



Human-Wildlife Conflicts in Amboseli Ecosystem: Implications for Sustainable Livelihoods and Wildlife Conservation

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ABSTRACT

Land use changes in developing countries have had huge impacts on both human livelihoods and the surrounding wildlife. This study carried out in the Amboseli ecosystem of southern Kenya, aimed to investigate how the shift from a traditional pastoralist lifestyle to a more agricultural livelihood affected and contributed to human-wildlife conflicts. Structured interviews conducted with for pastoralists, agro-pastoralists, and agriculturalists in the region, as well as key informants. Findings revealed that the land use shift to agriculture has resulted in increased human-wildlife conflicts and a larger amount of property damage incurred by the residents. In order to protect both people and the wildlife that is also being threatened by this land use shift, policies such as wildlife compensation programs and the construction of electric fences around farms should be implemented along with traditional conflict resolution techniques.

Keywords: human-wildlife conflict, agriculture, pastoralism, land-use change and livelihood

INTRODUCTION

The semi-arid rangelands of southern Kenya traditionally sustain pastoralist lifestyles, frequently practiced by the Maasai and various other tribes in the area (Western & Nightingale, 2003). The rangelands' unreliable rainfall and common droughts are not conducive to an agricultural, sedentary lifestyle with intensive water requirements. In recent years, the region's inhabitants have undergone a land use shift from primarily pastoralist to an agro-pastoralist or agriculturalist lifestyle, putting an immense strain on the environment's already limited resources (Western *et al.*, 2009). Both a desire for private land tenure and economic gain has prompted this land use shift. This agricultural expansion has also encroached upon wildlife habitats, resulting in increased human-wildlife conflicts.

Theoretical Issues of the Study

Due to the recent increase in land use and land tenure transformation in the Amboseli ecosystem dispersal areas, wildlife conservation has become a prominent challenge. Among the threats to wildlife conservation arising from land use changes are environmental degradation, habitat transformation, and human-wildlife conflicts. The principle types of human-wildlife conflicts in East Africa are human injury and death, crop raiding, property damage and livestock predation. Increases in human-wildlife conflicts throughout East Africa are driven by several underlying factors: population growth, land use transformation, habitat degradation and fragmentation, increasing livestock populations, decrease in abundance and distribution of wild prey, and climatic factors (Distefano, 2005).

Population growth in the group ranches of the Amboseli ecosystem resulted in more direct contact with wildlife and expansion into and around protected areas. Households will often seek revenge for damages, which has caused a major obstacle to community support of regional conservation initiatives (Bulte & Rondeau, 2005).

The increase of land use from pastoralism to agriculture has resulted in lifestyles incompatible for wildlife conservation. A survey of people around national parks in Tanzania found that the incidents of crop raiding were over eight times that of livestock predation (Newmark *et al.*, 1994). The development of small scale farming in rural Kenya has precipitated human wildlife conflicts through habitat

encroachment and resource exploitation (Distefano, 2005). Farms that have arisen next to forests have caused extensive wildlife habitat fragmentation, which is also adding to the augmented conflicts with wildlife.

Reduced resources have an effect on wild prey abundance and distribution, which forces predators to attack livestock population. It is evident that wild prey is decreasing within the Amboseli ecosystem, which will further the challenge of wildlife conservation as many predators may turn to livestock for survival. Predation is also affected by seasonal changes of rainfall in the Tsavo ecosystem, as predators will assault livestock during the rainy seasons since they have followed the wild prey into dispersal areas. In the dry season, the prey is concentrated and is easily hunted near the lower number of water sources, decreasing the chances of livestock predation (Distefano, 2005).

The current policy regarding wildlife conservation in Kenya restricts locals from threatening or killing wildlife, as it is considered the government's property. The Kenya Wildlife Service (KWS) enforces these rules, as well as manages national parks and dispersal areas, and aids the locals in property protection through patrols. Regardless of the damage done to local farms, the KWS does not currently offer consolation for crop raiding, and will only compensate in the event of human injury or livestock predation. However, there are programs which offer locals within close range of high risk areas stipends for education. Because of the current policy and frequent crop damage, many residents have a negative view of wildlife, the KWS and even wildlife conservation efforts as they perceive wildlife as the responsibility of the government. This burdens the people to care for the "government's cattle," creating detriments instead of assets (Connell-Rodwell *et al.*, 2000).

The crux of the matter is that human-wildlife conflicts persist and are a growing threat to conservation because there are no effective preventative methods in place. Preventative methods include mechanical exclusion of wildlife from property or altering society attitudes to reduce negative responses to conflict. Compensation schemes are one of the primary methods that are implemented in order to preserve wildlife through shifting local mind-sets. Though the policy currently does not compensate for crop damages, there is debate as to whether or not the policy should be reformed in order to allow farmers to seek out compensation, as there could be potential negative consequences. It is theorized that farmers may result in diminishing the amount of protection they give their farms, as well as exacerbate the damage and continue to increase their farmland. The increase of farmland will inevitably result in further habitat conversion and encroachment on wildlife, which challenges the overall goal of furthering conservation. In addition, most compensation programs rely on outside sources, raising questions of long-term sustainability (Bulte & Rondeau, 2005).

The problem of conservation continues as other preventative measures for human-wildlife conflicts are equally inadequate. According to Newmark *et al.*, (1994) strategies that have been tested include the use of guards, metaphorical fences, mechanical fences, trip wires, traps, alarm calls, spot lights, buffer zones, dogs, and non-lethal aggression. Metaphorical fences include the application of chili pepper extract to farm perimeters as well as burning them in fires, planting unpalatable crops, and beekeeping. An example of a mechanical fence is designing bomas in circular patterns, and piling thorny brush around the property – a common practice of the Maasai. Elephants are presenting the biggest wildlife-conflict challenge in the Kajiado district of Kenya and various methods have been proposed to exclude them from properties. Metaphorical fences are the most practical technique advocated for reducing human-elephant conflicts, but are restricted in use due to insufficient knowledge and access to these practices. These fences are also limited in their effectiveness, as many animals, such as baboons, are not deterred.

These techniques still fall short as many of these efforts ultimately do not permanently resolve conflicts. Defensive tactics that are potentially lethal, such as the use of dogs, firearms and spears, are more effective than non-lethal methods, but are a significant threat to wildlife populations (Newmark *et al.*, 1994). Thus far, fences have proven to be one of the most effective approaches despite the ecological problems that occur as well as the high costs of construction and maintenance (Hayward & Kerley, 2009). The electric fence that was erected in Kimana group ranch effectively reduced human-wildlife conflicts in Kimana, however the wildlife was redirected, simply redistributing the problems to adjacent areas. The

fence was dismantled because of insufficient funds and maintenance, exemplifying the difficulties of sustaining these conservation efforts. The more sensible solution with this mindset would be to enclose the national parks and sanctuaries completely, such as the case of Lake Nakuru National Park.

Kenya can best be divided into two separate climactic zones: arid and semi arid land (ASAL), and high to medium potential land (HMPL). HMPL makes up approximately 20% of all land in Kenya, while it produces 75% of all agriculture. The ASAL makes up the remaining 80% of land and is historically used for livestock herding and wildlife conservation. However, like most developing countries, Kenya has a high rate of population increase. Like urban areas, the ASAL have seen a very high rate of immigration from other parts of the country. While the ASAL in the Amboseli ecosystem was historically inhabited by the nomadic pastoralist Maasai, many different tribes are now in this area, practicing differing livelihoods, specifically agriculture.

One of the underlying issues behind the land changes in the Amboseli Ecosystem is the land tenure system of Kenya. Kenya has four distinct land tenure regimes- public, private, communal, and contested. Private land tenure is absolute ownership over the land, where any livelihood or resource use can be practiced and one has a physical deed to the land. Contested land has no distinct owner and has become managed by the government. Public and communal land share similarities, in that it is used by a group of people, but the difference between the two is the regards the right to access. Public land is open to anyone with no restrictions. When a resource is open with no management, the resource often becomes over used and exhibits the tragedy of the commons. Communal land is managed in an attempt to avoid the tragedy of the commons by limiting access to members in an attempt to live sustainably with the land. Group ranches are one of these tenure regimes. Group ranches were first established to attempt to give the Maasai ownership of their land, while allowing them to maintain their pastoral way of life (Waiganio, 2001). However, as the Maasai population has increased as well as the increasing population of other tribes, the group ranches have become crowded and their management has significantly deteriorated. Sub-division has been pressured by the younger Maasai population who want a piece of the land, as well as affluent older members who have more to gain from sub-division. However, from a wildlife conservation standpoint, increased subdivision will fragment habitats and increase human-wildlife conflict (Campbell *et al*, 2000).

METHODOLOGY

The study was carried out Amboseli ecosystem in Southern Kenya. This study aimed to collect household information from farmers, pastoralists and agro-pastoralists within the Amboseli ecosystem. A large-scale questionnaire based social survey was used for the study; this approach was integrated with a vertical transect method in which key information sources (like Ministry officials) in the area were interviewed.

Various techniques have already been used for studies related to livelihoods in rural areas.

The study area consisted of three distinct regions- the slopes of Kilimanjaro, Kuku Group Ranch and Kimana Group Ranch. All three manifest different stages of land-use change and livelihoods; the slopes of Kilimanjaro, for example, have been under cultivation for the past few decades while most of Kuku GR is still used for pastoralism. These different regions were chosen for this study to ensure that a wide spectrum of land-uses and livelihoods are covered, and to ensure that a comparison between different livelihoods and their sustainability in local environmental conditions is possible. A total of 255 individuals were interviewed at the end of the eight days. The information gained from the survey was cross-checked with, and supplemented by, the key informants. Key informants included the assistant chief of Kimana, the Agricultural Officer of Loitokitok district, and the Livestock Production Officer of the same district. Interviews with the key informants followed a standard interview format where they were asked to respond to open ended questions regarding their position, duties, and the communities that they govern. The spectrum of data gathered was broad enough to allow us to analyze the data from various perspectives and to look at individual issues, like human-wildlife conflict or livelihood change, as distinct issues as well in the greater context of all the other data.

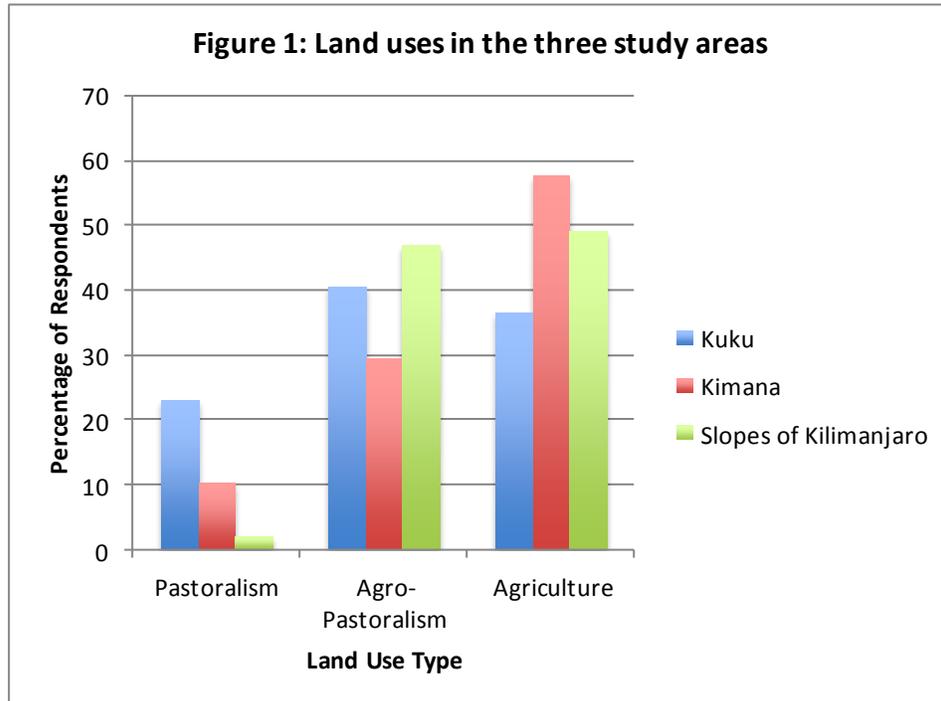
RESULTS

After gathering all of the information from the respondents, the results were analyzed and graphed to make them easier to interpret. First, the education levels of all respondents from all three locations were compiled. The vast majority of the respondents had received either no education or only primary level education. Very few of the interviewees went on to secondary school, and even fewer continued on to university.

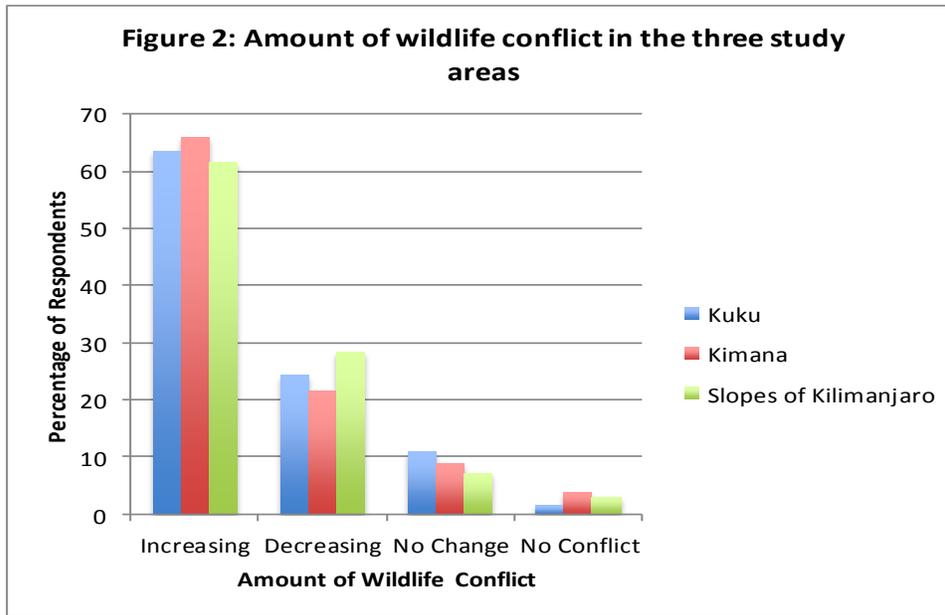
The tribes of the respondents were also broken down by study area. In Kuku Group Ranch, the vast majority of respondents were in the Maasai tribe, while in Kimana and the slopes of Kilimanjaro the different tribes were more evenly distributed.

Other demographics that were analyzed were gender and age of the respondents. 49.4% of the respondents were male, and 50.6% were female. Additionally, the highest number of respondents was aged between 21 and 30 years, followed by the older than 51 and 31- 40 ages range.

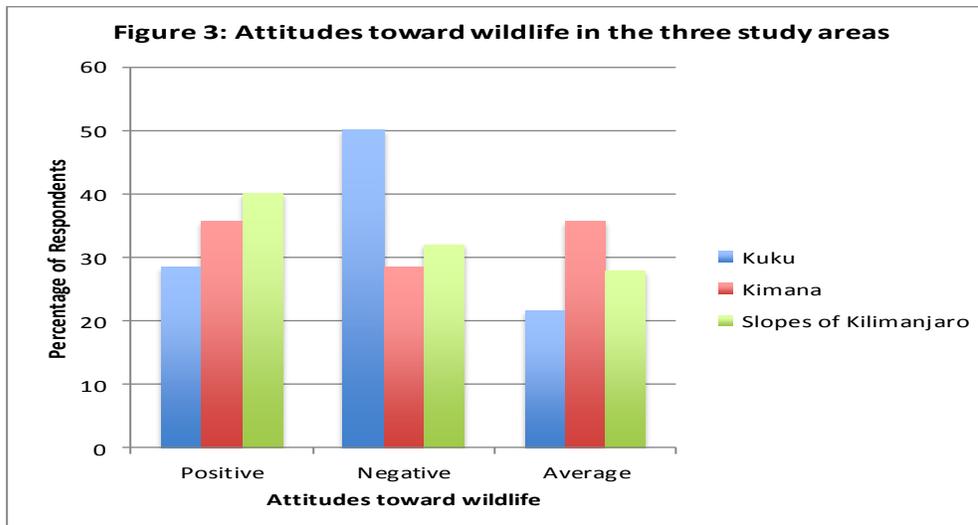
Once all of the demographics were collected, the different land uses- agriculture, agro- pastoralism, and pastoralism- were broken down by study area. For all three areas, pastoralism was the lowest land use percentage, but in Kuku the percentage of pastoralism was higher than in the other two areas. Agriculture was the highest in Kimana and in the slopes of Kilimanjaro, while agro- pastoralism was the highest in Kuku.



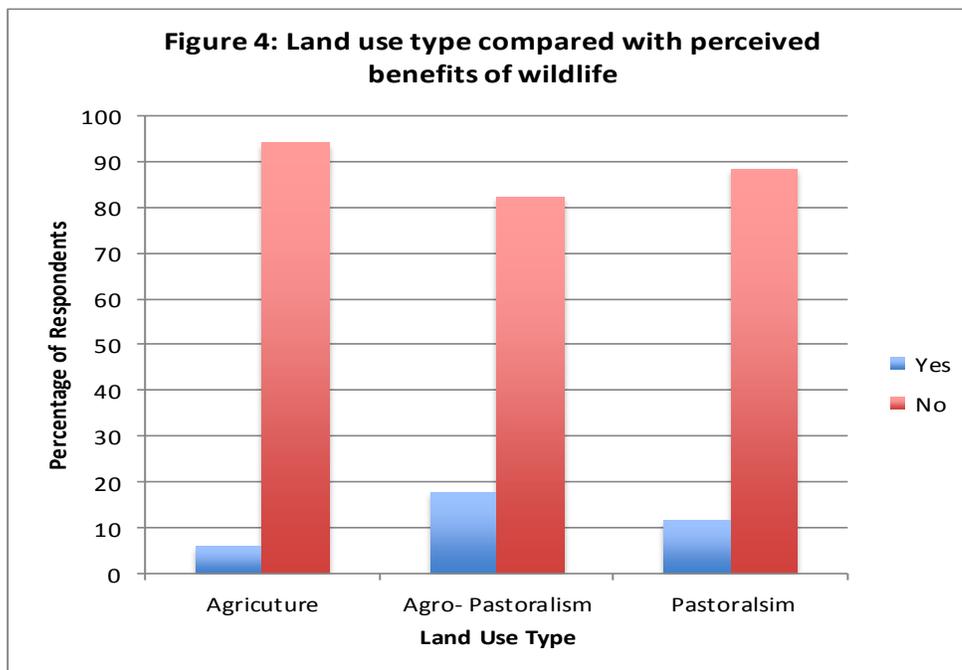
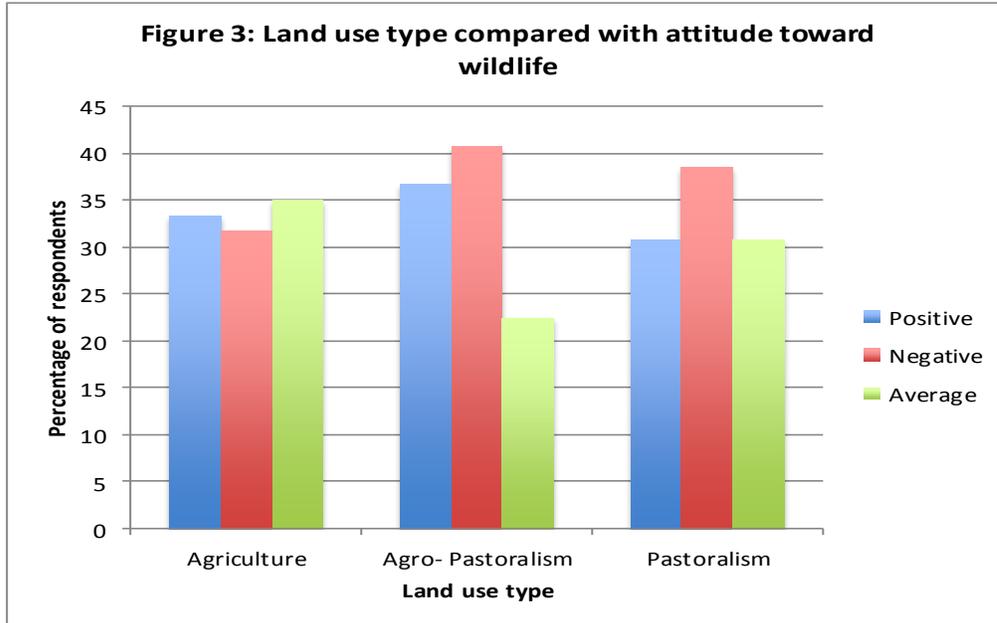
The majority of respondents in all three study areas reported that the amount of wildlife conflicts they experienced was increasing. Out of the people who reported that conflicts were decreasing, the majority were from the slopes of Kilimanjaro. Very few people reported no change in conflicts or no conflicts at all (Fig. 2).



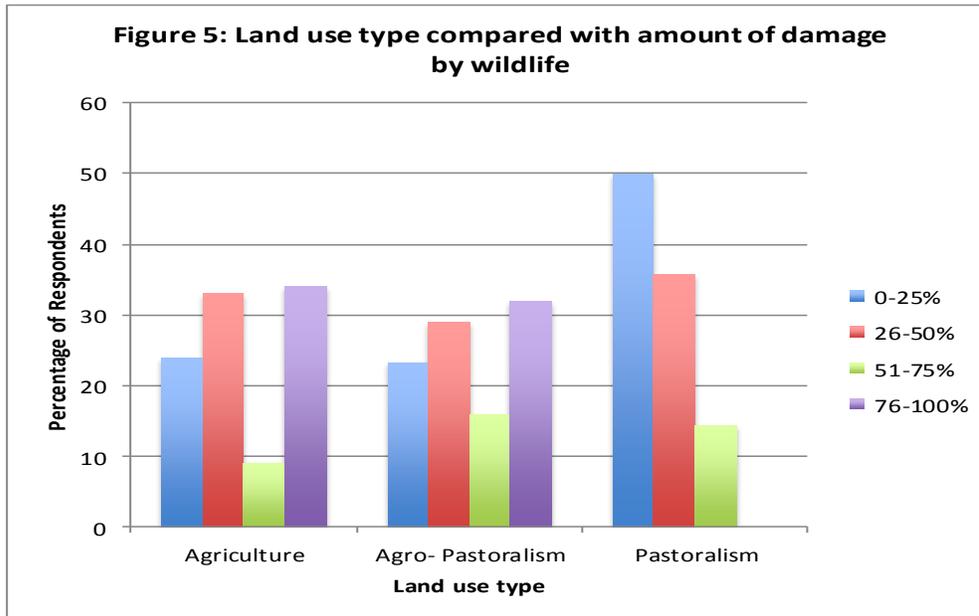
Additionally, attitudes toward wildlife were analyzed in the three study areas. The highest percentages of negative attitudes toward wildlife were in Kuku group ranch. In the slopes of Kilimanjaro, the majority of people felt positively about wildlife, and in Kimana both positive and average attitudes were the highest (Fig. 3).



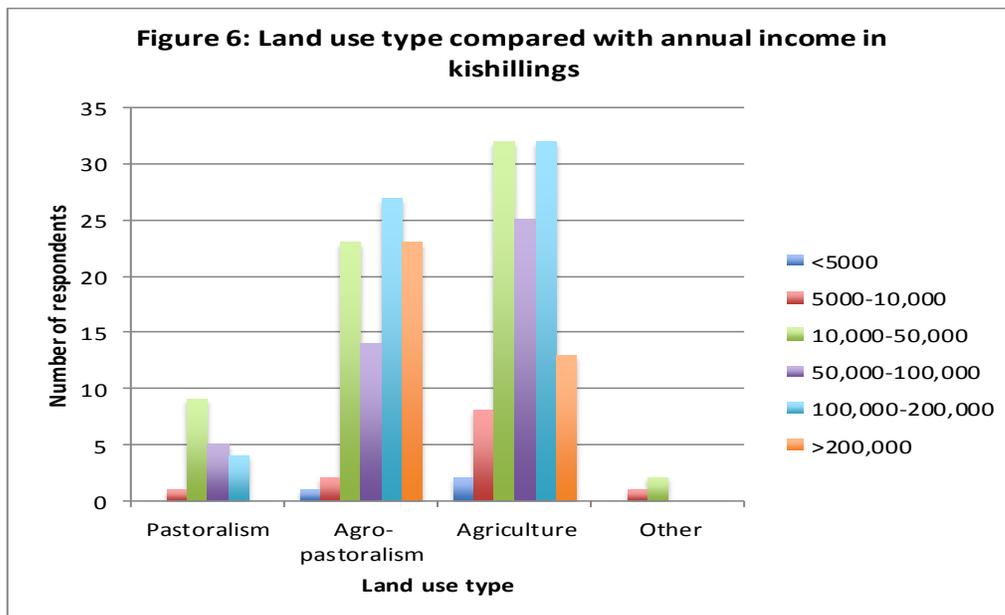
Land use type was also compared with attitudes toward wildlife and perceived benefits from wildlife. The majority of pastoralists and agro-pastoralists had negative attitudes, while slightly more agriculturalists had average and positive attitudes (Fig. 3). The majority of all three livelihood types perceived no benefits from wildlife. Slightly more pastoralists and agro-pastoralists believed that they did receive some benefits from wildlife, while very few agriculturalists thought they were benefitted by wildlife.



When land use types were compared with the amount of damage incurred by wildlife, half of the pastoralists that responded reported that 0-25% of their property was damaged last time they had a conflict with wildlife. This differed from agriculture and agro- pastoralism, which reported most often that 76- 100% of their property was destroyed in their last wildlife conflict (Fig. 5).



Finally, land use types were compared with the respondents' annual income. In general, agriculturalists had much higher incomes than pastoralists or agro- pastoralists, and pastoralists had the lowest incomes of the three land uses (Fig. 6).



DISCUSSIONS

Effects of land use changes on human- wildlife conflicts

After analyzing all of the data, the previously mentioned hypotheses were either accepted or rejected. The first hypothesis, that land use changes have not increased human- wildlife conflict and therefore have no effect on wildlife conservation, was rejected. Agriculture can cause land degradation in the form of deforestation and soil and wind erosion, which all contribute to the overall depletion of resources (Rosell, 1999). As shown in the results, agriculturalists were the highest percentage of respondents, especially in the Kimana region. 57.7% of all respondents from Kimana reported that they were agriculturalists. This region also reported the highest amount of increased wildlife conflicts- 65.8% of the respondents from Kimana reported an increase in the amount of wildlife conflicts. The combination of decreased resources for wildlife and the location of the study areas in the wildlife corridor between Amboseli and Tsavo National Parks results in wildlife being forced into the surrounding farmland (NEMA, 2009). From this, it can be concluded that the shift of land use from pastoralism to agriculture has resulted in higher amounts of wildlife conflict. Although conflicts seem to be increasing, overall wildlife populations in Africa have decreased between 35 and 50% in the last 30 years (Western *et al*, 2009). Much of this decline was attributed to the spread of farming into pastoral areas- in places like Kuku Group Ranch, which was traditionally used primarily for pastoralism by the Maasai; the numbers of agriculturalists and agro- pastoralists is greater than the number of pastoralists. 40.5% of the respondents from Kuku were agro- pastoralists, and 36.5% were agriculturalists. The amount of pastoralists in Kuku was still greater than in Kimana or on the slopes of Kilimanjaro- 23% as opposed to 10.3% and 2%, respectively. The increase of agriculture can be attributed to the fact that it is much more economically rewarding than pastoralism. The results showed that 75 of the agriculturalists made over 50,000 Kenya shillings a year, while only 9 of the pastoralists made this much. As more people realize that agriculture can be more lucrative than pastoralism, the shift toward farming, and therefore decreasing wildlife habitats, will continue.

A few of the people interviewed also admitted to killing wildlife such as elephants, rhinos, and lions that threatened their crops and livestock. While a few people retaliating in this way won't have huge impacts on wildlife populations, it has to be taken into consideration that our (the interviewers) status as foreigners could affect the answers that some people give us, so the numbers of wildlife being killed could be a lot higher (Nelson, 2007).

Effects of land use change on wildlife conservation

While wildlife populations in agricultural areas are decreasing, in areas such as group ranches where lands are still open and pastoral, wildlife is still relatively abundant (Western *et al*, 2009). The land use changes in the Amboseli ecosystem are shown to have a negative effect on wildlife conservation based on the fact that a shift to agriculture has caused an overall decrease in wildlife populations throughout the ecosystem. Even the land that remains primarily used for pastoralism has a negative effect on some wildlife populations. Livestock such as cattle are direct competition for large grazers such as zebra or buffalo; when both livestock and wildlife try to utilize an area, it can quickly become degraded. However, the grazing of these large mammals can increase the availability of forage for more selective grazers such as gazelles. Despite the potential for grazing competition, the same study also found that there was no evidence that the presence of the Maasai or their cattle in the study area outside Serengeti National Park was particularly detrimental to any specific wildlife species. It also found that there is no evidence that livestock biomass replaces wildlife biomass in the areas outside of national parks. Finally, the study reported that there were no marked changes in wildlife densities on either side of the protected area boundaries, which were the communally- managed pastoralist group ranches and within the park. By using techniques such as herd splitting, range management, herding techniques, close monitoring of livestock and environmental conditions, and using wildlife as indicators, pastoralists in this area are able to maximize their rangeland use without completely degrading the habitat for both their livestock and the surrounding wildlife (Western & Nightingale, 2003). The shift from traditional pastoralism to a mainly

agricultural and agro- pastoralist lifestyle has resulted in expansion into surrounding land and depletion of natural resources, which in turn takes away resources from wildlife (Walingo *et al*, 2009).

Effect of human- wildlife conflicts on livelihoods

The second hypothesis, that changes in human- wildlife conflicts have not negatively affected the livelihoods of inhabitants of the Amboseli ecosystem, can also be rejected. For both agriculturalists and agro- pastoralists, the majority reported that during their last conflict with wildlife, 76 to 100% of their property was destroyed.

This huge amount is detrimental to people whose livelihoods depend on their crop or livestock. The sale of crops makes a significant contribution to household income for the majority of rural households that employ a wide variety of livelihood strategies (Andrew *et al*, 2003). If the majority of their crops are destroyed, most rural households would have very little to fall back on. As the overall amount of wildlife conflicts increase, the amount of property they damage will increase as well. Most pastoralists reported a loss of 0-25% of their livestock during their last conflict with wildlife, which goes along with the conclusion that land use changes from pastoralism to agriculture result in increased human- wildlife conflicts.

The majority of respondents from all three land uses types reported that they did not believe they received any benefits from wildlife. However, more pastoralists and agro- pastoralists responded that they believed they did receive benefits from wildlife than did agriculturalists. 11.5% of the pastoralists and 17.5% of agro- pastoralists believed they received benefits from wildlife, while only 5.8% of agriculturalists reported this (Fig. 8). While most people did not feel they received benefits from wildlife, more people responded that they had positive attitudes toward wildlife anyway, whether because they were able to see that tourism was good for the nation or because they believed that all animals were 'God's creatures', as some responded. The majority of agro- pastoralists and pastoralists still had negative attitudes toward wildlife, but positive and average attitudes were not far behind. 30.8% of pastoralists reported positive attitudes, and an additional 30.8% reported average or neutral attitudes toward wildlife. 36.7% of agro- pastoralists had positive attitudes and 22.4% had average or neutral attitudes toward wildlife. Agriculturalists responded more with average and positive attitudes, and had the least amount of negative attitudes toward wildlife reported. 33.3% of agriculturalists had positive attitudes, and 35% had average or neutral attitudes toward wildlife. Only 31.7% of agriculturalists had negative attitudes toward wildlife. Even though agriculturalists had the highest amount of property damage incurred by wildlife and therefore the most negatively affected livelihoods, as well as the lowest percentage of people believing they benefitted from wildlife, they still had the highest percentage of positive attitudes toward wildlife.

Effects of subdivision of group ranches on human- wildlife conflicts

The third hypothesis, that the subdivision of group ranches leads to no changes in human- wildlife conflicts, can also be rejected. Of the three study areas, only Kuku is not subdivided. Wildlife conflicts in Kuku are increasing at about the same rate as those in Kimana and the slopes of Kilimanjaro. In Kuku, Kimana, and the slopes of Kilimanjaro, the amount of people who reported an increase in wildlife conflicts were 63.5%, 65.8%, and 61.6%, respectively. The attitudes toward wildlife of the residents of the three areas were not so close in percentage, however. In Kuku, 50% of the respondents had negative attitudes toward wildlife, and only 28.4% had positive attitudes. In Kimana, 35.8% of the respondents had positive attitudes, and in the slope of Kilimanjaro 40.2% of the respondents reported positive attitudes toward wildlife. However, in both Kimana and the slopes of Kilimanjaro- which were subdivided previously- there is a much higher percentage of agriculturalists than in Kuku. As previously stated, agriculturalists seemed to experience more human- wildlife conflicts. The subdivision led to increased agriculture production and decreased pastoralism, which in turn leads to increased human- wildlife conflicts and damage to property.

A majority of the people interviewed reported that they wanted Kuku to subdivide so they could own their own land, which is understandable. While group ranches are helpful in keeping the land not fragmented and open for wildlife, rises in population pressure, poverty, alienation of land for farming and

conservation, and the influence of market economies all are causing shifts in people's attitudes toward group ranches (Western *et al*, 2009). This study, done in the Kajiado district of Kenya where our three study areas were, showed that the land fragmentation that will come from subdivision could reduce herd productivity and increase drought risk to pastoralists, as well as cause a significant decline in wildlife populations (Western *et al*, 2009).

Finding a balance between what the people want- the subdivision of the land- and what will be best for the environment, and therefore wildlife and livestock, is a challenge that is facing officials in this region.

CONCLUSION AND RECOMMENDATIONS

Land tenure and land use changes occurring in the Amboseli ecosystem are posing a great challenge to wildlife conservation. The increase in population is forcing people to encroach into wildlife habitat and dispersal areas which in turn have excavated human-wildlife conflicts.

After hearing and seeing firsthand the many issues that face farmers and agriculturalists in this area, there are several recommendations to be made for future studies and courses of action. A main course of action that needs to be implemented is the enforcement of KWS compensation policies. Most people either do not know how to apply for compensation, or do not apply because they do not think they will receive any. In most cases this is true, which is why the compensation issue needs to be enforced. When the compensation program was in effect previously, people abused the program by falsely reporting damage and collecting compensation, so the policy was discontinued. If a study could be done to find a way to reinstate the program and make people be held accountable for what they claim, then many of the peoples' frustrations with wildlife could be eased. Additionally, KWS told several areas on the slopes of Kilimanjaro that they would begin construction on an electric fence around the farms that would succeed in keeping the wildlife out, but the fence was never built. If that project could get off the ground, and then be implemented in other areas, that would have a huge effect on the extent of damage caused by wildlife. When asked for suggestions on what should be done to decrease wildlife conflicts, nearly all of the respondents said that an electric fence should be constructed around either the parks of their farms. While a fence around the parks would not be feasible, constructing an electric fence around the farms would not be as difficult, and would be very successful in keeping out wildlife.

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