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UNTAPPED POTENTIAL OF WILDLIFE AGRICULTURAL EXTENSION MITIGATION STRATEGIES IN INFLUENCING THE EXTENT OF HUMAN-WILDLIFE CONFLICT: A CASE OF SMALLHOLDER AGRO-PASTORALISTS IN LAIKIPIA COUNTY, KENYA

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ABSTRACT

The agriculture sector is critical in the achievement of food security and also important for income generation, employment creation, and provision of raw materials for agro-based industries, economic growth and poverty reduction. This is especially for smallholder farmers, most of who live in rural areas, especially in Sub Saharan African countries such as Kenya. Rangelands occupy 34% of the world's landscape, 70% of the total landmass in the horn of Africa and 80% in Kenya. Rangelands are mostly occupied by pastoralists and agro-pastoralists besides being used for wildlife conservation. The interaction between humans and wildlife results in human-wildlife conflict which is one of the major problems experienced by farmers in rangelands such as in Laikipia County. Data were collected through document review. Study findings established that despite agricultural extension promoting human-wildlife conflict mitigation strategies, human-wildlife conflict is still being experienced among smallholder agro-pastoralists in Laikipia County. Additionally, limited information had been documented on the agricultural extension mitigation strategies used, their effectiveness and sustainability among smallholder agro-pastoralists. It was therefore concluded that despite agricultural extension having the potential for mitigating against human-wildlife conflict, this potential has not been exploited. Consequently, human-wildlife conflict is still being experienced among small-holder agro-pastoralists in Laikipia County. This could be undermining household food security among smallholder agro-pastoralists in Laikipia County. It was therefore recommended that further research be undertaken on factors influencing adoption of human-wildlife conflict mitigation strategies promoted by agricultural extension among smallholder agro-pastoralists.

Keywords: Agricultural Extension Wildlife Mitigation Strategies, human-wildlife conflict, influence, small-holder agro-pastoralists

INTRODUCTION:

Agriculture is a vital sector for the achievement of food security, employment creation and economic growth in the world (AGRA, 2013). The agriculture sector is also the backbone for economic growth especially for most of the African countries where it generates about 25% of the Gross Domestic Product (GDP) in Sub Saharan Africa (Schaffnit-Chatterjee, 2014). Additionally, agriculture is key to economic growth, poverty reduction and food security. Furthermore, most of the population in Sub

Saharan Africa is rural and relies largely on agriculture. Moreover, economic growth generated by agriculture is more effective in reducing poverty than GDP growth in other sectors (Cervantes-Godoy & Dewbre, 2010; AGRA, 2013; Schaffnit-Chatterjee, 2014). Since agriculture accounts for about 25 to 40 per cent of the total GDP in African countries (AGRA, 2013), raising agricultural production therefore boosts income for millions of smallholder farmers who account for about 75 per cent of Sub Saharan Africa's population (Schaffnit-Chatterjee, 2014). This is possible because smallholder farming accounts for about 80 per cent of all farms in Sub Saharan Africa. Therefore increasing agricultural

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productivity especially among smallholder farmers contributes to improved food security through increased food availability and access by lowering food prices.

Besides the agriculture sector being important in achieving world food security (AGRA, 2013), it is the main source of food, employment, raw materials for agro-industries, economic growth and poverty reduction (World Bank, 2012). Agriculture sector is also the largest single source of economic livelihood, by employing up to 80 per cent of rural population, especially, since majority of the population live in rural areas. Agriculture is the mainstay of Africa's economy, employing about 65 per cent of the labor-force, and accounting for about 60 per cent of total GDP (AGRA, 2013; Huho & Kosonei, 2013). In Sub Saharan Africa, agriculture employs about 70 per cent of the total population while accounting for about 30 per cent of the national GDP (IFPRI, 2009; World Bank, 2008). Moreover, about 80 per cent of all small farms in Sub Saharan Africa are small-scale and contribute up to 90 per cent of the total production (AGRA, 2014). For example in Botswana, about 76 per cent of the total human population depends on subsistence agriculture, 90 per cent in Malawi, and 85 per cent in Kenya (AGRA, 2014). The smallholder farms provide 80 per cent of the total food supply in Africa. In Kenya, the agriculture sector accounts for about 24 per cent of the national GDP (Kagira *et al.*, 2012). Furthermore, more than 75 per cent of the Kenyan population depends on the agriculture sector either directly or indirectly (Gitau *et al.*, 2009). In Kenya, agriculture sector is the main source of food, income, besides accounting for about 65 per cent of Kenya's total exports. The agriculture sector also contributes about 70 per cent of informal employment and more than 18 per cent of formal employment (Muriu *et al.*, 2014).

Agriculture is practiced in both arable and Arid and Semi Arid Lands (ASALs). Globally, ASALs, excluding deserts are occupied by about 32 per cent of the world's population and cover about 34 per cent of the world's total landscape (Magembe *et al.*, 2013). The ASALs occupy about 70 per cent of the total landmass in the horn of Africa, ranging from 95 per cent in Somalia, 60 per cent in Uganda and 80 per cent in Kenya (Kirimu *et al.*, 2013). Rangelands are a home to about 30 per cent of the world's agro-pastoral diversity (Garoma *et al.*, 2013). Pastoralists and agro-pastoralists occupy about 43 per cent of Africa's land and about 25 per cent of the total population living in Africa's ASALs (AGRA, 2014; Kirim

et al., 2013). Additionally, in East Africa, pastoralist areas are also used for wildlife conservation and tourism, especially in Tanzania and Kenya. Agro-pastoral farming systems are critical for achieving food security because a large proportion of the global population depends on them for their livelihoods (Thornton *et al.*, 2009).

In Uganda, smallholders produce about 96 per cent of the food consumed while they produce about 80 per cent in Ghana and Zambia (Fairtrade, 2013). In Kenya, agriculture is predominantly small-scale farming, practiced on farms averaging 0.2 to 3 hectares (GoK, 2010). In the Kenyan rangelands, small-scale pastoral and agro-pastoral productions are a common feature and production is mainly subsistence. Laikipia County is part of the Arid and Semi Arid regions in Kenya, with farmers using between 1 and 3 hectares of land per household for agro-pastoralism. Wildlife conservation and management is also practiced on rangelands. Wildlife plays a key role in Kenya's economy particularly through tourism (GoK, 2010). This is evidenced by the Kenya government's recognition of the tourism industry as one of the growth engines for the country's economy. This is because the tourism industry accounts for about 10 per cent of the national economy, making it the third largest foreign exchange earner (Wanyonyi, 2012). However, since most of the wildlife occurs outside protected areas, on lands owned by farming communities, their interaction triggers human-wildlife conflict (GoK, 2010; MFW, 2012). Human-wildlife conflict is a serious threat to crop and livestock production.

Challenges Facing Agriculture: The agricultural sector is dominated by smallholder farmers. Although the agriculture sector plays an important role in the achievement of food security and economic development, farmers experience numerous challenges which undermine agricultural productivity. In a global context, the smallholder Sub Saharan Africa agriculture experiences various challenges such as insecurity of land tenure, conflicts and effects of climate change (Schaffnit-Chatterjee, 2014). Small-scale farmers in Africa face problems such as receiving poor extension services, poor access to information, lack of training and knowledge and the wildlife menace (Lamarque *et al.*, 2009). The small-scale farmers in the world are constrained by poor quality land (degraded and less productive), effects of climate change (drought, floods,

disease spread and reduced water supply) and inadequate extension services (Fairtrade, 2013; Fre & Tesfagersis, 2013). Pastoralists in the horn of Africa experience challenges such as high and low intensity conflicts (civil and human-wildlife conflict) and land grabbing (Fre & Tesfagersis, 2013). In Uganda, small-scale farmers are faced with problems such as inadequate extension services and pressure on land due to increasing human population (ACORD, 2010). The pastoralists in Ethiopia also experience problems such as frequent droughts, livestock diseases and conflicts (Ministry of Agriculture of Ethiopia, 2014). On the other hand small-scale farmers bordering Kruger National Park face challenges such as drought and human-wildlife conflict (Sikhweni & Hassan, 2013). Therefore, agriculture will only succeed after addressing the challenges farmers face especially the smallholders.

In Kenya, the agriculture sector experiences challenges such as low adoption of modern technology, inadequate disaster preparedness and response and heavy livestock losses due to livestock diseases and pests (GoK, 2010). In the Arid and Semi Arid areas in Kenya such as Laikipia, Samburu Trans Mara and Isiolo Counties, farmers experience problems of insecurity, inter-communal tension, human-wildlife conflict and poor delivery of agricultural extension services (GoK, 2010; MFW, 2012). On the other hand smallholder farmers in Laikipia County experience problems such as human-wildlife conflict, environmental degradation, scarcity of water and pasture and insecurity arising from cattle raids and increased droughts (Huho & Kosonei, 2013; Kirimi *et al.*, 2013). The challenges experienced by smallholder farmers result in reduced agricultural productivity (Bruinsma, 2009), thus undermining food security. This shows that human-wildlife conflict is one of the major problems experienced by smallholder agropastoralists in Laikipia County which has the potential to reduce food security among them.

Human-Wildlife Conflict Manifestation and Mitigation: Human-wildlife conflict is a global problem that is experienced especially in areas where people and wildlife share limited resources (Musimbi, 2013), and also share boundaries (Eniang *et al.*, 2011). Human-wildlife conflict is more intensive in developing countries where agriculture is a major source of livelihood for the rural people (Eniang *et al.*, 2011; Musimbi, 2013). In America, bears attack dustbins in towns in Northern USA, and about 29,000 deers are

killed annually after colliding with automobiles, wolves killed 2,806 livestock in Canada between 1992 and 1996, wolves killed about 718 livestock in USA between 1987 and 2001 (Musimbi, 2013). In Africa, human-wildlife conflict is prevalent because large numbers of big animals such as lions and elephants roam freely in marginal and protected areas (Makindi *et al.*, 2014). Globally, over the last four decades, wildlife habitats have shrunk drastically because of human encroachment (Mbugua, 2012). Consequently, conflicts occur between wildlife and farmers cultivating adjacent to wildlife habitats (Strum, 2010; Hill & Wallace, 2012). Furthermore in Africa there is a high dependence on agriculture for subsistence use, for example in Uganda 80% of the total population derive their livelihood from agriculture (Kate, 2012). Human-wildlife conflict manifests itself as crop damage, humans injury or even death, livestock injury or death, competition for pasture or infection of livestock with zoonotic disease (Waithaka, 2012; Musimbi, 2013). In Nigeria crop damage is sometimes up to 98% (Eniang *et al.*, 2011). In Botswana, sometimes farmers stop large-scale farming due to big losses resulting from human-wildlife conflict (Gupta, 2013). In Cameroon about 28.4 hectares of crop was destroyed by wildlife around Campo-maan area and two people were killed in 2004 (Eyebe *et al.*, 2012). In Uganda, crop damage by wildlife reduces yield by up to 50 per cent (Wallace & Hill, 2007). Human-wildlife conflict is experienced in rural Kenya especially in farms bordering wildlife habitats (Graham *et al.*, 2009b). Between 2003 and 2004, about 2,429 crop damage incidences were reported in Laikipia County (Laikipia Wildlife Forum, 2012; Lauren Bond, 2013).

Human-wildlife conflict is a global problem which occurs in various parts of the world in countries where human and wildlife requirements overlap (Dickman, 2010; Hoffman & O'Riain, 2012). It has been observed that globally, wildlife protected areas are instrumental in fuelling human-wildlife conflict, over the use of land, water and forests (Eniang *et al.*, 2011; Waithaka, 2012). In response to human-wildlife conflict, people use different strategies to mitigate the effect of human-wildlife conflict which are classified as direct and indirect interventions. Direct interventions are aimed at reducing the severity of wildlife damage, such as guarding (human or animal), use of barriers (fences, trenches, walls or buffer zone), enhancing the type, timing or location of human activities, repellents

(chemical, auditory, visual aversiveness or stimuli) or removal of wildlife (Treves, 2007). On the other hand, indirect interventions raise people's tolerance to conflict with wildlife when affected households cannot tolerate it. They include compensation or provision of incentives in form of materials or technical input and environmental education.

Some farmers use land-use planning and change and Community Based Natural Resource Management practices such as planting crops that are not palatable or appealing to wildlife, planting heavily attacked crops beyond a buffer of unappealing crops or suitable habitat (Hocking & Humle, 2009). In Africa, farmers use various human-wildlife conflict mitigation strategies such as poaching, chasing away the animal, fencing, using olfactory deterrents, community conservation, land-use planning and change or use African honey bees (Karidozo & Osborn, 2007; King *et al.*, 2011). In Uganda some small-scale farmers mitigate against human-wildlife conflict using barriers, creating buffers, guarding against wildlife, using deterrents or repellents (Wallace & Hill, 2007), while others lay traps against wildlife, hunt wildlife or cut down forests (Kate, 2012). In Mozambique, farmers mitigate against human-wildlife conflict using loud noise, lighting fire, making chilli barriers and hunting wildlife (Anderson & Parieda, 2005). In the Tsavo Conservation Area of Kenya, farmers mitigate against human-wildlife conflict using noise, scare crow, burning hot pepper, using fire, burning cow dung, guarding using dogs, killing or chasing away the wild animal (Makindi *et al.*, 2014). In Laikipia County in Kenya, experiments had been done on various human-wildlife mitigation strategies such as watch towers, fire, digging ditches, loud noise, chilli-grease fences, and powerful electric light and using barriers such as electric fences. However, little information was available on the mitigation strategies adopted and their potential in influencing the extent of human-wildlife conflict among small-holder agro-pastoralists in Laikipia County.

Agricultural extension was initiated in the 1900s (World Bank, 2010). Agricultural extension refers to a range of information, training and agriculture-related knowledge provided to farmers with the aim of increasing farmers' ability to improve farm productivity (Peterman *et al.*, 2011). Through agricultural extension farmers are trained and educated on farming technologies aimed at improving agricultural production and productivity (Anaeto *et al.*, 2012). Farmer education also influences

adoption of farming technologies (Anderson, 2008; Zivkovic *et al.*, 2009). Agricultural extension is provided to farmers both in developed countries such as New Zealand, Canada and Japan and developing countries such as Serbia (Zivkovic *et al.*, 2009). Although agricultural extension was provided by only the Ministry of Agriculture at initiation, currently it is offered by many service providers in many models, although still dominated by public extension under the Ministry of Agriculture (AGRA, 2013; Christoplos, 2010; Davis *et al.*, 2013). Agricultural extension services are crucial in dealing with food insecurity and poverty (AGRA, 2013). The extension service is also an important pre-requisite for promoting technology uptake and its eventual use in increasing both livestock and crop productivity (AGRA, 2013). Agricultural extension also serves as a means of delivering information to farmers, besides disseminating new technologies aimed at increasing production in both crop and livestock products (Kiriimi *et al.*, 2013). This shows that agricultural extension is crucial for improving agricultural productivity. In Malawi and Kenya, farmers acquire agricultural information and the knowledge they need to achieve and sustain high production through agricultural extension (Ifejika Speranza, 2010).

At initiation, the main focus of agricultural extension was the transfer of agricultural technologies from research stations to farmers, with the aim of increasing agricultural production so as to achieve food security (CGIAR, 2013; Kidanemariam *et al.*, 2013). Currently, the objective of agricultural extension is to promote sustainable output growth and natural resource management besides increasing agricultural productivity and output (Swanson, 2008). Consequently, agricultural extension promotes output growth and sustainable use of natural resources plus food security and improved livelihoods (Kidanemariam *et al.*, 2013). Therefore in Kenya, one of the core functions of agricultural extension is to promote conservation and management of natural resources for agriculture (MoA, 2009). Additionally, agricultural extension in Kenya is pluralistic in nature. Since natural resources form the basis for agriculture, human encroachment into wildlife habitats (forests) especially in Arid and Semi Arid areas triggers human-wildlife conflict. This situation demands that agricultural extension promotes natural conservation approaches and also human-wildlife conflict mitigation strategies. However, the potential of

agricultural extension in mitigating against human-wildlife conflict in Laikipia County was not documented. In the past, human-wildlife conflict management was the responsibility of wildlife conservation authorities. In Africa wildlife conservation authorities promote community-based conflict management strategies such as land-use planning, benefit sharing and crop insurance (Parker *et al.*, 2007). But currently, wildlife conservation has been decentralized with the introduction of community-based conservation programs and approaches. The Community-Based Conflict Mitigation (CBCM) practices which are gaining support in Zimbabwe, Ghana and Kenya include use of pepper. In Kenya, including in Laikipia County, agricultural extension promotes various human-wildlife conflict mitigation strategies such as planting crops that are unpalatable to wildlife, digging ditches around the farm to prevent wildlife from accessing crops, livestock and humans, planting natural barriers such as sisal, cactus or Mauritius thorn to protect crops, livestock or humans from wildlife attack. The other strategies include guarding using livestock (such as donkeys), growing less susceptible crops, growing crops with spikes to control damage by birds and also protecting the farm using African honey bees.

There are also other organizations which provide extension service in Laikipia County. The Kenya Wildlife Service (KWS) which is the government of Kenya's authority for wildlife conservation and management also provides extension services aimed at enhancing wildlife conservation education and training (GoK, 2010; GoK, 2013; Musimbi, 2013; Wanyonyi, 2012). The Kenya Forest Service (KFS) is a state corporation which protects forests in Kenya and also promotes community forestry education and training (KWS, 2013; Lowe & Ombai, 2013). The KFS also initiates formation of Community Forest Associations by communities neighboring forests. The other organizations involved in managing Kenya's natural resources include National Environmental Management Authority (NEMA), KWS and the Ministry of Water and Irrigation of Kenya. The Space for Giants (SFG) is an international organization involved in wildlife conservation and human-wildlife conflict management in Laikipia County, particularly along Rumuruti Forest (SFG, 2013). The SFG also trains community members on human-wildlife conflict mitigation strategies. The Rain Forest Alliance (RFA) is an international society which educates farmers on

wildlife protection and discourages farmers in Kenya from hunting wildlife in farmer-owned, government protected forests (Kagira *et al.*, 2012). Lastly, the Laikipia Wildlife Forum (LWF), an organization formed by wildlife conservation and management stakeholders promotes wildlife conservation especially in unprotected areas of Laikipia County (United States Agency for International Development, 2013). The LWF works with other partners and support organizations such as World Vision, African Wildlife Foundation, Kenya Wildlife Service, Kenya Forest Service, private ranches, Tree is Life Trust, Worldwide Fund, Community Development Trust Fund and Community Forest Associations (CFAs) (USAID, 2013).

The other wildlife conservation partners include United States Agency for International Development (USAID), Global Environmental Facility (GEF), International Fund for Agricultural Development (IFAD), European Union, World Bank, French Development Agency (AFD), and the United Kingdom Department of International Development (DFID) (USAID, 2013). These development partners collaborate with the Kenya Wildlife Service in implementing community-based wildlife conservation and management projects such as Kenya Wildlife Conservation Project (KWCP) (KWS, 2013). The KWCP is funded jointly by the Kenya government and USAID. These development partners also provide extension services to communities living adjacent wildlife habitats.

CONCLUSION AND RECOMMENDATIONS

This study established through document review that farmers in Laikipia County receive agricultural extension services which promote adoption of various agricultural technologies and also human-wildlife conflict mitigation strategies. Human-wildlife conflict is aggravated by the unprotected forests which are wildlife habitats such as Rumuruti. Wildlife therefore freely moves out of their habitats into the surrounding farms where they damage crops, injure or kill livestock, injure or kill humans and even transmit diseases. Although agricultural extension promotes various human-wildlife conflict mitigation strategies in Laikipia County, crop damage and livestock attack were still being experienced. Additionally, limited information was documented on the human-wildlife conflict mitigation strategies used by smallholder agro-pastoralists, their effectiveness and sustainability among the smallholder agro-pastoralists in Laikipia County. Based on the study findings, it was concluded that the potential of agricultural extension in mitigating against

human-wildlife conflict among smallholder agro-pastoralists in Laikipia County had not been exploited. This is because human-wildlife conflict was still being experienced among the smallholder agro-pastoralists in Laikipia County and this could be undermining their household food security. It was therefore recommended that further research be undertaken on the factors that could be influencing adoption of human-wildlife conflict mitigation strategies promoted by agricultural extension among smallholder agro-pastoralists.

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