting up and maintaining pepper fences in order to test their affordability to farmers.

Using estimates from Box 2, and assuming one 10 acre farm per household, each household needs to invest more than US$ 450 into the initial set-up of a pepper fence around their farm. An additional amount of ~US$ 292 needs to be spent on grease, used oil and chilli powder every 3 months to sustain potency of the fence. Total annual running cost for the first (installation) year is therefore US$ 1,326 = [450 + (3 x 292)] and that for subsequent years is US$ 1,168 = [4 x 292]. Since average annual household income is estimated to be only US$ 612 per 4-member rural farm household in the Central Region of Ghana (TUC 2004), costs of installing and maintaining a pepper fence are far beyond the means of local households around KCA. These estimates validate farmer perceptions that the non-traditional pepper fencing technique is too expensive. Even though pepper fencing is a highly effective low-tech low-cost anti crop-raiding technique used to manage human-elephant conflicts worldwide, it was concludes that pepper fencing is inappropriate for the local KCA setting because it is unaffordable for the average farmer household.

Box 2. Budget for 38 acres of farms (Pepper fence)

ITEM	UNIT PRICE (¢)		COST (¢)
120 tins of grease	@ 45,000	-	5,400,000
10 gallons of spent oil	@ 15,000	-	150,000
60 bundles nylon rope	@ 45,000	-	2,700,000
300 mini bells	@ 10,000	-	3,000,000
Powdered pepper/chilli (lump sum)		-	5,000,000
TOTAL		-	16,250,000

⇨ ¢ 427,631.58 (US$ 45.00**) per acre

¢ represents the Cedi (old currency used prior to national redenomination)
** US$ rate as at May 2006
Source: Binlinla 2006 (with amendments from www.oanda.com/currency/converter)
NB: Cost of wooden poles, used clothing/rags and labour are not included in above estimate

In order to encourage the adoption of pepper fences in communities around KCA, initiatives to subsidize the cost of inputs must be introduced. HWC management programmes should capitalize on the fact that 45% of respondents support the idea of adopting pepper fencing as a means of reducing future human-elephant conflicts. The researcher encourages administrators, NGOs and donors to deliberately consider that 36% of farmers cited financial challenges with purchasing inputs as a barrier to the adoption of chilli-based techniques. Any future plans of upscaling the use of these non-traditional techniques should therefore first address the above-mentioned financial constraints to ensure higher levels of adoption than those achieved by previous efforts within the last decade.

5.6 Long term solutions to HWC

Land-use planning, which was recommended by the FAO-CI project as a long-term solution to human-wildlife conflicts in the area, is conspicuously lacking from management measures currently in place around KCA. Measures proposed by the Wildlife Division in the mid 1990's to establish various utility zones in and around KCA (WD 1996; see Fig. 26) have still not been implemented. The researcher believes that it is time to move away from temporary or short term of HWC symptoms to a more permanent of the underlying land-use incompatibility problem at KCA (Sam pers. comm.; Ortsin pers. comm.; Barnes 2002). It is imperative that land-use planning be carried out because incompatible land-use was the main cause of conflicts at KCA which was identified during the 'Elephant biology and management' project (Binlinla 2006). As Barnes (2009) aptly put it, the right question for conflict managers to ask is not '... how can elephants and people share the land?' but rather '... how can elephants and farmers be kept apart?' since the latter focuses attention on land-use planning.

In the KCA area, a few farmers have independently abandoned their farms because of repeated animal crop raiding. To them, decisively relocating to farm lands which are further away from reserve boundaries has paid off by bringing about a permanent end to crop raiding by elephants. These farmers have either rented plots from other land-owners, or have been allotted new farmlands by their own [extended] family heads in accordance with existing traditional land tenure systems described by Agyare (1995).

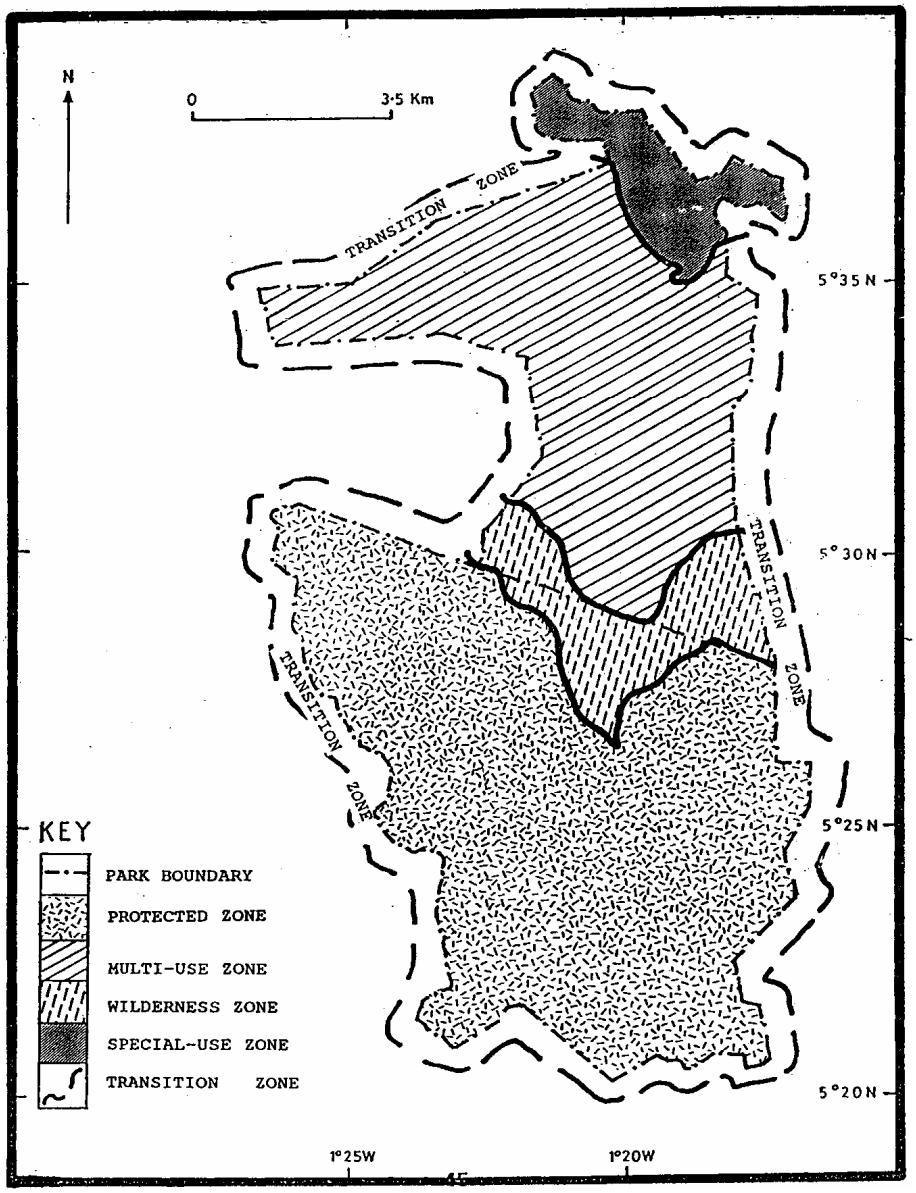

Figure 26. Proposed management zones of KCA

(Source: Wildlife Division 1996)

The resolve of these farmers is commendable, but the practice of randomly abandoning farms may cause more harm than good in the long run; it increases the patchiness of secondary forest vegetation (also caused by traditional shifting cultivation) around reserve borders, creating the ideal mosaic vegetation that attracts elephants out of forests and increases the probability of crop raiding in nearby farms (Binlinla 2006; Barnes 2002). Instead of random abandonment, a well coordinated systematic relocation exercise of all crop farms within a specified radial zone around the park to create a buffer zone may be an option. Community woodlots can be created in place of the crop farms. These will provide secondary sources of income from resulting trade in fire-wood and non-timber forest products (NTFPs). To further reduce conflicts in the north-eastern portions of KCA it is suggested that admitted farms located inside park boundaries (WD 1996) should be purchased outrightly by WD and reverted to forest through natural succession.

Some farmers (6% of respondents) who recognise the need to move but lack the means to secure new plots are appealing for Government/WD assistance. They insist that if financial incentives are made available, they will immediately and willingly stop cultivating boundary farms. This may be an opportunity which can be used by KCA administrators as a stepping stone to promote the dissemination of proposed zonation plans among communities.

5.7 National legislation and policy vs local HWC management practice

As discussed in section 5.3 some traditional conflict management measures widely practiced around KCA are in direct contravention of the Ghana wildlife laws. Since these laws are rendered partially redundant due to low levels of law enforcement, some revisions to the laws may need to be made e.g. creation of a fourth schedule listing animal species which may be eliminated by farmers in cases of crop raiding. This amendment will legalize the use of

traditional anti crop raiding techniques so that trapping and killing problem animals outside the reserve will not incur penalties. Policy reforms such as are suggested above have been effective in Malawi (see National Parks and Wildlife (Amendment) Act 2004 cited in Anthony and Wasambo 2009)

Secondly, it is observed that WD's insistence on non -payment of compensation for crop raiding is consistent with the legal framework in place. As cited in Chapter 2, no policy provision has been made to enable the payment of compensation to raided farmers. On this issue, WD is therefore not in a position to meet farmer expectations. The researcher underscores the need for intensive expectation management in communities bordering KCA. This is to keep human-human conflicts between farmers and WD staff as low as possible.

Alternatively, as expressed by Sam (pers. comm.) crop raiding should be reclassified and considered as a national disaster situation. Similar to natural disasters such as floods and droughts, crop raiding should be viewed as a disaster since it robs many farmers of their livelihoods and creates food insecurity among affected households and communities nationwide. The National Disaster Management Organisation (NADMO) should therefore provide humanitarian relief to farmers affected by severe crop raiding since NADMO's mandate includes 'rehabilitation of persons affected by disasters …' (MoI 2007). This would assuage those farmers (52% of respondents) who were discouraged by a lack of response to reported crop raiding and would go a long way to foster collaboration between WD and local communities.

5.8 Synopsis

The plight of farmers due to human-wildlife conflicts, particularly those involving elephant crop raiding is demonstrated in a letter addressed to the Minister of Food and Agriculture by farmers at Nyamebekyere (see Figure B in Appendix 1). Not only does crop raiding adversely affect farmer livelihoods and household food security, but HWC around KCA undermines national biodiversity conservation efforts. The latter is because traditional anti crop raiding measures, which are perceived to be effective at reducing most conflicts, involve the elimination of problem animals. Alternative non-destructive chilli based methods of managing human-elephant conflicts have not been widely adopted due to financial constraints, insufficient knowledge on techniques, and perceived ineffectiveness of measures. Long term solutions to HWC which involve land-use planning are not in current use, though they have been on the drawing board since 1996. The researcher highlighted several issues of concern regarding the use of various techniques as well as problem areas in policy-practice correlation.

CHAPTER SIX - CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The findings of this study confirm that human-wildlife conflicts are a common occurrence of great significance in the Kakum Conservation Area. Elephant crop raiding is the primary type of conflict experienced by the majority of respondents surveyed. One third of respondents reportedly experienced additional crop raiding problems involving less charismatic species such as rodents, birds, felines, hogs, antelopes and primates. A few respondents reported damaged infrastructure as an additional consequence of human-elephant conflicts, and even less respondents reportedly suffered loss of stored produce due to conflicts.

Traditional methods of managing conflicts were used by the majority of respondents including noise-making, setting of fires which emit noxious smoke, guarding of farms, bamboo fencing and the erection of scarecrows. These methods were perceived to be ineffective at reducing elephant raiding, but reportedly were highly effective at controlling other problem animals.

In spite of 3 consecutive capacity-building projects' efforts to promote the use of non-traditional chilli-based techniques, survey results showed that these techniques were not in wide use by respondents. This was despite pepper fencing techniques being rated by respondents as more effective at managing human-elephant conflicts than all other traditional methods known to them. Low adoption was also despite the fact that 45% of respondents recommended the use of pepper fencing to manage future conflicts involving elephants.

Even though some traditional techniques were perceived to effectively manage some conflicts, their continued extensive use was thought to be in contravention of national wildlife laws. It was argued that by eliminating problem animals, these techniques jeopardised the conservation of

uncharismatic species which are non-the-less of great ecological value (some being found on the IUCN endangered species list). Thus the current mode of use of traditional techniques in communities around KCA to be unsustainable.

Analysis of some barriers to the adoption of non-traditional techniques identified two major impediments: insufficient knowledge and financial constraints. Among respondents, a lack of sufficient knowledge on the appropriate use of chilli-based techniques led to false perceptions on their ineffectiveness. Though highly effective and low-tech, pepper fencing was deemed to be inappropriate for the local setting because of its associated high cost of installation and maintenance. The current mode of use of non-traditional conflict management techniques were therefore found by the researcher to also be unsustainable because they were beyond the means of the majority of farmers interviewed.

With regards to the correlation between national legislation / policy and local HWC management practice, both convergences and divergences were noted by the researcher. Since there is no policy framework for the payment of compensation for crop damage, WD practice was noted to be in conformity with current policy guidelines. The staunch WD stance was confirmed by the complaint of respondents against this seeming unwillingness of Park Officials to pay for damage inflicted by 'their' animals. Conversely, the enforcement of wildlife laws, especially LI 685, was observed to be lax. Due to logistical constraints, only the spirit and not the letter of this law was practiced. Thus, the killing of large conspicuous species such as elephants was closely monitored, while that of smaller mammals such as rodents (also wholly or partially protected by the same law) was allowed to slide. Continued use of some traditional methods of conflict management was deemed by the researcher to be at odds with the existing legal framework of Ghana.

In light of all the above, it is concluded that though the combined use of traditional and non-traditional methods was perceived to be moderately effective at managing conflicts, techniques being used in communities around Kakum Conservation Area need to be further researched and honed. Additionally, points of contention or digression between national legislation and local practice need to be re-aligned in order to promote the sustainability of KCA and its surrounding farming communities.

6.2 Recommendations

1. It is recommended that further studies be conducted into the nature and extent of conflicts between humans and ALL animal species around KCA (and wherever conflicts are reportedly occurring in other parts of Ghana). Specifically, research should seek to address the knowledge gap that exists in other HWC besides human-elephant ones e.g. Feline-human conflicts reported at Kruwa and Afiaso.

2. Land-use planning, which is a long term strategy for managing conflicts, should be practiced (not merely planned) around KCA.

3. Record keeping of HWC should be expanded to cover uncharismatic species as well as impacts other than crop raiding. Accordingly, a national database of HWC should be created and maintained by WD Head Office in Accra. This should include final reports of all research carried out on wildlife and wildlife related issues in Ghana.

4. Financial and other barriers to the adoption of non-traditional chilli-based techniques which were raised by respondents of this survey should be thoroughly investigated and appropriately addressed in order to facilitate wider adoption of these techniques. The

introduction of subsidies for commodities such as spent vehicle oil should be considered. Technical assistance offered for the erection of fences as well as training of willing farmers should be intensified in all major communities around KCA.

5. Issues of contention e.g. compensation for crop damage, should be reconsidered by policy makers since HWC inflicts disastrous consequences on affected households.

6. A drastic upward revision of penalties for poaching should be undertaken to curb bush-meat trade, and thereby reduce HWC in Ghana.

7. Additional budgetary support should be granted to the Wildlife Division in order to facilitate its optimal functioning. This specifically should include the improvement of WD law enforcement capacity by expanding its personnel base through future staff recruitment efforts.

8. As recommended by GSS (2005), the construction, improvement and regular maintenance of feeder roads to link food production centres to nearby market centres is imperative for rural and national development. Further, the development of simple vehicles to carry food from such areas in a timely manner will reduce post-harvest losses due to spoilage and animal damage (HWC).

9. Policy makers within various Ministries who advocate for the boosting of agriculture production should consider the consequences of such initiatives on HWC. If traditional agricultural practice as it is currently practiced expands as planned, it would entail dramatic land-use changes which would also affect biodiversity conservation. Inter-sectoral collaboration is therefore recommended to ensure that environmental, economic and social goals are sustainably balanced.

10. Promoting the education of Ghanaian citizenry, particularly rural farming communities in HWC hot-spot areas, will yield multiple positive results. These include the empowerment of stakeholders for participatory resource management, and the reduction of HWC by increasing tolerance levels among affected communities.

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PERSONAL COMMUNICATIONS

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Anie, Ernestina. Assistant Manager and Tourism Officer, Wildlife Division - Kakum. Formal interview. Kakum, March 2010.

Amankwah, Richard. Technical Assistant, Wildlife Division - Kakum. FAO-CI project trainee. Formal interview. Kakum, March 2010.

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Owusu, Erasmus Heneku (Dr.). Senior Lecturer at Zoology Department, University of Ghana. Former Executive Director of Ghana Wildlife Society. Field survey advisory consultation. Legon, March 2010.

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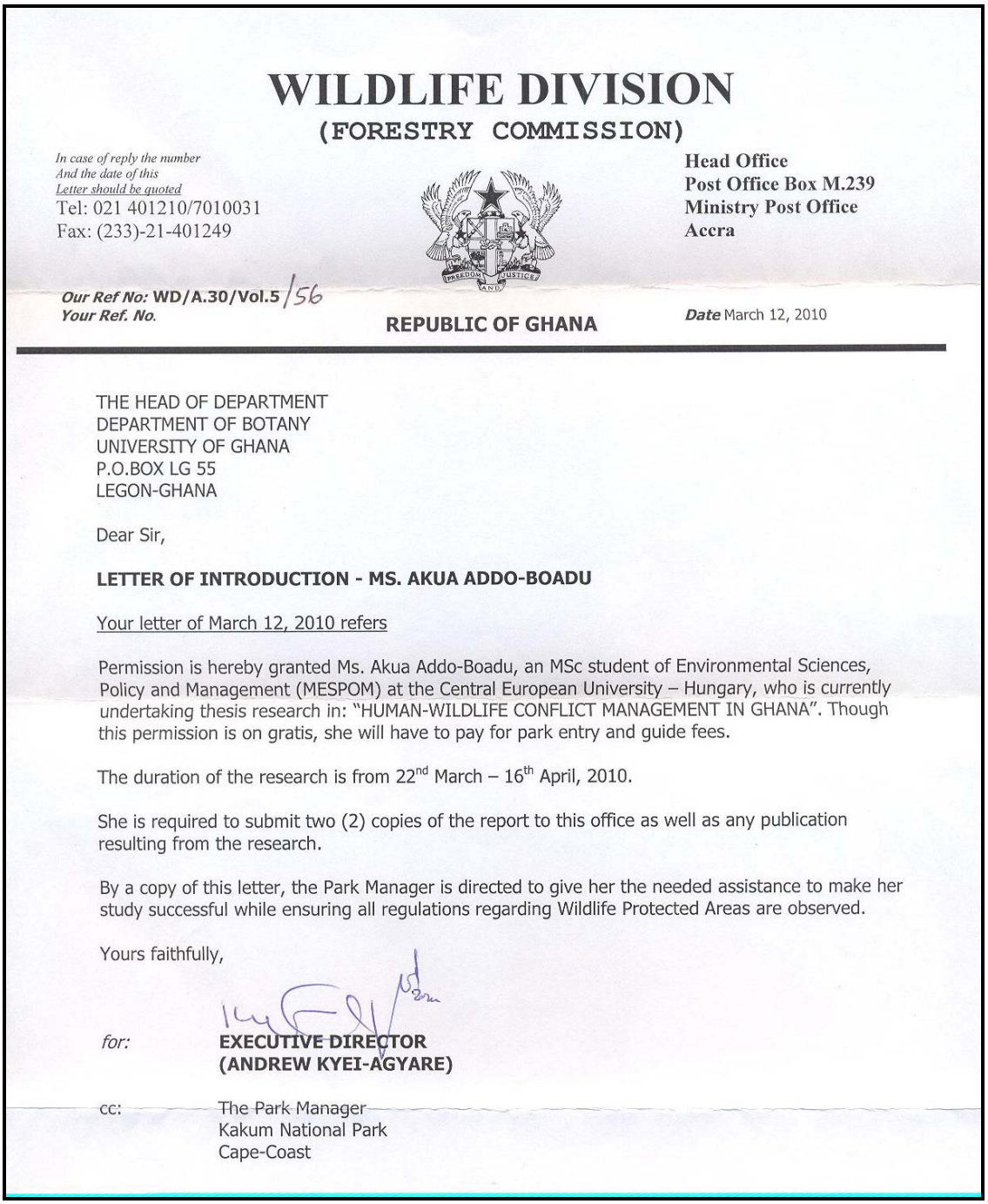
Yapi, Atse (Dr). National Forest Programme Facility Officer of Food and Agriculture Organization of the United Nations. Formal interview. Accra, March 2010.

APPENDICES

APPENDIX 1 – LETTERS OF INTEREST



WILDLIFE DIVISION
(FORESTRY COMMISSION)

In case of reply the number
And the date of this
Letter should be quoted
Tel: 021 401210/7010031
Fax: (233)-21-401249

Head Office
Post Office Box M.239
Ministry Post Office
Accra

Our Ref No: **WD/A.30/Vol.5/56**
Your Ref. No.

REPUBLIC OF GHANA

Date March 12, 2010

THE HEAD OF DEPARTMENT
DEPARTMENT OF BOTANY
UNIVERSITY OF GHANA
P.O.BOX LG 55
LEGON-GHANA

Dear Sir,

LETTER OF INTRODUCTION - MS. AKUA ADDO-BOADU

Your letter of March 12, 2010 refers

Permission is hereby granted Ms. Akua Addo-Boadu, an MSc student of Environmental Sciences, Policy and Management (MESPOM) at the Central European University – Hungary, who is currently undertaking thesis research in: "HUMAN-WILDLIFE CONFLICT MANAGEMENT IN GHANA". Though this permission is on gratis, she will have to pay for park entry and guide fees.

The duration of the research is from 22nd March – 16th April, 2010.

She is required to submit two (2) copies of the report to this office as well as any publication resulting from the research.

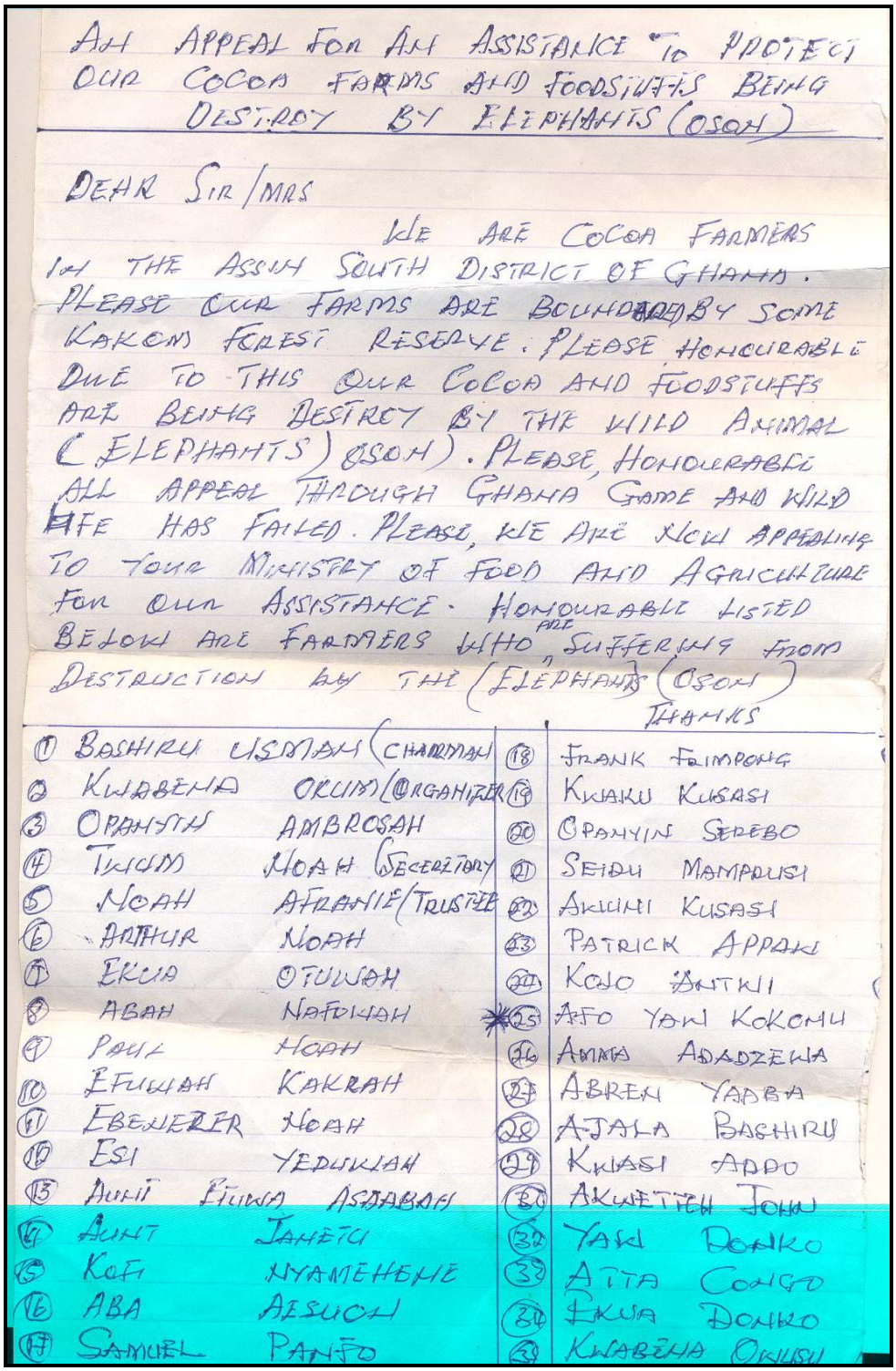
By a copy of this letter, the Park Manager is directed to give her the needed assistance to make her study successful while ensuring all regulations regarding Wildlife Protected Areas are observed.

Yours faithfully,

for: **EXECUTIVE DIRECTOR**
(ANDREW KYEI-AGYARE)

cc: The Park Manager
Kakum National Park
Cape-Coast

Figure A. Letter of permission to carry out research at Kakum



AN APPEAL FOR AN ASSISTANCE TO PROTECT OUR COCOA FARMS AND FOODSTUFFS BEING DESTROY BY ELEPHANTS (OSOM)

DEAR SIR/MAS

WE ARE COCOA FARMERS IN THE ASSIN SOUTH DISTRICT OF GHANA. PLEASE OUR FARMS ARE BOUNDED BY SOME KAKUM FOREST RESERVE. PLEASE HONOURABLE DUE TO THIS OUR COCOA AND FOODSTUFFS ARE BEING DESTREY BY THE WILD ANIMAL (ELEPHANTS) (OSOM). PLEASE, HONOURABLE ALL APPEAL THROUGH GHANA GAME AND WILD LIFE HAS FAILED. PLEASE, WE ARE NOW APPEALING TO YOUR MINISTRY OF FOOD AND AGRICULTURE FOR OUR ASSISTANCE. HONOURABLE LISTED BELOW ARE FARMERS WHO ARE SUFFERING FROM DESTRUCTION BY THE (ELEPHANTS (OSOM)

THANKS

1	BASHIRU	USMAN (CHAIRMAN	18	FRANK	FOMPONG
2	KWABENA	OKUM) (ORGANIZER	19	KWAKU	KUSASI
3	OPANYIN	AMBROSAH	20	OPANYIN	SEREBO
4	TUKUM	NOAH (SECERTARY	21	SEIDU	MAMPRUSI
5	NOAH	AFRANIE (TRUSTEE	22	AKUMI	KUSASI
6	ARTHUR	NOAH	23	PATRICK	APPAU
7	EKUA	OTUNAH	24	KOJO	ANTWI
8	ABAN	NAFOKAH	25	AFO	YAW KOKOMU
9	PAUL	NOAH	26	AMMA	ADADZEWA
10	EFUKAH	KAKRAH	27	ABREN	YADBA
11	EBENEZER	NOAH	28	AJALA	BASHIRU
12	ESI	YEDUKAH	29	KWASI	ADDO
13	AUNTI	FUKWA ASAABAH	30	AKWETEH	JOHN
14	AUNT	JANETU	31	YAW	DONKO
15	KOFI	NYAMEHENE	32	ATTA	CONGO
16	ABA	AESUOM	33	EKUA	DONKO
17	SAMUEL	PANFO	34	KWABENA	OKUSU

Figure B. Copy of appeal letter from Farmers' Union at Nyamebekyere (also see Fig. viii in Appendix 4)

APPENDIX 2 – SAMPLE QUESTIONNAIRES

HUMAN-WILDLIFE CONFLICT MANAGEMENT IN GHANA

INTERVIEW GUIDE / QUESTIONNAIRE 3

(Community Members)

Name of Respondent:

Name of Community:

Role within Community:

Contact details (Telephone, e-mail, postal address):

Education: [Informal, Primary, Secondary, Tertiary (Graduate), Tertiary (Postgraduate), Other]

Religion: [Christian, Muslim, Traditionalist, Other]

Age: [19 and below] [20-29] [30-39] [40-49] [50-59] [60-69] [70-79] [80 and above]

Gender: [Male, Female]

Occupation: [Farmer, Hunter, Trader, Other]

[If farmer, total size of farm, and area of each crop cultivated]

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Definition:

Human-wildlife conflict (HWC) is defined as "any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment" (WWF SARPO 2005).

1. Has your village had any problems with wild animals in the last 10 years? a. Yes b. No
2. If yes what animals? a. elephants b. monkeys c. rodents d. birds e. other ....
3. What types of problems did the animals cause? a. crop raiding b. damage to stored produce c. injury or threat to human life d. damage to infrastructure e. other

   .....

   ....
4. If crop raiding, what types of crops a. maize b. cocoa c.oil palm d. citrus e. vegetables f. other .....

   .....

   .....
5. What traditional methods are you using to manage conflicts? a. traps b. killing c. noise-making d. fires e. scarecrow f. guarding g. other .....

   .....
6. What new methods are you using to manage conflicts? a. Pepper + grease fence b. pepper + palm kernel c. fence + alarm bells d. pepper + dung brick e. other .....
7. If pepper techniques are not being used, why? .....

   .....

   .....
8. Are you growing alternative crops (e.g. pepper and ginger) close to the boundary of the park? a. Yes b. No
9. If No why not? .....

.....

.....

10. Which method is more effective? a. traditional method b. new method c. both are equally effective d. they are complementary e. other .....
11. Have human-wildlife conflicts a. increased or b. decreased or c. remained the same in the last 10 years? Why? .....

    .....
12. What do you do when a conflict occurs? a. manage yourself b. report to elders c. report to wildlife officials d. other .....
13. What are the main challenges you face when managing conflicts? .....

    .....

    .....

    .....
14. Suggest other things that can be done to reduce future conflicts

    .....

    .....

APPENDIX 3 - ADDITIONAL TABLES

Table A. Socio-Economic Characteristics of Respondents

		Respondents (count)	Respondents (%)
Social role within community	Leader	105	42.0%
	Non-leader	145	58.0%
Level of education of respondent	Informal	74	29.6%
	Primary	73	29.2%
	Secondary	99	39.6%
	Graduate	4	1.6%
	Postgraduate	0	0.0%
Religious background of respondent	Christian	191	77.0%
	Muslim	45	18.1%
	Traditionalist	8	3.2%
	Other	4	1.6%
Age of respondent	19 and below	9	3.6%
	20-29	43	17.3%
	30-39	59	23.8%
	40-49	70	28.2%
	50-59	40	16.1%
	60-69	19	7.7%
	70-79	4	1.6%
	80 and above	4	1.6%
Gender of respondent	Male	168	67.2%
	Female	82	32.8%
Occupation of respondent	Farmer	193	77.2%
	Farmer PLUS	57	22.8%
	Other	0	0.0%

Table B. Statistics on farm sizes (acres) of respondents

N	Valid	244
	Missing	6
Mean		15.568
Std. Error of Mean		3.0701
Median		6.000
Mode		10.0
Range		639.6
Minimum		0.4
Maximum		640.0
Sum		3798.5

Table C. Types of problems caused by animals

		Respondents (count)	Respondents (percent)
Valid	Crop raiding only	214	85.6
	Crop raiding plus damage to stored produce	2	0.8
	Crop raiding plus damaged infrastructure	29	11.6
	Crop raiding plus youth out-migration	2	0.8
	Crop raiding plus insect pests	3	1.2
	Total	250	100.0

Table D. Cross tabulation results for perceived conflict trends per village

Name of community * What has been the trend of conflicts in the last 10 years? Crosstabulation

Count

		What has been the trend of conflicts in the last 10 years?			
		Increased	Decreased	No idea/answer	Total
Name of community	Kruwa	19	3	0	22
	Adiembra	3	0	0	3
	Mpentembua	7	0	0	7
	Gyahare	15	0	0	15
	Homaho	19	2	0	21
	Mesomagor	8	2	0	10
	Seidukrom	5	7	0	12
	Gyaware	3	11	1	15
	Aboabo	4	7	0	11
	Nyamebekyere	11	2	0	13
	Onomakwa	2	13	0	15
	Afiaso	1	41	0	42
	Afiaso-Nsuntem	0	4	0	4
	Bediako	0	2	0	2
	Tawiah-Nkwanta	1	8	0	9
	Bobi	12	3	0	15
	Antwikwaa	25	5	2	32
	Abrafo	1	1	0	2
Total		136	111	3	250

Table E. Results of Statistical Analysis (Cross tabulations)

Variable 1	Variable 2	Pearson Chi-square test (Probability values) 2 tailed [at 5% CL]	Correlation test	Comment on linear relationship
Name of community	Problem animals identified	56.980 (0.008)	Phi: 0.477	Moderate to substantial
Name of community	Primate problem	49.930 (0.000)	Cramer's V: 0.447	Moderate to substantial
Name of community	Rodent problem	33.432 (0.010)	Cramer's V: 0.366	Moderate to substantial
Name of community	Bird problem	42.411 (0.001)	Cramer's V: 0.412	Moderate to substantial
Name of community	Type of problem experienced	1.340E2 (0.000)	Cramer's V: 0.366	Moderate to substantial
Name of community	Trap setting	82.805 (0.000)	Cramer's V: 0.576	Substantial to very strong
Name of community	Killing of animals	71.544 (0.000)	Cramer's V: 0.535	Substantial to very strong
Name of community	Noise-making	55.160 (0.000)	Cramer's V: 0.470	Moderate to substantial
Name of community	Fire setting	56.105 (0.000)	Cramer's V: 0.474	Moderate to substantial
Name of community	Guarding	36.090 (0.004)	Cramer's V: 0.380	Moderate to substantial
Name of community	Bamboo fences	46.282 (0.000)	Cramer's V: 0.430	Moderate to substantial
Name of community	Chain-saw noise	36.999 (0.003)	Cramer's V: 0.385	Moderate to substantial
Name of community	Pepper fencing	36.701 (0.004)	Cramer's V: 0.383	Moderate to substantial
Name of community	Alternative / boundary cropping	40.267 (0.001)	Cramer's V: 0.401	Moderate to substantial
Name of community	Comparison of technique effectiveness	1.601E2 (0.000)	Cramer's V: 0.400	Moderate to substantial
Name of community	Conflict trend	1.550E2 (0.000)	Cramer's V: 0.557	Substantial to very strong
Religious background	Problem animal identification	42.326 (0.000)	Cramer's V: 0.292	Low to moderate
Occupation	Problem animal identification	8.751 (0.013)	Cramer's V: 0.187	Low to moderate
Occupation	Type of problem experienced	11.879 (0.018)	Cramer's V: 0.218	Low to moderate

Table F. Scope of Human Wildlife Conflict around Kakum Conservation Area (Summary)

	Problem Animals							Type of damage				
Community	Elephants	Primates	Rodents	Birds	Antelopes	Hogs	Felines	Crop raiding	Stored produce	Infrastructure damage	Out-migration	Insect pests
Kruwa	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Adiembra	✓		✓					✓				
Mpentembua	✓							✓				
Gyahare	✓							✓				
Homaho	✓		✓	✓	✓	✓		✓	✓			
Mesomagor	✓	✓	✓					✓		✓		
Seidukrom	✓	✓	✓	✓	✓	✓		✓				
Gyaware	✓	✓	✓		✓	✓		✓			✓	
Aboabo	✓	✓	✓	✓				✓				
Nyamebekyere	✓	✓	✓					✓				
Onomakwa	✓		✓		✓			✓		✓		
Afiaso	✓	✓	✓		✓	✓	✓	✓		✓		✓
Afiaso-Nsuntem	✓		✓					✓				
Bediako	✓							✓				✓
Tawiah-Nkwanta	✓		✓		✓			✓		✓		✓
Bobi	✓		✓					✓		✓		
Antwikwaa	✓	✓	✓		✓			✓		✓	✓	
Abrafo	✓		✓	✓				✓				

Table G. Human-Wildlife Conflict Management at Kakum Conservation Area (Summary)

Community	Traditional Methods									Non-traditional Methods		Collaborative management
	Traps	Killing	Noise-making	Fires/smoke	Scarecrows	Guarding	Bamboo fencing	Chainsaw noise	Boundary clearing	Pepper fencing	Alternative crops	Stopped reporting
Kruwa	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Adiembra			✓	✓		✓				✓		
Mpentembua			✓	✓		✓				✓	✓	
Gyahare			✓	✓		✓				✓	✓	
Homaho			✓	✓		✓	✓			✓	✓	✓
Mesomagor	✓		✓	✓		✓	✓		✓		✓	
Seidukrom	✓		✓	✓	✓	✓	✓			✓		
Gyaware	✓	✓	✓	✓		✓				✓	✓	✓
Aboabo			✓	✓		✓				✓	✓	✓
Nyamebekyere			✓	✓		✓				✓	✓	✓
Onomakwa			✓	✓		✓				✓	✓	
Afiaso		✓	✓	✓		✓	✓			✓	✓	✓
Afiaso-Nsuntem		✓	✓			✓	✓				✓	
Bediako			✓	✓		✓					✓	
Tawiah-Nkwanta	✓	✓	✓	✓		✓		✓		✓	✓	
Bobi		✓	✓	✓						✓	✓	
Antwikwaa		✓	✓	✓		✓		✓		✓	✓	
Abrafo	✓		✓									

APPENDIX 4 - ADDITIONAL PHOTOGRAPHS

Figure i. Research team members ready for another day of field work

Figure ii. Research team conducting interviews en route to Mpentembua

Figure iii. *Alternative income-generating activity (fire-wood trade) at Onomakwa*

Figure iv. *Members of the local Farmers Union interacting with research team at Nyamebekyere*

Figure v. *Close proximity of border farms to Reserve (Fore: Cocoa farm; Back: KCA forest trees)*

Figure vi. *Children of families affected my human-wildlife conflicts*