

# Food and nutrition security and wildlife conservation: Case studies from Kenya

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## 9.1 Introduction

Food and nutrition security has been debated and discussed all over the world for a long time. Many ideas and policies have been suggested by world leaders to reduce hunger and food insecurity in the world such as Millennium Development Goals (UN-SCN, 2010) and UNDP (2015). Despite all these efforts food and nutrition security is still a challenge in the world today, more so in the developing countries (FAO et al., 2018). Food and nutrition security is achieved at all levels (both at the individual, household, regional, and global) when all people have physical and economic access to adequate, safe, and nutritious food (FAO, 1996). From its definition, food security has four dimensions (Gina, 2003; FAO et al., 2018):

- Availability of adequate quantities of food of good quality is made available using

various means such as domestic production, trade, stocks, and transfers (which include food aid by various organizations, for example, donors and African governments).

- Both physical and economic access to food at the household and individual level is mainly through farm production, whereas others access food by purchasing from the local markets and through a cultural exchange such as barter trade or gifts from family members and the community.
- In order for food to be used by the body optimally, there is a need for intake of nutritious food supplied through a well-formulated diet, which includes clean water and proper sanitation.
- Continuous sustainability of the above three—the nutrition aspect and food preferences are important to food security, so is the ability to have stable access and

capacity to utilize the available quality food, supported by a clean environment and proper adequate sanitation and efficient health services (Alders and Kock, 2017).

When all these dimensions of food security and nutrition are considered, achieving food security in most developing countries has been an uphill task, and many countries have not been able to achieve it. For example, the achievement of food and nutrition security in most developing countries such as Kenya has remained a mirage on a distant horizon. According to a report on nutrition status among 47 countries, members of the World Health Organization (WHO) Africa region, the proportion of children (under 2 years of age) receiving a minimum acceptable diet was low in Benin and in Kenya (WHO, 2017). Millions of people in Kenya suffer from chronic food insecurity and poor nutrition, and many more (between two and four million people), especially in the arid and semiarid areas, require emergency food assistance (Republic of Kenya, 2011). Even in years of good on-farm production, poor nutrition (stunting) still affects 30% of children in Kenya. This shows that there is a long term insufficient dietary intake of food (both macronutrients and micronutrients). Food insecurity is worsened by an inadequate distribution of high-quality foods, lack of knowledge about feeding by mothers and caregivers of young children and lack of prevention of infectious diseases, and poor medical services in rural areas (Republic of Kenya, 2009a,b, 2011). This situation is even direr for people who live in arid and semiarid lands (ASALs) where agricultural food production is affected by climate variability and human–wildlife conflicts (HWCs).

Many advances have been made in agriculture in most countries of the world, but food insecurity in most countries has continued to persist (FAO et al., 2012). Over a third of the human population in developing economies is affected

by micronutrient deficiencies. Malnutrition is a multifaceted problem and spans across a number of sectors and occurs in both developed and developing countries. In developed countries, it manifests in overnutrition (obesity) or undernutrition (micronutrient deficiencies). However, in developing countries, poverty is a major driver of food and nutrition insecurity (World Bank, 2008a). Deficiencies in certain nutrients such as vitamin A and trace elements such as iron and zinc contribute to increased diseases and mortality in women and children in poor countries in Africa (Brown et al., 2009; World Bank, 2008a). According to FAO (2014), there are high malnutrition incidences in Africa with one in four people estimated to be undernourished. The situation is aggravated by inequitable household power relations where women have limited access and control of production resources (Nyongesa et al., 2016a, 2016b; Meinzen-Dick et al., 2011).

The UN Environment 2019 observed that despite increased technological advances over the last century, more than 90% of crop varieties and half of the domesticated animals have disappeared from agricultural fields and the world's 17 main fishing grounds are at or above the sustainable fishing limits (UNEP, 2019). This narrows the human dietary diversification options amid an increasing world population. The decline in species and the increase in the human population put pressure on the available resources and contribute to the fragmentation of existing ecosystems as people clear out more land for habitation (UNEP, 2019). This trade-off between food production (in search of food and nutrition security) and ecosystem and hence wildlife conservation have existed for ages. It is the more vulnerable people who end up clearing the available land, often near wildlife habitations (Alders, 2009). Whereas the land expansion assures human populations of increased food production in the short term, the expected impact on food and nutrition security, including a reduction in

malnutrition levels among vulnerable groups has not been achieved (Alders and Kock, 2017; Teja et al., 2012).

In this chapter, we provide a link between wildlife conservation and food and nutrition security, using case studies from Kenya. The manuscript is organized as follows: Section 9.1 gives the introduction, Section 9.2 gives a literature review, Section 9.3 gives case studies from Kenya, and Section 9.4 discusses imperatives and challenges.

## 9.2 Literature review

### 9.2.1 Definitions

#### 9.2.1.1 *Wildlife*

“Wildlife” refers to the undomesticated animals and uncultivated plants living in their natural habitats such as forest, grassland, ocean, lake, river, stream, and desert, without the influence of human activities (Sharma et al., 2014). In the context of this chapter, the term “wildlife” refers to wild animals, wild birds, and “flora” in general.

#### 9.2.1.2 *Wildlife conservation*

Wildlife conservation is the practice of protecting wild species (plant and animal) and their habitats in order to ensure that the wildlife is preserved and prevented from becoming extinct. Earlier works by various authors such as Giles (1978) described wildlife conservation and management as a science and art of making decisions and using natural resources to conserve wildlife and manage them well to eliminate threats to the existence of wild flora, fauna, and their habitats for improved human welfare, present, and future. Most threats to wildlife are mainly human imposed and include but not limited to: habitat destruction/fragmentation, overexploitation of natural resources, pollution of the environment, and climate change (Sharma et al., 2014). A key challenge facing the world today is

how to meet the need for sufficient, safe, and nutritious food without exhausting the natural resources available (FAO, 2014). According to Tidball (2014), *maintaining a stable ecological balance and human quality of life are both dependent on wildlife*.

Wildlife conservation, therefore, has direct and indirect contributions to food and nutrition security. Wildlife, as a direct and basic benefit, is a food resource to many households either as a primary source of animal protein or vegetables/fruits/medicines/weld products such as honey or as luxury/delicacy food (Golden et al., 2011). In many world cultures, wild animals are an integral part of cultural diets. Studies show that wildlife was a major contributor to food and nutrition security for people living in African countries. Consumption of wild animal and plant products contributes to improved health and income of households (Cooper et al., 2018; Golden et al., 2011). Illegal hunting, overhunting, and encroaching into the wild animals’ natural habitat have led to declining animal populations, hence affecting food security in such regions. Encroaching too close to their natural habitat has also led to the destruction of agricultural fields. Sustainability of the direct benefit of wildlife is therefore dependent on the existence and implementation of government policies/controls and/or cultural prohibitions. Without controls, and with the devastating effects of climate change on agricultural food production, HWC is apparent as humans use technological advances in hunting, and the wild animals attack human beings and livestock and destroy crops.

### 9.2.2 Why wildlife conservation

Conservation of wildlife has become a necessity in order to preserve organisms in the wild, which might be faced with extinction as a result of human activities such as hunting and destruction of wildlife habitats due to the increasing human population in the world. As

the human population increases, there is an increased demand for more food, leading to the expansion of farming into wildlife areas or unsuitable lands such as the ASALs. This expansion may lead to the destruction of wildlife landscapes further jeopardizing food and nutrition security. The various policies and legislation enacted to conserve wildlife may limit access to wild food supplies by communities, resulting in food insecurity to many rural households located in the conservation areas. Therefore there is a need for a holistic approach to farming, which should include methods to preserve wildlife and biodiversity.

### 9.2.3 Loss of biodiversity

With increasing human population, encroachment on wildlife areas by clearing of forested land to grow food crops has led to a loss of biodiversity. The contribution of wild plants and animals to household food diversity may be reduced as biodiversity is lost, and humans are no longer able to meet their protein requirements especially communities bordering conservation areas. In order to preserve wildlife, governments enact laws that try to keep people out of the conservation areas. However, it is imperative that instead of considering biodiversity as exclusive, successful food production and biodiversity conservation need to be considered as interconnected. This holistic view of agricultural production and biodiversity conservation could lead to better management of natural resources (Smith and Haddad, 2015; Burlingame and Dernini, 2012; Frison et al., 2006). Therefore to achieve sustainable food and nutrition security, novel methods and policies of integrating food production and biodiversity conservation are required in many developing countries of the world (Sunderland, 2011; Chappell et al., 2016; Wittman and Blesh, 2015).

Agricultural production has an impact on biodiversity, and hence a holistic approach will deliver better results ensuring sustainable and ecologically sound food production systems. Certain individuals particularly women and girls who have limited access and rights to production resources face threats to food and nutrition security. In turn, these groups are a threat to biodiversity as they attempt to acquire food from the limited natural resources at their disposal. These will further increase the destruction of biodiversity, leading to unstable food systems (Schipanski et al., 2016; Chappell and LaValle, 2011). Due to the nature of agricultural production that is mainly carried out at the household level and mainly on smallholder farms in Africa, issues of gender equality and justice need to be taken more seriously to avoid negative impacts of agricultural production on biodiversity (Stone, 2002). Gender mainstreaming in agricultural production systems is necessary to enable more sustainable food systems to be developed. For food systems to be sustainable, all genders should have equal access to resources for production such as land and capital (Liu et al., 2007). Men and women in agricultural households make decisions that impact on labor provision as well as the adoption of new technologies, which in turn affect natural resource utilization and agricultural productivity. Also, the proceeds from the sale of agriculture produce go to the one controlling resources of production who are mainly men, and this implies that most women in rural areas do not have income. It has been documented that when women have income, they allocate more to food, health, and education of their children. This leads to improved welfare at household level (Sweetman, 2012). The role of women in food production, utilization, and biodiversity conservation needs to be reexamined and emphasized.

### 9.2.4 Food security and wildlife conservation

Wildlife conservation contributes to all four aspects of food and nutrition security discussed earlier. Most households in rural regions are depended on land and related natural resources for survival. In some communities living close to protected areas, there has been encroachment on wildlife habitats, leading to overexploitation of the natural resources and HWCs. Some poor communities living close to protected areas have moved into these areas to obtain food and other naturally occurring products to supplement their food requirements. For example, some communities in Central Africa obtained most of their protein requirements from hunting wildlife in gazetted forest areas (Sharma et al., 2014). To sustain their lifestyles, there is a need for controlled offtake of wild animals in these regions so that this resource can be conserved and thus be available to future generations.

The conservation, enrichment, and utilization of biological diversity are the prerequisites for the sustainability of the agricultural sector. Food security cannot be detached from the primary source, that is, productive land and marine ecosystems, whether wild or managed (Millennium Ecosystem Assessment, 2008; Frison et al., 2006; Lockie and Carpenter, 2010). Overlooking the intricate dependencies implies that although the outcome of the MDGs indicated that globally at least 805 million were experiencing extreme, chronic malnourishment between 2012 and 2014, the actual hunger due to lack of micronutrients is higher, and often results from delinking food and nutrition security from biodiversity conservation and utilization (FAO et al., 2012). Micronutrient deficiencies affect more than a quarter of the world's population (IFPRI et al., 2013). Further, the extinction of bees, important pollinators, for example, has been linked to the end of human life, hence showing the importance of making the

connection between food and nutrition security and wildlife conservation.

To ensure intentional linkage between food security and wildlife conservation, therefore, the policy development for food security at a national level should be undertaken as a multi-sectoral activity that should encompass, but not limited to, the agricultural, forestry, wildlife, environment, and trade sectors (IUCN, 2013). Without this linkage, policy enforcements related to wildlife conservation would instead be a significant contributor to food and nutrition insecurity.

Loss of forest cover, for example, has led to flooding, seasonality of rivers, loss of habitat for important insect pollinators, and reduced access to wild and medicinal plants, which result in reduced food and nutrition security of rural communities. The loss of biodiversity due to human activities results in reduced agricultural productivity and fuels the vicious cycle where communities living near forests continue encroaching into the forest. Actions to conserve wildlife should be deliberate in enhancing food and nutrition security to populations depending on the natural resources, whether near or further in geographical distance.

Food and nutrition security is also jeopardized by increased postharvest losses at the farm level and also along the food value chain. Postharvest handling of farm produce highly influences the quantity and quality of food available to the rural and urban populations. The quality and quantity of food available depend on postharvest handling of food at the point of production and as food moves along the value chain. Poor handling of food leads to food wastage and also diseases which adversely affects human health.

#### 9.2.4.1 Postharvest losses and food safety

There is a lot of food lost through poor postharvest handling. Postharvest losses contribute significantly to food and nutrition insecurity along the food supply chain. These necessitate

rural households to supplement their food needs by collecting veldt products. For proper human health, there is a need for adequate consumption of energy, protein, vitamins, minerals, dietary fiber, and antioxidants giving foods, which are plant and animal-based products. Consumption of fruits and vegetables on a regular basis has been associated with the reduction of lifestyle diseases such as cancer, heart disease, stroke, and diabetes (Kader, 2005; Emongor, 2010). Some of these products are collected from natural forests and from wildlife areas. At the global level, food production has significantly increased in developed countries; however, in the developing countries many people do not have access to adequate food supplies due to frequent droughts, floods, and war (Kader, 2013; Emongor, 2014). These inadequacies in food availability and affordability have been exacerbated by postharvest losses at all levels of the food value chain. Access of communities to wild fruits and vegetables from conservation areas contributes immensely to the improved health of farm households but this can be curtailed by laws and policies that aim to keep people out of the conservation areas.

A postharvest food loss is any change in the quantity or quality that prevents or alters its intended use or decreases its value. Postharvest food losses tend to be highest in countries with the greatest need for food (Emongor, 2014). Postharvest food losses vary in magnitude along the food value chain (Emongor, 2010, 2014). Estimates of the postharvest food losses for grains have been estimated at 25% (Kader, 2005; FAO, 2008). Primary and secondary causes of food deterioration vary across countries and cultures. The different causes of food spoilage influence the availability and affordability of food, hence contributing to food and nutrition insecurity. Postharvest losses vary in magnitude across and within commodities, production regions, and growing seasons. Reduction in postharvest food losses would be of importance to both farmers and consumers. These

will lead to conservation of the environment as less land would be required for production; hence there is reduction in encroachment on wildlife habitats leading to conservation of biodiversity and reduction in wildlife–human conflicts.

The postharvest physiology of a food product is influenced by the product itself, especially its perishability, the intended use of the product, the storage environment, handling conditions, the relative abundance of the product at the time, the culture of the society, and socioeconomic factors. To reduce postharvest food losses, all stakeholders in the food value chain such as farmers, traders, processors, and end users must understand the primary and secondary causes involved in food deterioration and spoilage. The use of postharvest technologies such as refrigeration, controlled atmosphere storage, and modified atmosphere packaging that delay senescence, ripening, deterioration and maintaining the best possible food quality are recommended (Emongor, 2014). Reduction of postharvest food losses can increase food availability, decrease the land area needed for production, therefore leading to reduced encroachment on land allocated to wildlife and prevent HWC. Minimizing postharvest food losses is more sustainable than increasing production to compensate for food loss, resulting from poor postharvest handling of food from production to consumption. To achieve this, more funding toward agricultural research, extension, and postharvest handling programs is required in developing countries.

#### **9.2.4.2 Food safety factors**

Food safety is threatened by several factors such as glycoalkaloids, toxins of fungal (aflatoxin, patulin) and bacterial (*Salmonella*, *Listeria*, and *Escherichia coli*) origin, viruses such as Norovirus, parasites (trematodes and prions), heavy metals, environmental pollutants, and pesticide residues (Emongor, 2010). Food contamination can occur at any point of

the food value chain from the farm to fork (harvesting or slaughtering, storage, processing, distribution, preparation, handling, and consumption). Microorganisms release toxic substances to foods leading to food condemnation for human consumption, leading to food insecurity. Consumption of foods contaminated with aflatoxin or patulin has been associated with certain forms of cancer in human beings and other animal species (Hendricks, 1994). Food safety is an important aspect of food security and nutrition. WHO (2006) developed five keys to safer food manual, which has been translated into many languages of the world with the goal of promoting safe food handling and educate food handlers and consumers, thereby leading to prevention of foodborne diseases. Microbial contamination of food is ranked top by public health authorities and scientists, whereas many consumers rank pesticide residues as the most important safety concern (Emongor, 2010; Emongor et al., 2010). Generally, horticultural, agronomic, and fodder crops are free of human and enteric pathogens, unless fertilized with sewage effluent or sludge (Emongor, 2009). Organic manures must be completely decomposed before application to horticultural and agronomic crops especially those eaten as salads to avoid the risk of contamination with bacteria (*Salmonella*, *Listeria*, *E. coli*, fecal coliforms), viruses, and other pathogens such as worms (tapeworms, hookworms, roundworms, and threadworms) (Emongor, 2012). In order to achieve and maintain food safety, the focus should be on maintaining high standards of hygiene and sanitation at all levels of the food value chain. Strict adherence to good agricultural practices also helps in minimizing chemical and physical hazards along the food value chain (Emongor, 2012). The health of the workers handling horticultural produce consumed raw is also important in reducing microbial and other pathogen contamination hence increased food security.

### 9.2.5 Contribution of wildlife to household food and nutrition security

Wildlife contribution to the economies of African countries through tourism and sale of wildlife products has been well documented. For example, in Kenya wildlife and related activities contribute 12% of the gross domestic product (GDP) (the Republic of Kenya, 2018). Results from a study carried out in Ghana, Rwanda, Uganda, and Tanzania showed that geographic location influenced whether rural households could collect wild foods from the wild areas or not. Households located near wildlife sanctuaries collected wild food from forest areas to supplement rural household diets and income. The wild food collected also contributed to dietary diversity (Cooper et al., 2018; Alders and Kock, 2017). In view of the previous discussion, policies formulated to conserve natural resources in these areas may limit access of local communities to the food resources they desperately need if not well thought out. These communities neighboring the game parks, game reserves, and other conservation areas may not be able to access wild food products from these gazetted areas. Limited access by these communities may interfere with access to food, leading to food and nutrition insecurity, and reduced food diversity for these households, which might lead to poor health of men, women, and children who depend on proteins from wild animals and plants.

Apart from food, households in rural regions that border conservation areas also obtain other benefits such as ecosystem services, water, and wild products. For example, communities especially the rural poor who live near-natural forests obtain diversified products and ecosystem services from the forests, which sustain their livelihoods. Among the activities that contribute to the livelihoods of communities, near-natural forests include gathering firewood, preparing charcoal, fishing, hunting, collecting materials for making handicrafts,

and accessing nontimber forest products such as medicinal plants, fruits, and rubber, among others. Other products obtained by these households include food products such as mushrooms and honey, medicines, fodder, fibers, fuels and timber for construction, fencing, and furniture (FAO, 2010). These products may be sold or used at household level, leading to improvements in welfare and income of the said households. Therefore lack of efficient management systems and utilization of the natural resources may lead to degradation of these resources and loss of biodiversity, which affect many people far and near regardless of gender, race, age, and level of income. However, the degree of severity of impacts on communities resulting from degraded resources depends on several factors such as the economic status of the household, health, education level, and gender. The effects are even more serious when laws and policies that are intended to safeguard forest areas are unfavorable to women who depend more on forests to get fuel wood, water, and wild foods. This may impact the food security of women and children in developing countries.

### 9.2.6 Gender, wildlife conservation, food, and nutrition security

Gender, wildlife conservation, food, and nutrition security are intricately linked as food production in developing countries is mainly the responsibility of women and girls, yet, women and girls are among the vulnerable groups due to inequality in resource endowments and labor drudgery at the household level. Results of a number studies, documented evidence, showed that when women have control over key resources and actively participate in related decision-making, the prevalence of child malnutrition at the household level is reduced (Rahman et al., 2015; Allendorf, 2007). In addition, when women participate in the

production or marketing of their agricultural produce and keep proceeds from the sales, this tends to increase their incomes and this, in turn, raises their influence in the decision-making process pertaining to the use of income at the household level. This, in turn, leads to improvement in consumption within given socioeconomic and cultural households (Grace et al., 2015; Van den Bold et al., 2015; Ruel and Alderman, 2013). Women and girls are responsible for household chores, farm production, and safeguarding of the environment. Gender is about social attributes and opportunities. It distinguishes the roles and responsibilities done by women, men, boys, and girls within a given society. It is about relationships and decision-making power among the different gender categories. In most societies, women and men normally carry out unique roles and tasks in agricultural production systems. The errands undertaken are gender-specific (O'Sullivan et al., 2014; Quisumbing et al., 2014; Gebreselassie and Haile, 2013; FAO, 2011; Anriquez et al., 2010; AASTD, 2008; World Bank, 2008b). Both men and women depending on a given society or culture have different privileges and tasks regarding different crops, livestock species, and products (Nigussiel et al., 2014; Anriquez et al., 2010; Yisehak, 2008).

In Kenya, agriculture is the mainstay of the economy, providing at least 29% of the GDP and employment for both paid and unpaid workers of about 75% and raw materials for agro-processing or manufacturing. About 80% of the labor force in the agricultural sector in the country is provided by women and girls (RoK, 2009a, 2009b, 2011). This is also true in other developing countries (FAO, 2015; Doss, 2014; Nelson et al., 2012). Women's labor force participating in agriculture in sub-Saharan Africa is recorded to be the highest (Quisumbing and Pandolfelli, 2010). Results of a study on farming in Kenya showed that if women equally accessed farm inputs, education, and experience



compared to their male counterparts, the crop yields would increase by 22%, leading to improved food security. However, balance is required so that women are not exposed to dangerous substances such as pesticides, biological agents, and vectors that can negatively impact nutrition (Gajadhar, 2015; Grace et al., 2015; Turner et al., 2012). This is critical because economic or income-generating activities can easily compromise the quality time spent on child care, child, and maternal nutrition (Johnston et al., 2015; Kadiyala et al., 2014). Hence by empowering women, this can lead to increased productivity, improved child health, nutrition, reduced infant mortality, and access to nutritious and diverse diets (Coleman, 2011).

In Kenya, like in any other developing country, loss of biodiversity affects the different gender categories. Although both men and women are affected, women are most affected because of the multiple roles and responsibilities that they play at the household level. These impacts are seen in increased household labor, poverty, and reduced health because gender and environmental issues tend to be linked in various ways. This is seen in women compromising a disproportionate percentage of the poor segment in the world; both men and women using natural resources differently in accomplishing their defined societal or community roles. There is also a differential treatment of women under legal, political, and social regimes that tend to affect women's ability in effectively managing the resources. Hence, gender inequality tends to alter women's access to assets, public goods, and services meant to increase livelihoods. The presence of assets gap within households tends to dictate the unequal distribution of resources among the different family gender categories. The access of women to employment is also constrained because women are also overburdened at the household level (Nyongesa et al., 2016b).

There are also external factors (changes in demographic trends, globalization, economic development, and climate change) that tend to

exert additional pressure on communities and more so on women. These factors tend to negatively impact both biodiversity conservation and poverty alleviation efforts. Increased population density is known to affect the natural environment seen in increased deforestation, decreased land or farm sizes, soil erosion, encroaching on wildlife habitats, and pollution (Shandra, 2008). The increased rate of farming reduces the time for land being left fallow, decreases land productivity, and increases reliance on biodiversity resources. This forces farmers to expand their farming activities into marginal lands and encroaching on public property to conduct their farming activities. The available fisheries are also severely fished. An increased number of fishers may tend to use marginal areas or destroy fish nurseries and rearing grounds. Thus all these uncontrolled activities due to population increase are a major cause of biodiversity loss in Kenya. It has led to the opening up of forest lands, increased fishing pressure, conversion of mangroves in coastal Kenya, disappearing water sources due to encroachment on the Mau forest, and other impacts to common property resources. This confirms the interlinkage and relationships between poverty, gender, and environmental degradation. It also confirms that as poverty and inequality increase, health decreases and biodiversity loss increases. Unequal economic growth tends to increase poverty within certain population segments especially among women. This increases both poverty and negative environmental impacts. Empowerment of women (Galiè et al., 2017) can thus serve as an approach to improving household food and nutrition security (Verhart et al., 2015; Sraboni et al., 2014).

Studies on empowerment and nutrition have shown that if women earned an income in the household, child and household nutrition would more likely improve compared to when the income was earned by men (UNCF, 2011; Smith et al., 2003). This is especially

critical at this time when agricultural systems are becoming increasingly vulnerable to climate change, variability, and globalization and degradation of the natural resource base. There is also a persistent increase in prices of inputs such as seeds, chemicals, and fertilizers. Women are disproportionately impacted by climate change (Nyongesa et al., 2017). These impacts can be in the form of natural disasters, food security, water security, economic security, and energy security. A better understanding of where such inequities lie could help find ways in which research could help in overcoming barriers to resilient household food and nutrition security in light of wildlife conservation. Gender targeted research using approaches such as Action Learning for Sustainability (Mayoux and Mackie, 2009; Vogel, 2012) and Pro-WEAI tool (Martinez, 2017; Heckert and Kim, 2016; Doss and Caitlin, 2014) could be effectively used in understanding the interlinkages between gender, wildlife conservation and food, and nutrition security.

### **9.3 Food and nutrition security and conservation: Kenyan case studies**

#### **9.3.1 Introduction**

A lot of effort has been made toward wildlife conservation in Kenya in the colonial era as well as after independence up to the current period. These efforts have borne fruit in some areas, whereas in others not much has been achieved. In the following section, case studies from Kenya are given in an attempt to show the link between wild conservation and its effects on food and nutrition security.

##### **9.3.1.1 Contribution of wildlife to the Kenyan economy**

Wildlife is the foundation of the tourism industry in Kenya; therefore wildlife conservation is critical to the Kenyan economy as

wildlife tourism is the bedrock of the tourism industry in Kenya. The tourism sector contributes immensely to the Kenyan economy; 12% to the GDP and 19% of the total wage employment (Vernon, 2010). It contributes significantly to the local and national economies (Udoto, 2012). The government of Kenya identifies the tourism industry as one of the growth engines for the national economy (Wanyonyi, 2012).

Forests found in gazetted areas managed by Kenya Wildlife Service (KWS), the so-called water towers are the important starting place for many rivers, which form a source of water for domestic and for agricultural use in Kenya. These include water catchment areas of Mount Kenya, the Aberdares, Mount Elgon, Chyulu Hills, Marsabit, and the Mau Forests complex. For example, Mount Elgon National Park is an important water source of many rivers in East Africa such as Nzoia and Turkwel. This gazetted game park serves as a vital source of water for millions of people in eastern Uganda and western Kenya. These rivers are also catchment areas for major lakes such as Kyoga, Turkana, and Victoria, and eventually for the Nile River. The people who live near obtain forest products such as wood and nonwood products such as medicinal herbs (Udoto, 2012).

Apart from the previous discussion, wildlife also contributes raw materials for industry and game meat, which contribute to the protein intake of households. The government also earns revenue from wildlife-related activities and wildlife tourism, which creates jobs and consequently has a significant downward large demand for food, leading to agricultural development. Given the foregoing, wildlife conservation, food and nutrition security in Kenya are intricately linked.

##### **9.3.2 Kenya wildlife conservation areas (game parks and national game reserves)**

Kenya's Wildlife Conservation and Management Act provides for three types of wildlife protected areas, namely, national parks; national

reserves; and game sanctuaries. Superintending these protected areas is vested in the KWS. As a state corporation, the KWS was established in 1989 by an Act of Parliament Cap 376. Its mandate is to conserve and manage wildlife and enforce associated laws and regulations. Public forest management falls under the Kenya Forest Service (KFS), a state corporation established under the Forest Act 2005, and the mandate of KFS was increased under the Forest Conservation and Management Act of 2016. The mandate of the KFS is to ensure conservation, protection, and management of all public forests. Therefore KWS and KFS are key institutions in the management and conservation of natural resources in Kenya.

In wildlife management and conservation, the country has 54 national parks and game reserves (Fig. 9.1). Located in the capital city of Kenya, the Nairobi National Park is a national park that has close proximity to the capital. It, therefore, attracts a large number of both local and international visitors earning government revenue. The Nairobi National Park is rich in biodiversity, hosting a variety of Africa's best known wild animals such as giraffes, zebras, ostriches, lions, baboons, cheetahs, and endangered species of black rhinos and white rhinos (MoDP, 2013). Its sustainability is however threatened by the accelerated pace of urbanization and development. Kajiado and Narok counties, located in the Southern border of Kenya, have large tracts of land dedicated to wildlife conservation. The counties boast of a wide range of wild animals, which include wildebeests, gazelles, zebras, warthogs, hyenas, giraffes, elephants, lions, leopards, and elands, in an area surrounded by human settlement. Areas designed for game reserves are Amboseli National Park, which covers a total area of 392 km<sup>2</sup>, and Chyulu conservation area in Makueni County covering an area of 445 km<sup>2</sup>. These areas fall within the

rangelands (MoDP, 2013). These areas support wildlife conservation as well as agricultural activities by communities that dwell in the proximity of the game parks and game reserves and hence support the livelihoods of the people.

### 9.3.3 Human–wildlife conflicts in Kenya

HWC is the interaction between humans and wildlife, which leads to negative economic and social impacts of communities in Kenya and other parts of the world (FAO, 2014). This is a problem that is experienced in many areas of the world where people and wildlife interact and share limited resources. When humans and wildlife compete for limited resources, a lot of undesirable impacts such as destruction or disruption of human life and livelihoods occur. The conflict involves people and their property on one side and wildlife on the other. It also includes interference of the rights of individuals, groups or community, and wildlife. HWCs may lead to food insecurity as wildlife move into human spaces and destroy crops and livestock. This may impoverish farm households dwelling near wildlife reserves. The types of conflicts include predation, crop destruction, property destruction, and destruction of human life. These have an impact on food and nutrition security of affected households and may lead to increasing poverty in these areas.

As wildlife habitats are lost, there is intensified competition between wildlife and humans, since the wildlife is confined into smaller pockets of suitable habitat. Direct or indirect alteration of the quantity or quality of wildlife habitat as a result of human activities such as agriculture, fishing, cutting trees for timber, infrastructural development including roads and railways and building tourism hotels further compromise wildlife habitats. Other habitat changes may be caused by natural factors

Kenya wildlife service conservation areas

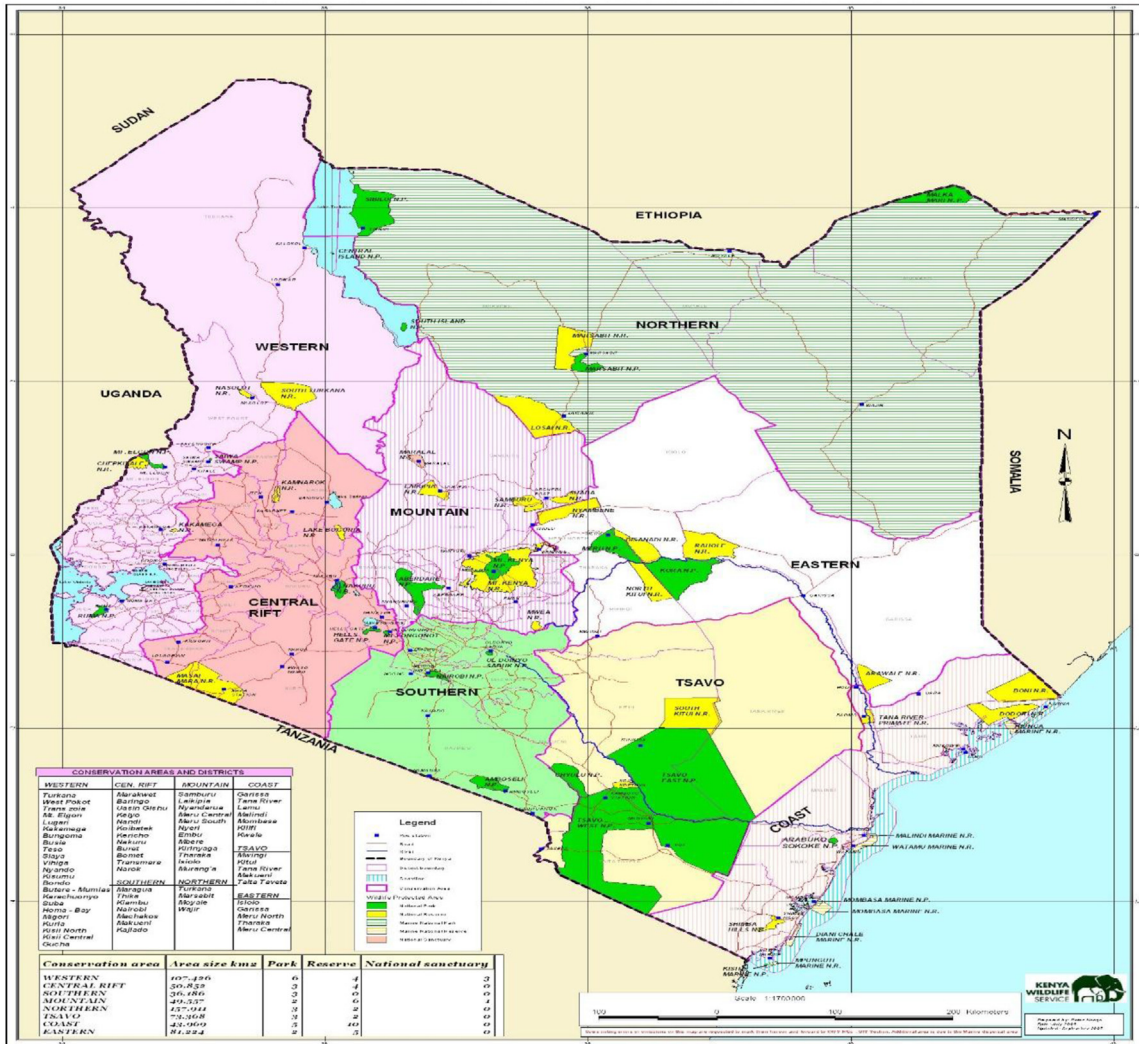


FIGURE 9.1 Map showing wildlife conservation areas in Kenya. Source: Kenya Wildlife Service (2019).

such as drought, bush fires, and climatic change. Changes in human attitudes and perceptions toward wildlife and their habitats also play a key role in altering wildlife habitats. For example, some people see wildlife purely as an economic resource that is available for their use without cost implication, leading to the

indiscriminate destruction of species such as elephants and rhinos for their valuable tusks and meat, resulting in a reduction of their numbers and in some cases extinction. Landowners, other land users, and some wildlife managers still sometimes deliberately kill wildlife species that they consider to be a

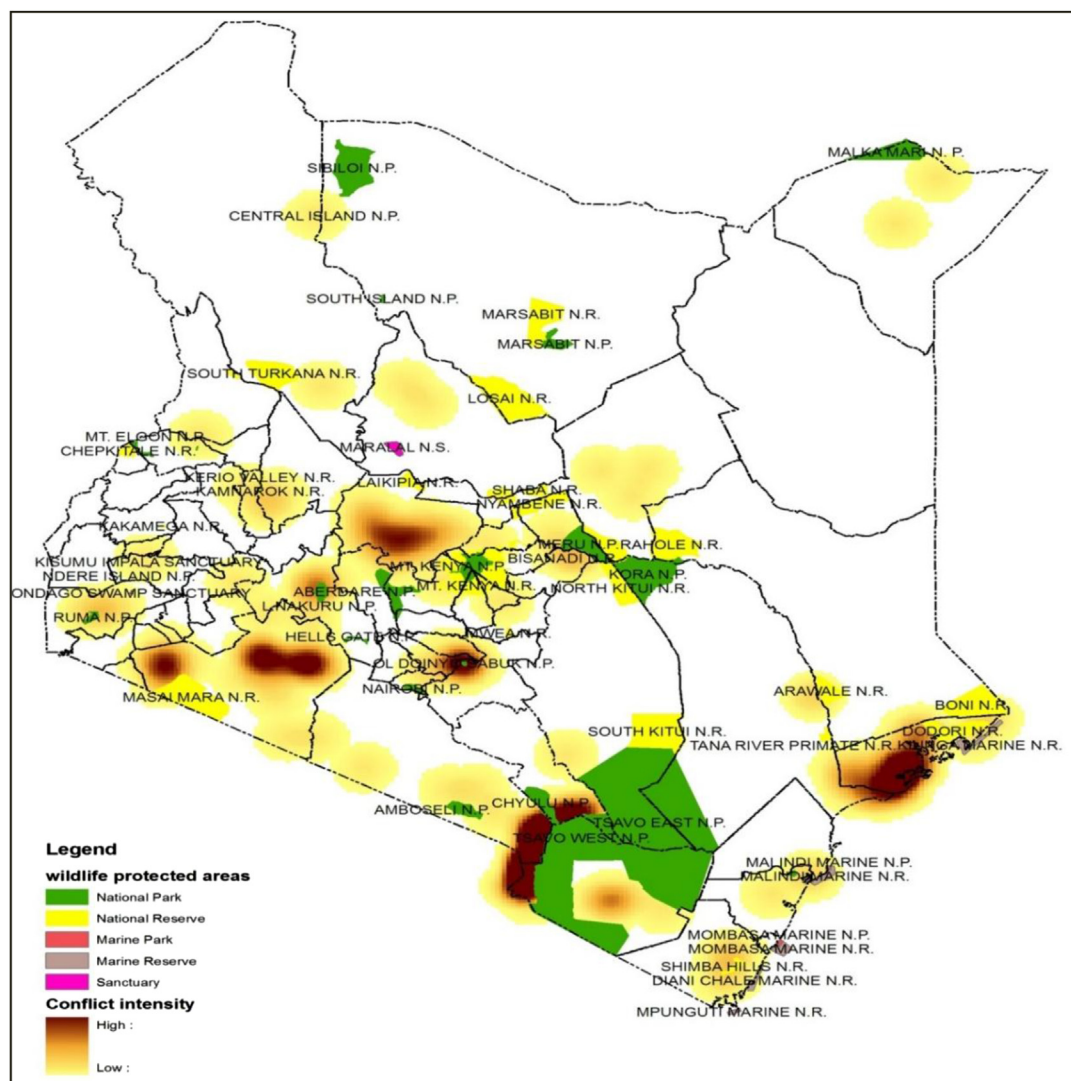


FIGURE 9.2 Human–wildlife conflict hotspots in Kenya. Source: Kenya Wildlife Service (2019).

threat. Extermination of large carnivores has been linked to human–lion conflicts as pastoralists retaliate when their livestock is attacked by the animals.

In Kenya, HWCs have been on the increase. In some parts of Kenya, HWC is prevalent and these areas are hot spots as shown in Fig. 9.2. These areas are usually close to wildlife

sanctuaries such as game parks and reserves. Areas, where HWC are prevalent, include Laikipia, Transmara, Tsavo East and West, Lamu, Meru, and Amboseli region.

As already alluded, HWCs have been on the rise in Kenya. These trends have been due to land-use modifications and wildlife habitat loss resulting from the increasing human

population. This trend has been observed in many areas of Kenya where wildlife and humans live close to each other. In some instances, some wildlife species are on the verge of extinction. As the human population increases, the need for human development increases as well, resulting in increased competition between humans and wildlife for the same resources. The deforestation of forests and other ecosystems for other uses such as agriculture and human settlement lead to declining space for wildlife. As both wildlife and human populations increase, there is an amplified competition for water resources and increased poaching for game meat and trophies by humans, which lead to declining animal species. Migration of people for various reasons such as insecurity or in search of food as a result of natural disasters for example droughts, floods, civil unrest, or war disrupts the production and distribution of food. War and civil unrest destabilize people forcing them to seek shelter in protected areas. The large influx of people in these fragile environments leads to the destruction of natural resources. Frequent droughts and resulting desertification of the land may contribute to food and nutrition insecurity in the regions where these internal migrants have settled.

### 9.3.3.1 Human–wildlife conflict in the Tsavo conservation area

The Tsavo conservation area (TCA) covers Tsavo East National Park which stretches from south Kitui National reserve in Kitui County to Mkomazi Game Reserve in North-eastern Tanzania, through Taita Taveta county, Tsavo West, and Chyulu National Parks, which stretch from Kibwezi forest in Makueni County, Kajiado county all the way to Kenya–Tanzania border. These areas form natural boundaries that limit the distribution of elephants and other wildlife species. With an area of 40,000 km<sup>2</sup>, the ecosystem hosts the largest wildlife populations in Kenya. Tsavo East and

West National Parks cover approximately 22,000 km<sup>2</sup>. The remaining area is occupied by private ranches, wildlife sanctuaries, sisal plantations, farming settlements, and ecotourism enterprises. All these areas have become a hot-spot for HWCs. There has been an increasing trend in HWCs in the TCA as shown in Table 9.1. The main impacts of the HWC in the TCA include the destruction of crops, loss of animals, and infection of livestock with zoonotic diseases, which result in loss of income

TABLE 9.1 Trends in human–wildlife conflicts in Tsavo conservation area.

Year	No. of reported cases	Crop damage cases	Livestock death cases
1990	21	9	2
1991	30	22	3
1992	40	29	5
1993	59	52	4
1994	90	72	9
1995	810	570	61
1996	1056	299	45
1997	1234	817	122
1998	725	396	119
1999	990	580	116
2000	1428	931	128
2001	1337	944	88
2002	1759	1305	108
2003	1218	896	63
2004	1458	1018	129
2005	1640	1027	150
2006	1745	741	99
2007	12,860	666	112

Note: crop and livestock deaths do not add to the number of reported cases, in some other cases such as injury and deaths of humans are not detailed.

Compiled from data from KWS.

as farmers have to pay for disease control and treatment of infected animals. There is also loss of grazing resources, loss of water facilities, and farm structures as well as the loss of human life and injuries, which might further jeopardize food production as farmers use their finances to treat those attacked by wildlife. In cases where there is a loss of human lives, the affected households are impoverished. All this impacts the food and nutrition security of communities and threatens wildlife conservation efforts (Makindi et al., 2014).

### **9.3.3.2 Human–wildlife conflict in Maasai Mara and adjacent group ranches**

A study was carried out by KWS to investigate the status of the conflict in four study sites in both wet and dry regions of the Maasai Mara ecosystem. The aim of the study was to identify and validate the best-bet strategies to mitigate HWCs through participatory processes within the Mara ecosystem. This objective was achieved using various methodologies: (1) documenting the status of HWCs associated with resource use in different land-use zones in the Maasai Mara, (2) identifying and documenting the current actions of resolving resource-use-related conflicts, (3) identifying sociocultural loss and gains if any related to HWCs and its implications to peoples livelihoods, (4) documenting existing strategies and mechanisms aimed at managing resource-use-related conflicts, (5) validating best-bet practical solutions to mitigate HWCs, and (6) recommending best policy recommendations to enhance best mitigation strategies for improved livelihoods and human–wildlife coexistence in the Maasai Mara ecosystem.

The study area was in Narok County. The county lies between latitudes  $0^{\circ} 50'$  and  $1^{\circ} 50'$  South and longitude  $35^{\circ} 28'$  and  $36^{\circ} 25'$  East. It borders the Republic of Tanzania to the South, Kisii, Migori, Nyamira, and Bomet counties to the West, Nakuru County to the North, and Kajjado County to the East. The county headquarters is at

Narok Town. The county covers an area of  $17,933.1 \text{ km}^2$  (Narok County Government, 2018). This area forms part of the Maasai Mara savannah ecosystem. The Mara Ecosystem houses an important tourist attraction; the Mara Serengeti Wildebeest migration which is the seventh wonder of the world. This region has been subject to considerable vegetation changes due to change in climate and human activity. The vegetation cover of Mara ecosystem consists of a mixture of forest and woodland with scattered bushes. The Mara ecosystem is rapidly being transformed into cultivated land and other uses. The current land uses in the area include pastoralism, tourism, and agriculture (Narok County Government, 2018; Muchane et al., 2012).

The Maasai Mara National Reserve (MMNR) covers a total of  $1368 \text{ km}^2$  and is owned by the Government of Kenya. The game reserve is managed by the Narok County Government. Maasai Mara game reserve is home to a variety of wildlife including wildebeests, gazelles, zebras, warthogs, hyenas, giraffes, elephants, lions, leopards, and elands. There has been an increase in the human population in the region leading to increased encroachment into the reserve, subsequently increased cases of HWC, thus threatening the sustainability of the reserve and the tourism sector at large, and also food and nutrition security of the people (Muchane et al., 2012).

The land within the MMNR comprises natural woodland and grassland, primarily a wildlife tourism restricted area. The reserve is one of the conservation areas in the country and is surrounded by group ranches communally, privately, or individually owned. The private and/or communal owners engage in diverse enterprises, mainly pastoralism, agriculture, and wildlife tourism. However, lack of enforcement of land-use policies for the woodland and grassland areas surrounding the park has resulted in increased human disturbances in the form of overgrazing, firewood collection, and unsustainable small-holder agriculture. The agricultural activities have attracted wildlife from the communal ranches,

which spill into the farmlands during the dry season in the search of food.

This has intensified conflict, in a region that was previously characterized by a sustainable and harmonious existence between humans and wildlife. Intensified mechanized production of select commercial monocrops, with heavy external input use, has also altered the biodiversity composition around the MMNR. The biodiversity alteration has led to reduced availability of feed for the wildlife as well as the livestock, seasonality of rivers, and subsequently endangered the sustainability of the reserve and food and nutrition security of the growing population in the area (Muchane et al., 2012). The situation has been exacerbated by socioeconomic and political marginalization, inadequate land tenure policies, insecurity, increase in availability of small arms and light weapons cattle rustling, weakened traditional governance of the pastoral areas management surrounding the MMNR, which in turn make the region vulnerable to climatic variability (less food for humans and less forage for the livestock and wildlife; Okech, 2010).

### **9.3.3.3 Status of human–wildlife conflicts in mountain conservation areas**

Increasing human encroachment on wildlife and forest resources in Kenya's mountain conservation areas has led to a new dimension in the management of these resources. In the 1960s, it centered on local overpopulation of elephants in National Parks, while in the 1970s, 1980s, and 1990s, the main issue was the impact of illegal hunting for ivory on elephant populations. In recent years, conflicts between humans and wildlife have emerged as a primary conservation concern. Although estimates vary, large numbers of elephants, buffaloes, and other wildlife species inhabit the Mt. Kenya ecosystem (Waithaka, 1994). Elephants and other large mammals occur nearly all over the mountain, but the densities vary considerably from place to place. Waithaka (1994) reported that

the Aberdares National Park had a high density of elephants that had been blocked from their seasonal traditional migrations through the plains of Laikipia to Mt. Kenya.

Historically, elephants probably moved into and out of Mt. Kenya in all directions. Mountain forests play many vital roles as water towers in the country (Kenya Water Towers Agency, 2018). These water towers provide various benefits to people. The water towers are important in Kenya as they provide critical ecosystem services. The other critical roles played by these water towers include capturing and storing rainfall, maintaining water quality, regulating river flows, and reducing erosion. The water towers are also important sources of wood and other forest products, providing many environmental services including protection against natural hazards, landscapes for tourism, recreation, and absorption of greenhouse gases from the atmosphere. A valuation of the Chyulu and Mau East water towers showed that they are of great value and contribute the following: goods and services (8%), tourism (52%), Carbon sequestration (21%), and other services (19%). Given the above, water towers are very critical to the survival of local communities far and near to these hills. These mountain areas face a number of threats such as encroachment on the gazetted forest areas of the mountains, deforestation whereby the forest cover in these forests has declined by up to 40%, and land degradation (Kenya Water Towers Agency, 2018). All these have an impact on the availability of water in the country. Reduced water availability is a threat to food production and hence food and nutrition insecurity of rural households.

### **9.3.4 Biodiversity destruction and climate change: Mau ecosystem**

Located in the eastern Rift Valley of Kenya is the largest closed-canopy indigenous montane forest in East Africa (Bird Life International,



2013). The forest comprises seven forest blocks, namely, South-West Mau, East Mau, Ol'donyo Purro, Transmara, Maasai Mau, Western Mau, and Southern Mau. Approximately 25% (107,707 ha) of the originally gazetted forest area of 452,007 ha has been converted to settlement and farmland (Republic of Kenya, 2009a, 2009b). Through excision and encroachment, the original gazetted forest land area has continued to decrease (Republic of Kenya, 2009a; NEMA, 2013).

The Mau complex is the single-most critical water catchment in the Rift Valley and western Kenya and a major source of numerous rivers. At least 60% of the water draining into Lake Victoria, for example, has its source from the Mau forest. Lake Nakuru National park, MMNR among others are a primal tourist destination in Kenya, which is sustained by water from the Mau forest (Republic of Kenya, 2009b). The forest is therefore, an important national and continental water catchment. Management and conservation of the Mau Forest complex is a crucial provider of ecological services to the country. These services include regulation of river flow and recharge of groundwater and hence mitigating against floods; water storage; reduction of soil erosion and siltation, enhancing water purification; biodiversity conservation; and regulation of microclimate (Republic of Kenya, 2009b). This position the Mau complex is not only important in supporting the tourism, construction, and energy sectors but also very crucial for agriculture and food and nutrition security of the communities living around it, the nation at large and beyond its boundaries. The wealth of biodiversity it supports, some of the international conservation concerns, and the invaluable goods and services it provides emphasizes the importance of conserving the complex for the sustainability of its resources and food and nutrition security of the country. The forest is a key habitat to Kenya's terrestrial animal species, including bird species and insects, which

are pillars to food production including moderation of soil and conditions impacting both the tea and coffee industry. Unlike other sectors where water is a vital input, water is an output from the forest.

Despite its importance, the water tower has been highly exploited and continues to be degraded at an alarming rate, threatening the food and nutrition security of many households in the country. This trend is as a result of inadequate institutional mechanisms, policies, and long-term strategic actions to conserve the forest's complex (Republic of Kenya, 2019). The degazettement of portions of the forest enhanced continuous widespread encroachment and ecosystem destruction through settlements, crop cultivation, grazing, illegal logging, and charcoal burning, disrupting the forest's role of being major water storage and output channel to outlying areas. The establishment of large exotic plantations by the government led to a loss of biodiversity by having the monoculture tree species replace the wealth of indigenous forest that has been the identity of the complex (NEMA, 2013). Kenya's economic growth rate is highly dependent on the agricultural growth rate, therefore any reduction in agricultural GDP growth leads to a decline in the economic growth of the country. Increased population growth rate and low access to production resources such as land have resulted in an increased number of local poor people who depend on forest resources. The governments' investment in ecosystem protection has not been increasing, resulting in poor management of natural resources, increasing Kenya's vulnerability to extreme environmental events primarily floods and droughts. The climate change-related environmental events have had a significant influence on Kenya's economic performance as well as on the food and nutrition security of many rural households.

The key drivers of the Mau ecosystem degradation are increased poverty and greed, high

population growth, government institutional failure, political failure, and changes in economic policies. Devastating effects of the degradation and the resultant increased cost to the government caused by the degradation have contributed to increased efforts to restore the “water tower.” The government has constituted a team to revert the situation by managing the indigenous forests including Mau forest for water and soil conservation, provision of forest goods, and services for biodiversity conservation (Republic of Kenya, 2019). This has started by the eviction of illegal settlers. Removal of illegal squatters from Mau forest is an emotive and political issue as many of the people being removed claim that they do not have alternative land to move to. This obviously impacts the food and nutrition security of these households. The local NGOs are supporting government efforts by enhancing transparency in project operations, accessing required information, strengthening capacity for law enforcement, and engaging local communities, schools, and other partners.

### 9.3.5 Impacts of human–wildlife conflicts on food and nutrition security in wildlife areas in Kenya

There are various HWCs with varied impacts on sustained availability of desired food in the right amounts and quality experienced in wildlife conservation areas and counties where wildlife and the population interact (Mukeka et al., 2019). HWCs have manifested in various ways in different parts of the country with varying effects. These include the following.

#### 9.3.5.1 Predation

Samburu County has a large and growing population of settled and semisedentary pastoralist communities living on group ranches. Livestock husbandry is the main livelihood

and due to the presence of many predators ranging from lions, cheetahs, leopards, hyenas, and wild dogs, predation is very high. The domestic animals are owned by the local people; hence a conflict against their livestock is a conflict against their wealth and food security. As a result, the communities attack and kill the wild animals such as lions, leopards, and spotted hyenas as retaliatory measure (Kissui, 2008). The number and type of domestic animals killed by wildlife depend on the species, seasons (time of the year), and availability of natural prey (alternative wildlife that the predator can feed on, other than the domestic animals). Hyenas, leopards, and wild dogs are known to kill sheep and goats, whereas lions tend to kill cattle. Therefore increased predation results in the destruction of both livestock and wildlife and subsequently impoverishment of the farming communities reducing food availability. This makes them more vulnerable and reliant on food aid to survive, and increased poverty among such pastoral communities that depend on livestock for their food and nutrition security.

#### 9.3.5.2 Crop destruction

Human agricultural activities are spreading rapidly leading to the destruction of natural habitats, alteration of rangeland landscapes, and increased crop raiding by wildlife, an important cause of farmers–wildlife conflict the world over. In Africa specifically, there is a high dependence on the farm for survival by a large proportion of the human population. As humans encroach more into the natural habitats of wildlife, there is an increased conflict between people and the wildlife, and especially the larger herbivores that can often raid farms in search of forage (FAO, 2009). The crop-raiding incidences and regularity are dependent on a number of factors including vicinity of the farm from the protected area, type of food crops and preference for the crop, human activity at the time on the farm, and the

time of maturation of the food crops compared to the availability of the wild animals' natural forage. However, wildlife has been known to prefer certain domestic crops such as bananas and sugar cane for elephants, such that when these are available in close proximity, they tend to raid the crops irrespective of the presence of other natural forage. Crop destruction leads to food insecurity in the affected households.

### **9.3.5.3 Property destruction**

Property destruction is another form of conflict where wildlife destroys peoples' properties such as fences, water pans, dams, water pipes, and other types of properties. The occupation of areas that were previously dispersal wildlife areas by the ever-increasing human populations and the further subdivisions of these areas through the use of fences reduces the area available for wildlife activities. The communities regard agricultural activities as being more profitable and beneficial, leading to incompatible changes to land use and consequently, the wildlife destroy the erected fences and other property. The big animals such as the elephants, elands, and zebras are the animals causing the greatest HWC, in turn jeopardizing the wildlife conservation efforts as well as food security of the communities. For sustainability, there is a need for joint efforts in minimizing the conflict and establishing conservation projects that benefit both the communities and wildlife.

### **9.3.5.4 Effect of conflict on humans**

Human beings have remained the most emotive and vulnerable casualties of HWC. Reports of human deaths, injuries, and threats are common. Wildlife often strays into the footpaths where humans use and potentially cause physical injury or hinder them from undertaking their daily errands. Incidences of wildlife preventing students from going to school and those going to the market centers are common.

Buffaloes, elephants, and lions are the major threats, and the majority of conflicts are along the roads or in watering points.

## **9.3.6 Mitigation of human–wildlife conflict for improved food and nutrition security in the conservation areas**

Some effort has been done to resolve the issues of HWC in conservation areas to prevent loss of livelihoods for humans and also to avoid loss of wildlife, both wild animals and wild plant species. Some of the mitigation measures are undertaken by KWS include the following.

### **9.3.6.1 Electric fencing**

Traditional methods devised by communities for deterring crop-raiding elephants such as the use of fires, brush fences, and loud noises have generally been unsuccessful (Ndlovu et al., 2016) requiring other methods to be used such as electric fencing. The use of electric fences and other barriers to prevent the movement of elephants into arable land are becoming increasingly vital conservation tools. For example, electric fences are extensively used as conservation tools in Kenya (Thouless and Sakwa, 1995). In 2005 the total length of the existing electric fence in wildlife protected areas in Kenya was 1080 km, and it has increased substantially since then. Large fenced areas include Shimba Hills, Kimana, central Laikipia, parts of Mount Kenya forest, Meru, and Tsavo East. The completed Aberdare fence is the longest game fence in Kenya, extending more than 400 km. Unfortunately, not all electric fences projects have been successful in deterring animals in raiding farms. Due to the ineffectiveness of electric fencing, some have been so ineffective that they have been abandoned, while others have reduced conflicts, but failed to eliminate the problem of crop raiding (Waithaka, 1994). Despite the

large sums of money invested in capital and recurrent costs of fencing, there has been a very little formal documentation of the success or failure of these fences, or of the impact of the fences on the protected biological resources and the socioeconomic implications on the communities living in the adjacent farms.

### 9.3.6.2 Formation of community conservancies

Formation of community conservancies in wildlife areas was aimed at addressing HWC and at the same time have the local communities derive some income from wildlife. For example in Samburu County, the following conservancies were formed: Namunyak, Meibae, Sera, Kalama, West Gate, Nkoteiya, Ltungani, Malaso, Angata Nanyukie/Morijo, Kalamudang, Mt. Nyiro, Elbarta, Ndoto, Kirisia, Sera Rhino sanctuary, Reteti elephant rescue center, and Maralal Game sanctuary. The conservancies have staff (community scouts) most of whom have been trained at KWS Law enforcement Academy whose duties

include HWC resolutions as well as ensuring the security of wildlife in those areas.

### 9.3.6.3 Formation of response teams

KWS has formed several outposts in various hotspot counties to respond to HWCs whenever and wherever they arise. For example, in Samburu County, outposts have been formed in Maralal town, which is the headquarters, and others are Wamba, Suguta, Baawa, Ltakweny, South Horr, and Serolipi, each having staff ranging from two to four, tasked with responding to HWC issues. Their activities include scaring of the animal away from human settlements/farms, trapping problematic animals especially predators and translocating them away from the conflict areas using traps as shown in Fig. 9.3.

## 9.4 Imperatives and challenges

The natural resources of Kenya, which includes its wildlife and habitats are critical for the social and economic development of



**FIGURE 9.3** An example of a trap that is used in human–wildlife conflict resolution. *Source: Kenya Wildlife Service (KWS) (2019).*

the country. These resources are critical for the economic development of the country as they are important for the development of the tourism industry that attracts millions of tourists to the country annually. The tourism industry, which in turn, creates employment for thousands of Kenyans as well as spillover effects such as increased demand for food, which drives the growth of the agricultural sector. The protected areas support wildlife (both plants and animals) biodiversity, which provides ecosystem services for the people such as water, wild foods, and tourism sites, which are very important for food and nutrition security as well as sustainable development of the nation. The proportion of wildlife outside protected areas in the country constitutes 65%. Kenya has the third largest population of rhinos in the world in 2017. The country's 35,548 (8.5%) elephants constitute the fourth largest population in Africa after Botswana, Zimbabwe, and Tanzania (Republic of Kenya, 2018). Tourism in the country is one of the biggest foreign exchange earners.

Wildlife management and conservation are therefore a priority if Kenya has to maintain or improve its earnings from the tourism industry as well as providing ecosystem services to the growing human population. Wildlife conservation and management in the country are meant to preserve the ecosystem for esthetic, scientific, and economic purposes (Republic of Kenya, 2012). According to the national wildlife conservation strategy 2030, Kenya has a rich and unique flora and fauna that contribute to the well-being of the Kenyan people by providing a number of ecosystem services as well as economic growth. Therefore the conservation of these resources is necessary even for future generations. The Government of Kenya is committed to the sustainable management of the country's wildlife resources, so as to contribute to the development of the country and enhance the livelihoods of the Kenyan people, for this to happen conservation of natural resources is a

prerequisite. There is a need for commitment by all stakeholders (the government, private sector, communities, landowners, and individuals) to safeguard this natural heritage of diverse landscapes and natural resources as the foundation of the country's collective development—both now and in the future. If this is not done, these resources can be lost forever for Kenya and also the world. The concerted efforts must be well directed toward addressing both the threats and also identifying opportunities emanating from wildlife conservation and management in order to achieve sustainable development.

However, there has been an increased loss of habitat as well as wildlife due to a number of factors such as increasing human population pressure, poverty, rapid development in key wildlife areas, and overutilization of natural resources. Further, all these factors weaken the achievement of sustainable development and attainment of food security and nutrition in the country. Therefore there is an urgent need to address these threats and emerging challenges holistically in order to preserve wildlife conservation areas. The country must protect the irreplaceably valuable natural resources on which its sustainable development depends.

Water availability, quality, and quantity have been on the decline further threatening agricultural productivity, food security, and rural livelihoods. Climate change and related impacts have led to the destruction of road infrastructure by frequent and heavy rains and floods, whereas in some cases increased droughts, which threaten both humans and wildlife. High population growth rate leads to rapid urbanization and pressure on land manifesting itself in HWC. This strains the available education and health amenities and increases crime rate due to unemployment, poaching of elephants and rhinos due to their valuable tusks, and mushrooming of informal settlements in urban areas. Encroachment of forested areas has resulted in major HWC in many areas that result in the destruction of farm crops by animals especially elephants. Wildlife in

the unprotected areas is a major impediment to the farming communities. The wildlife menace manifests itself in crop damage, death of livestock, loss of human lives, and infliction of physical injuries to people. As a result, many families have been impoverished. The ever-increasing wildlife menace and the resultant destruction of crops and transmission of diseases to livestock discourage agricultural production. The national government must ensure that national park fences are maintained and secured to discourage encroachment by people, and a comprehensive compensation package for damage to crops, property, and human life is given.

## 9.5 Conclusion

Wildlife conservation and food and nutrition security are in increasing competition due to increased human population and demand for agricultural and development land for settlements. In order to achieve wildlife conservation and food and nutrition security in Kenya and other African countries, a holistic, multi-disciplinary, and integrated approach to sustainable agricultural production must be adopted. This will involve developing new and appropriate, innovative, and sustainable production techniques that take wildlife, biodiversity, and environmental into consideration. This will require that all stakeholders involved in agriculture, health, natural resources, education, and infrastructure development should work as a team for sustainable safe food production that is wildlife and environment friendly. Because wildlife conservation and food and nutrition security are intricately linked, the Kenyan government should create and implement appropriate environmental policies with established legal, institutional, and technical frameworks for sustainable management and conservation of wildlife in protected areas.

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