THE WILDLIFE-LIVESTOCK-HUMAN INTERFACE, LEGISLATION AND ITS IMPACT ON COMMUNITIES AROUND MOSI-OA-TUNYA NATIONAL PARK IN ZAMBIA

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ABSTRACT

The main thrust of this study was to assess wildlife legislation in relation to conservation and control of animal diseases, and socio-economic impacts on interface livestock keeping communities. The study was structured in two phases. The first involved review of available wildlife/ancillary legislation from 1912 to 2014. The second involved a questionnaire survey on interface livestock keepers around the Mosi-oa-Tunya National Park in Zambia.

Reviewed data showed that enactment of wildlife legislation over this period responded to increased poaching trends, and depletion/extinction of species like the rhinoceros. Subsequent amendments of legislation increased enforcement powers, autonomy and transfer of decision-making to the wildlife Authority. Provisions for communities' participation in enforcement remained weak. Ancillary legislations provided for control of diseases of wildlife origin.

This study showed disconnect in implementation of legislations, amplifying their negative socio-economic impacts on interface livestock keepers, and demonstrating unsustainable development. Comprehensive nationwide multi-sectorial regulatory impact assessment was recommended.

Keywords: Disease, Impact, Legislation, National Park, Interface, Zambia.

INTRODUCTION

Wildlife Conservation in Zambia

Colonial wildlife conservation in Zambia started during the 1910s, although the declaration of Kafue National Park as the first game park only happened in 1950 (Chansa, Mwenya & Nyirenda, 2011). Wildlife legislation has since been amended several times (Chansa *et al*, 2011) and much subsidiary legislation passed to support the main Act, addressing matters as they arise. Zambia's wildlife conservation areas occupy 32% of the land area, located across all the 10 provinces (Fernández, 2010), and categorized as National Parks (NP), Game Management Areas (GMAs), and Open areas (where Game Ranches and zoos are located). There are 20 NPs in Zambia occupying a total area of 63,585 km^2, and 36 GMAs occupying about 162,000 km^2 (Chansa *et al*, 2011; Saiwana, 1995) located between NPs and open areas (OAs) where they act as buffer zones (Fernández, 2010; Simasiku *et al*, 2008).

Most NPs and GMAs are located proximal to some key livestock producing regions, and harness important water resources, such as Kafue flats, Barotse flood plains, Mweru Wantipa swamps, Victoria Falls and the Bangweulu swamps, which have rich flora suitable for supporting wildlife. However, these characteristics are also attractive to livestock keepers, especially during the long dry seasons and periods of drought (Munyeme *et al*, 2008). This results in very close interaction between livestock and wildlife, creating a large interface and opportunity for disease transmission. It also brings about conflict between wildlife authorities and the communities especially when it comes to sharing of common pool resources (CPRs) (Marks, 2009; Sutton, Larson & Jarvis, 2004). This situation also makes wildlife protection more complex, and poaching appears to be more rampant amongst these communities (Simasiku *et al*, 2008). Game ranches, though an upcoming method of wildlife conservation (Chansa *et al*, 2011), do not yet occupy significant land areas in Zambia.

Wildlife plays an important role to Zambia's economy and national development, being a major part of the resource marketed in Zambia's tourism. Tourism is a foreign exchange earner identified by government as one of the sustainable alternative national income sources to copper mining (Pandey *et al*, 1995), although its full potential has not yet been realized (Hamilton *et al*, 2007). This places the wildlife sector in a key economic position, as evidenced by a three-fold increase in the number of tourists that visited Zambia over the past 2 decades (CSO, 2012). Wildlife also plays a more important economic role in the rural communities, especially those living in close proximity to NPs and within GMAs.

The Livestock Sector in Zambia

A good number of livestock diseases of economic importance are maintained among wildlife and are transmitted at the wildlife-livestock-human interface. This is reinforced by the fact that, about 70% of the households living in the interface areas practice livestock keeping (Fernández, 2010). With the current policy by government towards the improvement of livestock production and creation of livestock disease free zones, it is imperative to consider the important role that the interface plays in livestock disease outbreaks. It is equally important to evaluate the current legislation that provide for the control of such diseases in these areas.

The Wildlife-livestock-human interface

This is an area where livestock producing communities have a constant and direct or indirect interaction with wild animals. Defining the physical interface is critical to understanding disease transmission dynamics among wildlife, livestock, and human populations. Wildlife usually avoids livestock and human contact unless habituated (Kock, 2002). Disease interface between wildlife and livestock is not always by direct physical contact or mingling but also indirect, through soils, forage, water sources, insect vectors and intermediate hosts. This interface has existed for hundreds of years, maintaining a complex coexistence. In recent years however, the management of livestock, wildlife and environment at the interface has presented a challenging scenario in the integration of development and environmental conservation in Sub-Saharan Africa [AU-IBAR, 2009; Hazzah, 2006; Tschopp *et al*, 2010). Key challenges include increasing conflicts over natural resources, increasing land degradation and loss of wildlife diversity and populations (AU-IBAR, 2009), and more risks of disease transmission created in cases when wildlife protection results in overabundance of wild animals (Gortázar, Acevedo, Ruiz-Fons & Vicente, 2006).

In pre-colonial Zambia, this interface was sustained by community's dependence on wildlife (Chansa *et al*, 2011). After the establishment of National Parks, restricted access to wildlife resulted in reduced interaction between humans and wildlife, and brought about conflict between wildlife authorities and rural local communities. However, the institution of community-based natural resource management (CBNRM) policies in the GMAs coupled with the effects of climate change on weather patterns and availability of grazing land, there has been an increased interaction between humans and their livestock, with wildlife (Simasiku *et al*, 2008). Trends towards human population increase in interface areas are partly owed to improved livelihood and governments' provision of better social amenities (Chansa *et al*, 2011; Fernández, 2010). The presence of wildlife in almost all tourist destinations in Zambia and particularly at Mosi-oa-Tunya NP adds a dimension of international importance, because the dynamics of emerging and re-emerging diseases are favored by interaction of people from various parts of the world; as such interaction plays an important role in worldwide spread of disease. It is therefore important that policies toward prevention of disease transmission in such areas are up-to-date and capable of reducing the transmission risks to acceptable minimal levels to allow sustainable development.

Wildlife, Livestock and Zoonotic Diseases

Diseases from or with a wildlife origin can be classified as species specific, trans-species or zoonoses. Most wildlife diseases can also occur in livestock of same species as affected wild animals (Ruiz-Fons *et al*, 2008). There is also a rising concern about emerging and re-emerging diseases in recent years, most of which appear to occur at the fertile livestock-wildlife interface (Gortázar *et al*, 2007). Wildlife diseases become very crucial when they appear to affect wild animals, domesticated animals, and humans (zoonoses such as anthrax). Wildlife-related zoonoses are diverse and complicated requiring close collaboration among ecologists, veterinarians and public health professionals (Gortázar *et al*, 2007; Magalhães *et al*, 2010). Wildlife protection tends to contribute to the maintenance of such diseases (Bengis, Kock & Fischer, 2002). In Zambia, various examples of important zoonotic diseases reported in wild animals include tuberculosis, trypanosomiasis, anthrax, rabies, brucellosis and rift valley fever (Acevedo-Whitehouse *et al*, 2005: Chilonda *et al*, 1999; Muma *et al*, 2006; Munyeme, 2008; Tuchili & Pandey, 1995). Important livestock diseases that have been maintained in wild animals include foot and

mouth disease (FMD), theileriosis, African swine fever (ASF) and African horse sickness (AHS), rabies, and malignant catarrhal fever (MCF) (Bengis *et al*, 2002; Thomson, 1985).

The battle against wildlife diseases, diseases of livestock maintained between livestock and wildlife, and zoonotic diseases occurring at the wildlife-livestock-human interface areas is complex. In the SADC region for instance, Trans-frontier Conservation Areas (TFCAs) though advantageous for wildlife conservation and biodiversity, present serious challenges from disease transmission between domesticated and wild animals which can impact negatively on marketing of both wildlife and domesticated animals and their products, both in local and lucrative international markets (SADC, 2008). A policy of minimum intervention generally adopted in most wildlife management policies worldwide does not help in mitigating this situation. Current interactions among wild animals, livestock and humans appear to prompt an urgent need for human effort in the control of wildlife diseases and zoonoses. The complexity of the wildlife-livestock-human interface areas and conflicts arising there appears to be similar world over (AU-IBAR, 2009).

Various wildlife legislations are in place in Zambia. However, there is little information available on the evaluation of their effectiveness. It was therefore important to conduct an overview evaluation of these legislations to assess their effectiveness and suitability for wildlife disease control at the interface area. The study further targeted to assess the impact that different wildlife legislations have on livestock production, disease control and socio-economic structure of communities in the interface areas of Mosi-oa-Tunya NP.

MATERIALS AND METHODS

In trying to evaluate these impacts, the following questions were framed: 1. How has legislation been developed to implement government policy on wildlife conservation and disease control? 2. Are the communities in wildlife-livestock-human interface areas aware of this legislation? 3. What impact has this legislation had on livestock production, disease control and socio-economic structure of communities in the interface areas?

Document and Legislation Review

Wildlife legislations enacted from 1912 to 2014 were critically reviewed. The document search was conducted from the Zambian Parliament library in Lusaka, the Zambia Wildlife Authority (ZAWA) library in Chilanga, and from on-line resources. Ancillary legislation in Zambia – the Animal Health Act (No. 27) of 2010, the Veterinary Professions and Para-Professionals Act (No. 45) of 2010, and the Public Health Act (No. 22) of 1995 – were also reviewed, to capture provisions applicable to wildlife and affecting the Wildlife-Livestock-Human interface livestock keepers.

Study Site and Geographical Considerations

The study site was selected purposively, as sampling was only done from communities located in a wildlife-livestock-human interface area. Information on the activities and characteristics of the interface areas around NPs was obtained. Four (4) key parameters used in selection of the sampling area were: (i) diversity and number of wildlife in the NP; (ii) type of livestock keeping activities carried out; (iii) demographic patterns and socio-economic activities; (iv) international significance of the area.

Mosi-oa-Tunya NP was selected based on this criteria. It is one of the smallest NPs in Zambia occupying 66 Km^2 land area. It is located South-west of Livingstone town, Zambia's tourist capital, which is 470 Km South-west of Lusaka. Although it has a limited variety of wildlife, mainly elephants, rhinoceros, lion, antelopes, zebra, giraffe, warthog, buffalo, crocodile, hippo, monkeys, birds and fish, it is open to the public 365 days a year. The wildlife-livestock-human interface area around this NP provides a very complex diversity, having urban, peri-urban and rural components, with two large game parks located across the Zambia-Zimbabwe international boarder to the south. The high activity of livestock keeping and private wildlife (game) ranching activities around this NP makes this interface arguably the most complex in Zambia. The NP also harnesses one of the Seven Wonders of the World – the Victoria Falls a world heritage site as well as a RAMSAR site and by far the most important and famous tourist attraction in Zambia, receiving over 300,000 tourists annually. The NP is also part of the Kavango-Zambezi (KAZA) Trans-frontier Conservation Areas (TFCAs) of Southern Africa. These parameters made the interface area around the Mosi-oa-Tunya NP of very high significance both locally and internationally.

Survey Instrument, Sample Size Determination and Data Collection
A questionnaire was prepared to capture quantitative data about the livestock keeping households and qualitative data from household heads' (HH) opinions on wildlife conservation legislations and impacts on their economic status and livestock productivity.

To determine the minimum required number of sampling units, challenges related to lack of accurate information on the number of livestock keeping households in the selected study area had to be overcome. For the purpose of this study, all areas within 20 Km radius from the Mosi-oa-Tunya NP were considered part of the interface area. The total area around the NP was calculated to be 2,160 Km^2. It was estimated that 45% of this area was located in Zimbabwe, while 20% was occupied by Livingstone City where livestock keeping activities were considered negligible. This meant that the area under consideration for this study was 35%, an area 756 Km^2 in size.

An estimation of the study population size was based on the 2010 census data on average population density, number of households by category, number of households involved in livestock keeping and average size of an agricultural household in southern province (CSO, 2011). Using these data, the estimated livestock keeping households in the study area was 747. Using the formulae provided by Godden (2004), the minimum required sample size of livestock keeping households was calculated to be 85. A sample of 120 households was drawn, providing a 40% non-response margin.

The study area was stratified according to the veterinary camps; there were thirteen (13) camps in Livingstone and Kazungula districts at the time of the research. Six (6) veterinary camps were randomly selected and twenty questionnaires were assigned to each veterinary camp's catchment. Respondents were selected from at least five (5) villages in each catchment. Households were randomly selected in each village, and if a household head declined to be included in the survey, the household was excluded and replaced randomly. A questionnaire was administered directed to a household head during a face to face interview. Figure 1 illustrates the study area with the location of sampling sites show in relation to some important features around and within the Mosi-oa-Tunya NP.

Of the 120 questionnaires administered, 12 incomplete questionnaires were excluded from analysis. Data from 108 questionnaires was double entered in excel and transferred to STATA® version 11.2 for cleaning and analysis to obtain survey descriptive statistics and perform detailed two-way analyses.

RESULTS

Wildlife Legislation and Ancillary Legislation

Desktop review of wildlife legislation demonstrated that legislation was progressively amended, resulting in 6 amendment of the principle law, namely, the Game Ordinance of 1962, the National Parks and Wildlife Act (No. 57) of 1968, the National Parks and Wildlife (Amendment) Act (No. 65) of 1970, the International Game Park and Wildlife Act (No. 27) of 1971, the National Parks and Wildlife (Amendment) Act (No. 32) of 1982, The National Parks and Wildlife Act (No. 10) of 1991, The Zambia Wildlife Act (No. 12) of 1998, and the Zambia Wildlife (Amendment) Act of 2001. Key provisions of these pieces of legislation were as outlined by Chansa *et al* (2011).

Socio-Economic Characteristics of Respondents

Table 1 contains data on the socio-economic characteristics of respondents. 58.3% of the respondents were from Livingstone district while the 41.7% were from Kazungula district. Majority of the household heads were males, making up 88.0% of the respondents with only 12.0% of household heads being female. The distribution of marital status of household heads showed that 86.8% of the respondents were married. Table 2 indicates that the average size of a livestock keeping house hold was 8, the mean age for the household head was 53 years, and the mean number of years the respondent lived in the area was 21.3 years. The mean number of years of keeping livestock by the Household head was 18.5 years.

Descriptive Statistics for Livestock Keeping

Table 2 shows that the mean herd size of beef cattle and dairy cattle kept were 42 and 4, respectively. The mean number of pigs kept was 30, the mean number of goats and sheep were 23 and 29, respectively. The mean size of poultry flocks was 320. Few households kept donkeys, with herd sizes ranging from 2 to 4, but most households kept dogs with numbers ranging between 1 and 14. Further, Table 2 indicates that 83.2% of respondents kept beef cattle, 10.2% kept dairy cattle, and 15.9% kept pigs. Furthermore, 54.2% indicated that they kept goats, 61.1% kept poultry, while 59.3% kept dogs. Donkeys were kept by only 4.6% while sheep were kept by 3.7%. Table 3 shows that 81.5% of the households practiced a form of mixed livestock keeping while only 18.5% practiced single livestock keeping. Among the households that practiced single livestock keeping, 80% kept beef cattle, 10% kept goats, 5% kept donkeys and 5% kept sheep.

Descriptive Statistics for Awareness of Wildlife Legislation and Existence of Wildlife-Associated Animal Diseases and Zoonoses

68.5% of respondents indicated that they had knowledge of some wildlife legislation. 81.5% respondents stated that it was necessary to practice wildlife conservation. 92.6% respondents indicated that the hunting of wild animals should be regulated

by Government. 58.3% of respondents indicated that they had knowledge of some disease(s) that affect both wild animals and their livestock. The diseases that were mentioned were FMD, rabies, anthrax, tetanus, bird flu, African swine fever, black leg, trypanosomiasis, tuberculosis and corridor disease (theileriosis). FMD, rabies and corridor disease were prominently the most frequently given responses among these diseases, respectively. Table 4 details the statistics reported here.

Two Way Analyses of Awareness of Wildlife Legislation, and Impact of Wildlife Legislation and Conservation on Livestock Keepers

Analysis of awareness of wildlife legislation, and impact of wildlife legislation and conservation revealed that of the 74 respondents that were aware of existence of wildlife legislation, 75.3% indicated having been affected by wildlife conservation. Of the affected, 16.4% said the impact was improved income generation, while 12.7% said the impact was reduced animal disease occurrence; these were positive impacts. 23.6% indicated that the impact was reduced source of animal protein while 72.7% indicated that the impact was increased attacks by wild animals. 1.8% indicated that the impact was increased crop destruction by wild animals.

Two Way Analyses of Livestock Keeping, Awareness of Wildlife Legislation and Awareness of Existence of Wildlife-Associated Animal Diseases and Zoonoses

Analysis of livestock keeping and awareness of wildlife legislation showed that 85% of the 20 respondents that practiced single livestock keeping were aware of wildlife legislation. 73.7% of the respondents that practiced 2-species mixed livestock keeping were aware of wildlife legislation. 65.6% of those who practiced 3-species mixed livestock keeping were aware of wildlife legislation. 50% of those who practiced 4-species mixed livestock keeping were aware of wildlife legislation. All respondents that practiced 5-species mixed livestock keeping were aware of wildlife legislation, while 66.7% of those who practiced 6-species mixed livestock keeping were aware of wildlife legislation. These results are also detailed in Table 3.

DISCUSSION

Wildlife Conservation Legislation

The development of wildlife legislation in Zambia could be said to have been done in a "reactionary" manner, rather than the more preferred "innovative proactive" manner. "Reactionary" refers to the fact that the formulation of the legislation is in response to an apparent problem seen within a sector. Findings of this study support this assertion, as evidenced by the following points from each piece of legislation considered.

Although wildlife conservation laws were first introduced in Zambia (then Northern Rhodesia) in 1912 when the Ostrich Protection Ordinance was enacted, it was not until 1962 that the law was more comprehensive, enacted as the Game Ordinance. From then on, the law evolved as need for more policing was identified, and several times it was either amended or repealed and replaced, with key provisions as described by Chansa *et al* (2011).

The Veterinary and Veterinary para-professions Act No. 47 of 2010

This Act which made provision for the regulation of veterinary practice in Zambia, establishment of the Veterinary Association of Zambia, and the Veterinary Council of Zambia, empowered the Veterinary Association and the Veterinary

Council with the mandate of ensuring that professionals qualified to practice veterinary medicine and allied professions were registered and managed in accordance with its provisions. Veterinary practice covered all animals including wildlife, fish and bees. The Act was to be administered by the Ministry responsible for veterinary services (Parliament, 2010).

The Animal Health Act No. 25 of 2010

The Act was formulated to make provisions for the control of diseases of animals, especially those of livestock, but covered wildlife diseases as well. The provisions of the Act were to be applied in any area of the Republic of Zambia, including wildlife conservation areas. This Act was to be administered by the Ministry responsible for veterinary services.

The Public Health Act No. 22 of 1995

This Act made provisions for ensuring that public health was protected at all times. The provisions of the Act were made with reference to human health. Provisions mentioning animals or issues pertaining to animal health were made in the context of preventing transmission and occurrence of infectious diseases affecting animals to and in humans, respectively. The provisions of this Act were applicable at the wildlife-livestock-human interface in general (Parliament, 1994).

Applicability of Legislations at the Wildlife-Livestock-Human Interface

The progressive increase of authority given to the wildlife officers by subsequent legislation was done in response to the increase in illegal activities such as poaching. The National Parks and Wildlife Act No. 57 of 1968 did not expressly authorize wildlife officers to use fire arms in line with the conduct of their duties. However, the National Parks and Wildlife Act No. 10 of 1991 provided that wildlife officers could use firearms issued to them against any offender under certain circumstances. The power to arrest an offender by wildlife officers were defined more to provide clarity and specifics in given instances. This increased the authority with which the wildlife officers would enforce the Wildlife Act. The change of the name from Wildlife Officer to Wildlife Police Officer was done to show authority granted to the officers to police the provisions of the wildlife conservation legislation. The mere change of name has the policing effect, where people would tend to respect the officer more as law enforcement officers. However, this may have caused resentment towards the officers, seen as agents of the state machinery which may have been considered to be insensitive to the cause of the common man. Coupled with better defined wildlife conservation areas, these interventions to protect wildlife, actually also defined a wildlife-livestock-human interface more clearly. Though unintended, the conflicts that occur at this interface were actually legislated by the same legal framework intended to protect the precious resource.

The increase in severity of penalties and imprisonment terms for offenders convicted under the wildlife Act showed that the legislation was responding to the continued depletion of endangered animals, the increase in poaching activities and the drastic reduction in numbers of protected animals such as rhinoceros and elephant. However, the more stringent punitive measures, the more ardent the offenders became. Poaching activities developed side by side with development of legislation. The current high value placed on the illicit trade of certain wildlife products can be attributed partly to the stringency of the legislation (Saiwana, 1995).

The listing of wild animals as protected and game animals was also reactionary, as a worldwide trend. Prescription of trophies was in reaction to reported activities of illicit trade in wildlife products. This reactionary development of wildlife legislation does not provide real-time protection, as the provisions of the legislation come into effect long after the effect of the targeted vice have had full impact. This is evident for instance, in the case of provisions meant to protect the Rhinoceros population – listing them as protected animals, increasing the fees for hunting these animals, prohibiting issuance and cancelation of already issued hunting licenses, prohibition of dealing in trophies from these animals – which failed to prevent extinction of the white rhino.

The model for wildlife legislation was based on an exotic system of conservation, based on the British legal system. Furthermore, the purpose of wildlife conservation was based on the value placed on wildlife by Western countries, and not by the indigenous people. As a result the actual value of the animals to the locals, who make sacrifices in terms of natural resource utilization, has been difficult to justify. It was important to note that the emphasis of wildlife conservation had been more on aesthetic value addition to quality of life, rather than improvement of livelihood, which was a more critical need for the majority indigenous Zambians. It also focused more on future benefits, over provision of immediate solutions to the economically challenged local communities.

The Public Health legislation was developed to meet international practices in ensuring effective prevention of transmission of communicable diseases. The Law provided necessary mechanisms for ensuring prevention of disease transmission and treatment and prevention of the spread of disease outbreaks. The Law made provisions patterning to all the social tenants applicable to disease prevention and control. Listing of notifiable diseases was done in accordance with international conventions, based on disease endemic or epidemic status in Zambia and the sub-region.

The Animal Health Act was formulated to replace the Stock Diseases Act. The former was developed based on British legislation, while the Animal Health Act was developed based on the state-of-affairs of the livestock sector in Zambia at that time. Its provisions were more practical to the Zambian situation, and therefore, were more applicable and appropriate to ensure effective and efficient control of animal diseases, and human diseases of animal origin. These provisions were applicable in all areas of the country, NPs inclusive.

The Veterinary and Veterinary Para-professions Act was enacted to replace the Veterinary Surgeons Act, provide a regulatory framework for professionals involved in the provision of veterinary services and prevention and control of animal diseases. Its provisions were current and covered most areas of veterinary service delivery, including control of wildlife-related diseases.

Although the wildlife legislation does not make categorical provisions in relation to animal disease control, prevention and treatment, and public health issues regarding the interface areas, the provisions in other legislation cover the interface areas in these regards. However, the implementation of these legislations is both fragmented and segmented, and hence not having the desired impacts at the interface area.

Livestock Keepers Awareness of Wildlife Legislation, Diseases Common to Wildlife and Livestock, and Wildlife Zoonoses

The finding that majority of the household heads were males (88.0%) differed significantly with findings in the 2010 census summary report (CSO, 2012), which indicated that in Southern Zambia, the male headed households made up 75.5 % of total households. This difference may be attributed to better economic conditions in livestock producing households, which are more stable socially. However, it might have also been caused by the small sample size in this study compared to the population in the census report. The distribution of marital status of household heads (86.8% married) were comparable to the figure in the housing and household analysis report for the 2000 census of population and housing (CSO, 2001), which indicated a national distribution of marital status of 88.4% married of male household heads and only 17.1% married of female household heads; since the male household heads in this study formed the majority. The mean age for the household head (53 years) was comparable to the life expectance for Zambia which was estimated at 52 years in 2010. There was no specific data on national average age of household heads available to compare to.

The mean household size (8 members) was significantly higher than that reported in the 2010 census summary report (CSO, 2012) for Southern Province (5.4 persons). This could be attributed to better economic conditions in livestock keeping households, enabling them to support lager families. It may also be attributed to the higher labor demands for livestock keeping activities, as well as the proximity of the research area to an urban center, where population density is expected to be relatively higher than other rural settings, owed to availability of better social amenities. The mean number of years lived in the area by the household heads (21.3 years) and the mean number of years of keeping livestock by the household heads (18.5 years) indicated that household heads spent over 80% of the time they lived in the study area keeping livestock, indicating a high level of stability and sustainability of livestock keeping as a means of subsistence.

The type of livestock kept by the respondents was similar to the reported trends in the smallholder livestock sector status report (Lubungu & Mofya-Mukuka, 2012), although the mean herd sizes were relatively higher in this study. This marked difference in mean herd/flock sizes could be attributed to the different focus of the 2 documents – the status report was confined to smallholder livestock keepers, while this study included all subsistent livestock keepers. At the time of reporting, no information was found for average herd/flock sizes for livestock keepers in the interface areas in Zambia. The finding that 81% of the households practiced some form of mixed livestock keeping illustrates a common practice among livestock keeping households in Zambia. Although this practice has various advantages, it tends to promote disease transmission across species, with the potential of gene re-assortment, as reported to be common with influenza virus (Zhou *et al*, 1999). This also increases the risks to humans in cases of zoonotic diseases, and is further compounded at the wildlife-livestock-human interface where diseases can be transmitted from wildlife to livestock and humans. Amongst the households that practiced single livestock keeping, the high proportion of beef cattle reared (80%) could be an indication that beef production was a more profitable venture. It may also have been influenced by nearness to markets and the traditional practices of beef cattle rearing as a source of value used for the payment of "Lobola" (dowry) for marriage, social status and security.

Results from the questionnaire survey showed that many of the livestock keeping household heads (68.5%) had some form of awareness of wildlife legislation. However, almost one quarter of respondents showed misunderstanding of the laws, evidenced by indication of 2.8% that they resided in the National Park when in fact not, and by 19.8% that they resided in a game management area when there was none around Mosi-oa-Tunya National Park. This response reinforced the need for more sensitization of communities on the provisions of wildlife legislation, in order for them to understand and comply.

Furthermore, indication of having knowledge of some wildlife legislation showed that government's efforts to promote wildlife conservation was effective to some extent. This was reinforced further by the support of practicing wildlife conservation by 81% of respondents and indication by 93% of respondents that hunting of wild animals should be regulated by government. This point is emphasized because the concepts of wildlife legislation and controlled hunting of wild animals are not indigenous to the local communities, having been adopted over the past 100 years (Chansa *et al*, 2011). This affirmation to the concepts of wildlife conservation and control of hunting indicate sufficient knowledge of the provisions of wildlife legislation. However, this affirmation may also indicate an awareness and fear of the severe repercussions of contravening or not supporting the provisions of the wildlife legislation. Alternatively, although the provisions maybe well understood, other constraining factors at the interface area may have outweighed the impact of this awareness, resulting in sustained depletion of wild animals through illicit activities. Reasons advanced by respondents against the concept of government control of hunting were that: *conservation of wild animals resulted in increased attacks of people and livestock in the interface area*; *when wild animal populations increased, pressure on the environment also increased, resulting in increased competition for scarce resources between humans and their* livestock, and wild animals; and, *no significant benefits had been seen from wildlife conservation, hence hunting provided direct benefits in form of food and income*.

The 58.3% respondents indicated knowledge of some disease(s) that affect both wild animals and livestock, was a major cause for concern for an interface area occurring so close to an important urban center in Zambia (Livingstone), adjacent to a world heritage site (Victoria Falls), and within the largest Trans-frontier Conservation Area (TFCA) in the region. Such information on important livestock diseases and zoonoses of wildlife origin likely to occur within the interface area should have been more readily available. This would improve the communities' preparedness in the event of outbreaks of diseases of national and international importance. On the other hand, the respondents that indicated awareness of livestock diseases and zoonoses of wildlife origin mentioned most of the important diseases (Chilonda *et al*, 1999; Pandey *et al*, 1995).

Two way analysis results of livestock keeping and awareness of wildlife legislation showed that more respondents that practiced single livestock keeping were aware of wildlife legislation (85 %) than most of those that practiced mixed livestock keeping (73.7%, 65.6%, 50.0%, 100% and 66.7%, that practiced mixed livestock keeping of 2, 3, 4, 5 and 6 species, respectively). Although the data sets were small to give conclusive interpretation, the variation may have been due to the occurrence of livestock diseases that affected cattle, the species most reared singularly. The high number of respondents that indicated that they had been affected by wildlife conservation legislation (75.3%) showed that implementation of wildlife conservation laws had notable impact on livestock keeping communities in the interface areas. 72.7% of respondents' indication that the impact of wildlife conservation on them was increased attacks by wild animals is consistent with the

reports of most researchers on wildlife in Zambia (Simasiku *et al,* 2008) who reported that *Poverty in GMAs is linked to a high incidence of conflicts between humans and wildlife,* and that *conflicts result in loss of human lives*. This reinforces the opinions of the respondent that live in an interface area where attacks and trespasses by mainly the Elephants, are quiet common. This was also supported by Fernández (2010). Such animal attacks tend to also result in damage to crops and other property, lending to more economic hardships (Simasiku *et al*, 2008). However, the indication by only 1.8% respondents that the impact of wildlife conservation was increased crop destruction may have been because livestock keepers focus more on their livestock than crop production. The number of respondents that indicated that the impact of wildlife conservation was reduced source of animal protein maybe considered lower (23.6%), but significant since livestock keepers have available source of animal protein. Indication of reduced source of animal protein by these livestock keepers may indicate a worse-off situation for those that do not keep any livestock of their own. Fernández (2010) indicated that *"the new policies deprived communities of traditional wildlife food sources"*. Most of these communities have little alternative sources of such food sources as they are poor, with little viable economic activities.

It was interesting to note that some respondents indicated that the implementation of wildlife conservation laws improved income generation (16.4%). This response may be attributed to an increased demand for animal protein from domesticated sources, resulting in a benefit for some livestock keepers. However, the low number of respondents reporting an economic benefit may be an indicator of economic hardships, resulting in inability to afford food products of livestock origin. The respondents that indicated a reduction in the occurrence of animal diseases (12.7%) may have benefited from existence of a fence around the Mosi-oa-Tunya National Park. However, the reduction of occurrence of wildlife diseases due to wildlife conservation is difficult to justify, as research indicates an increase in animal diseases in the interface areas (Bengis *et al*, 2002; Muma *et al*, 2006; Munyeme *et al*, 2008).

CONCLUSION AND RECOMMENDATIONS

Conclusion

Despite the various pieces of legislation with regards to wildlife management and conservation in Zambia, disconnects between these and other ancillary legislation intended to provide for control of livestock diseases and protection of public health have been found. This has resulted in negative impact of wildlife conservation on livestock keepers residing within or around the wildlife-livestock-human interface areas. Although the questionnaire survey did not provide sufficient evidence to quantify the negative effects, the opinions of livestock keepers who were resident around the Mosi-oa-Tunya National Park demonstrated that these negative effects were there.

Recommendations

- It was recommended that a comprehensive multi-sectorial Regulatory Impact Assessment (RIA) should be conducted taking into consideration all the stakeholders that have been and would be impacted by wildlife conservation.

- To clearly quantify the effectiveness of wildlife conservation and their benefits to all the stakeholders, it is recommended that detailed studies such as risk analysis, cost-benefit analysis and policy evaluation at all interface areas be conducted.
- The implementation of wildlife legislation should be done in tandem with other legislation in order to ensure that there is effective prevention of disease transmission among the wildlife, domestic animals and humans.
- The promotion of private game ranching over management of public owned National Parks is a more sustainable wildlife conservation mode and could be done by empowering Community Resource Boards to own game ranches where animals of traditional and national importance could be preserved.
- Well-funded veterinary and livestock production centers should be established in interface areas where livestock keeping is a principle economic activity in ensuring better production systems employed by livestock keepers, thereby improving their economic status, and sustainable wildlife conservation.

CONFLICT OF INTEREST

None of the authors has any financial or personal relationships that could inappropriately influence or bias the content of this paper.

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TABLES

Table 1: Number of respondents by District, Area Conservation Status, Gender and Marital Status

Parameter	Categories	Number of respondents	Percentage (%)
District	Livingstone	63	58.3
	Kazungula	45	41.7
Area Conservation Status	National Park	3	2.8
	GMA	21	19.8
	Open Area	82	77.4
Gender of Household Head	Male	95	88.0
	Female	13	12.0
Marital Status of Household Head	Single	12	11.3
	Married	92	86.8
	Divorced	2	1.9
Total Number of Respondents		**108**	**100**

Table 2: Social characteristics of Household heads/respondents, number of households and Livestock kept by type

PARAMETER		MAXIMUM	MINIMUM	MEAN	CI	SE	OBSERVATIONS	PERCENTAGE
Age of Household Head (years)		84	22	52.6	-	-	108	100%
Household size		35	2	7.7	-	-	108	100%
Years lived in area by Household head		83	2	21.3	-	-	108	100%
Years of practicing livestock keeping		70	1	18.5	-	-	108	100%
Number of Livestock kept by type	Beef Cattle	900	1	42.5	±22.9	11.5	85	78.7%
	Dairy Cattle	6	1	3.5	±1.4	0.6	11	10.2%
	Pigs	100	1	30.1	±17.4	8.1	14	13%
	Goats	150	1	16.6	±6.2	3.1	55	50.9%
	Poultry[#]	10,000	4	319.5	±348.8	174.4	62	57.4%
	Donkey	4	2	3	±1.3	0.4	4	3.7%
	Sheep	50	5	28.8	±33.2	10.4	4	3.7%
	Dog[#]	14	1	3.1	±0.5	0.3	59	54.6%

[#]although dogs and poultry are not classified as livestock, they were included in this study due to their role in disease transmission; and their use for hunting (dogs).

Table 3: Indicating the proportion of household practicing single and mixed livestock keeping and respondents' awareness of wildlife legislation.

Number of Different Species of Livestock Kept	Number of respondents	Percentage	Awareness of wildlife legislation		
				Yes	No
1	20	18.5%		17	3
			Percentage	85%	15%
2	19	17.6%		14	5
			Percentage	73.7%	26.3%
3	32	29.6%		21	11
			Percentage	63.6%	36.4%
4	28	25.9%		14	14
			Percentage	50%	50%
5	6	5.6%		6	0
			Percentage	100%	0%
6	3	2.8%		2	1
			Percentage	66.7%	33.3%

Figure 1: map showing the study area and sampling sites with related key features (Insert: the red box represents the sampling area)
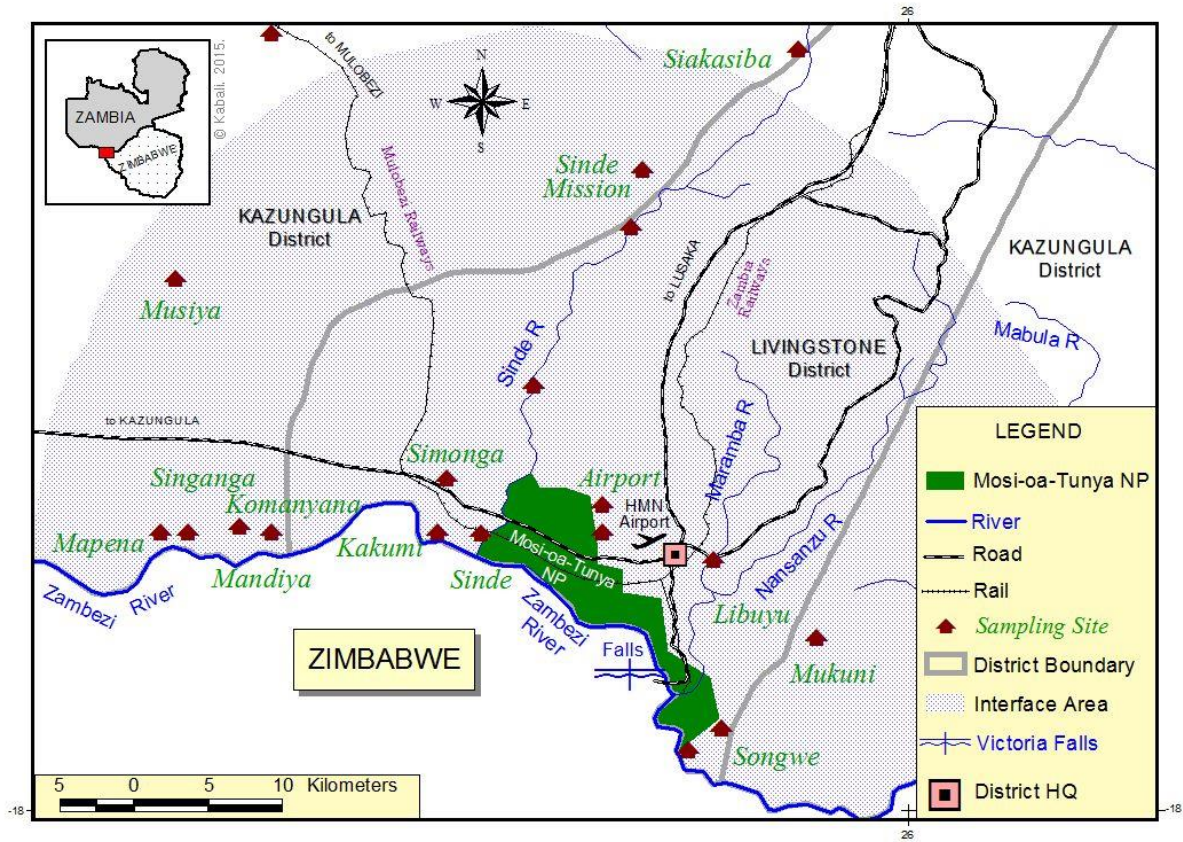
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