Master thesis

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Investigating the relationship between attitudes, intention and illegal grazing behavior in the Serengeti ecosystem using the theory of planned behavior

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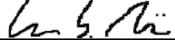
Date: 05/12/16

DECLARATION

I hereby declare that this thesis is the result of my own research, investigation and findings. Sources of information other than my own have been acknowledged and a reference list has been included. This work has not been previously submitted to any other university for the award of any academic degree.

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ABSTRACT

Tanzania is currently experiencing declining trends in and a loss of biodiversity and natural habitats due to an increasing human pressure both outside and inside its protected areas (PAs). A lack of local support for conservation and illegal resource extraction within PA boundaries are among the major challenges. This study investigates the relationship between attitude, intention and illegal grazing behavior (i.e. livestock grazing within PAs) of local communities bordering PAs in the southwestern part of the Serengeti ecosystem using the theory of planned behavior. Data was collected during April 2016 by household interviews (n = 122) using a semi-structured questionnaire. The results show that the households' attitudes towards the PAs were largely influenced by the study site, perception of benefits and problems, awareness of local NGOs, household size and gender. The attitude towards the PAs was related to the intention to illegally graze. However, the attitude towards and the perceived behavioral control over illegal grazing and attitude towards illegal resource extraction in the PAs emerged as the strongest predictors of intention. Intention and wealth, in turn, emerged as the most important predictors of behavior. These findings emphasize the need to understand and incorporate psychological, general attitude and socioeconomic factors in the development of conservation interventions targeted to change behavior.

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List of Abbreviations:

ATT   Attitude towards illegal grazing in the protected areas (construct)
ATTCON   Attitude towards conservation (construct)
ATTPA   Attitude towards the protected areas (construct)
CFA   Confirmatory factor analysis
MGR   Maswa Game Reserve
PA   Protected area
PBC   Perceived behavioral control of illegal grazing in the protected areas (construct)
SN   Subjective norm towards illegal grazing in the protected areas (construct)
SNP   Serengeti National Park
TOPB   Theory of Planned Behavior

1. INTRODUCTION

Biodiversity conservation has received increasing attention in recent decades and PAs, which are internationally regarded as one of the most important and efficient measures to protect biodiversity and ecosystem services (Bruner et al., 2001), have substantially increased both in numbers and coverage (Jenkins and Jobba, 2009). In addition, 196 nations have signed the United Nation's Convention on Biological Diversity (UNEP, 2016). The environmental, economic and cultural value of biodiversity is widely acknowledged (Balmford et al., 2002; MEA 2005). However, it is currently threatened by unsustainable consumption in developed nations and population growth, urban expansion and poverty in the tropics (Vitousek et al., 1997; Chapin et al., 2000; Isbell, 2010). The expansion of agriculture, industry and urbanization is fragmenting, degrading and destroying the natural environment while fishing, hunting, trade and increasingly climate change (Parmesan and Matthews, 2006) continue to cause habitat degradation and further depletion of critically endangered species (Schipper, 2008; Isbell, 2010; Pimm et al., 2014).

Tanzania, one of the twelve mega-biodiverse countries in the world, is currently facing such challenges (CBD, 2014; Caro and Davenport, 2016). Tanzania is home to a vast diversity of species including a high number of endemic as well as threatened species and the country has designated about 40% of its total surface area as PAs. The government of Tanzania has taken several actions to halt the loss of biodiversity within the country including mainstreaming biodiversity issues into national policies, expanding the network of PAs and implementing community-based conservation (CBD, 2014). Despite these efforts, Tanzania continues to face conservation challenges as a result of a number of factors. These include a limited financial, human and research-related capacity, limited public awareness on biodiversity issues and the failure to acknowledge the importance of ecosystem services in rural peoples' livelihoods (CBD, 2014). The latter in particular is not quantified and taken into consideration in political decision-making (CBD, 2014; Caro and Davenport, 2016). As a result, Tanzania experiences declining trends in and loss of biodiversity and natural habitats due to increasing human pressure both outside and inside its PAs (CBD, 2014). Human encroachment, poaching (Loibooki et al., 2002; Ceppi and Nielsen, 2014) and livestock grazing within the boundaries of PAs (Nyahongo et al., 2005; Kideghesho, 2012) are among the major challenges confronting the biodiversity of Tanzania (Caro and Davenport, 2016).

Illegal grazing in PAs commonly occurs when local communities or individuals experience shortage of pasture and water sources in village lands, especially during dry seasons (Kideghesho, 2012; Mwakatobe et al., 2013). The increase of livestock populations within PAs threatens conservation objectives for a number of reasons. Livestock may outcompete wild herbivores due to overlap of diets resulting in overgrazing and subsequent decline in the populations of wild herbivores (Fekdu et al., 2016). Livestock may also increase soil erosion from the trampling of soil (Ba Diao, 2006) and increase the risk of disease transmission due to the interactions between wild and domestic animals (Gortázar et al., 2007). Therefore, illegal grazing has become a crucial management issue in many of Tanzania's PAs including Maswa, Ibanda and Kitengule Game Reserves as well as Tarangire and the Serengeti national parks (Kideghesho, 2012). The motivational drivers of illegal grazing may range from economic incentives, to legal ignorance, tradition, attitudes and concepts of fairness (Keane, 2008). However, the underlying factors behind the increase in illegal grazing include human population growth, climate change and the failure of current conservation interventions to change the behavior of local communities or individuals (Kideghesho, 2010).

While population growth and climate change are critical issues, they are beyond the scope of most conservation interventions, which commonly concern themselves with the more immediate drivers of biodiversity loss such as the illegal extraction of resources within PAs (Jachmann, 2008). In these instances, conservation interventions such as the adoption of inclusive management strategies or increased enforcement efforts aim to change the behavior of the responsible local communities or individuals (Robinson, 2010; Mackenzie et al., 2012). Nevertheless, successfully influencing behavior depends on the predictors of human behavior being appropriately identified (St John et al., 2011).

Attitudinal studies have widely been adopted to evaluate the impact and acceptance of conservation interventions on local communities (Gillingham and Lee, 1999; Mehta and Heinen, 2001; Infield and Namara, 2002; Holmes, 2003; Struhsaker et al., 2005; Kideghesho et al., 2007; Bragagnolo et al., 2016). An attitude towards an object can be seen as an individual's evaluation of general positive or negative feelings towards that object (Ajzen and Fishbein, 1980). Positive attitudes towards PAs or conservation in general have been considered an important criterion of long-term success (Brockington, 2004; Allendorf, 2010; Pullin et al., 2013). This idea states that if protected areas are to continue existing as

institutions and effectively protect the biodiversity within them, then local communities must support them (Holmes, 2013). Dissatisfied local people may oppose protected area regulations (von Essen, 2014) and refuse to cooperate with authorities (Stern, 2008; Holmes, 2013). Further, attitudes towards PAs may relate to behavior, and can thus predict the behavior of local communities and their response to conservation interventions (Holmes, 2003; Lee et al., 2009; Tesfaye et al., 2012).

Numerous factors have been shown to influence the attitudes towards PAs (see Bragagnolo et al., 2016 for review). These factors include the perceptions about the benefits and costs related to PAs (Allendorf et al., 2007; Schmitt, 2010; Tessema et al., 2010), the perceptions about PA management and other relevant organizations e.g. NGOs, (Gillingham and Lee, 1999; Kideghesho, 2007; Allendorf, 2010), the interaction with PA management (Holmes, 2003), conservation attitudes (Karki and Hubacek, 2015) and demographic and socioeconomic characteristics (from now referred as socioeconomic characteristics) (Anthony, 2007; Vodouhê et al., 2010). The role of socioeconomic characteristics in influencing attitudes has been shown to be less consistent than the role of perceptions and attitudes (Allendorf, 2007; Bragagnolo, 2016).

Although the results of some studies have indicated that improving the attitudes of local residents towards PAs has led to more conservation-friendly behavior (Adams and Infield, 2001; Holmes, 2003; Lee et al., 2009; Sirivongs and Tsuchiya, 2012), other studies have not been able to document this important link (Walpole and Goodwin, 2001; Infield and Namara, 2001; Waylen, 2009; Karki and Hubacek, 2015). Instead, they found that households which held positive attitudes towards a PA either continue to engage in behaviors that have a negative effect on biodiversity, thereby undermining conservation efforts, or do not actively engage in conservation-friendly behaviors. For example, in a study by Infield and Namara (2001), local communities around Lake Mburo National Park in Uganda, which had been subject to a 7-year-long community conservation program, did show more positive attitudes towards the park and wildlife than communities that had not been included in the program. However, their behavior did not significantly change and high levels of poaching and illegal grazing continued to persist within the park. Moreover, in a study on the attitudes of households towards two critically endangered species, the leatherback turtle (*Dermochelys coriacea*) and the Trinidad piping-guan (*Pipile pipile*), Waylen et al. (2009) found that

attitudes towards conservation did not necessarily predict behavior. In this case, hunting remained a popular activity even among respondents who had a positive attitude towards conservation and recognized that hunting threatened conservation objectives. As a consequence, attitude towards PAs or conservation in general may not be useful in the design of conservation interventions (e.g. implementation of benefit-sharing mechanisms) aimed at changing either general (e.g. resource extraction) or specific behaviors (e.g. illegal grazing) because a person may have a positive attitude toward a PA and still engage in behaviors that oppose that attitude (Vining et al., 2002; St John et al. 2011).

The problem also lies in demonstrating a causal relationship between attitude and behavior controlling for the range of circumstances that might set aside positive attitudes and good intentions. For example, in a study of local villagers living adjacent to Bardia National Park in Nepal, Karki and Hubacek (2015) found that although attitude towards the national park was significantly related with the intention to contribute to conservation efforts, intention did not significantly influence actual behavior (i.e. fuelwood extraction). In explaining these results, they stressed that many of the studied households were highly dependent on the resources of the park with no or little access to alternatives. Their findings suggest that attitudes are important but whether an individual engages in illegal resource extraction activities is also influenced by contextual and socioeconomic factors. Marshall et al. (2010) also emphasized that a high level of resource dependency on PAs can act as a barrier to conservation interventions.

Conservation research, especially in the context of developing countries, has often neglected social-psychological factors that are known to influence human behavior (St John et al., 2011). Interventions that focus on social-psychological factors rather than general information and educational campaigns or economic incentives may be likelier to achieve behavioral change (McKenzie-Mohr, 2000). Social–psychological models may thus offer new and promising insights into the relationship between attitude, intention and behavior in the context of biodiversity conservation and PA management (Mascia, 2003; Stern, 2008; St John et al., 2011; Bragagnolo et al., 2016). Particularly with regard to non-compliant behavior, it has been argued that aspects from social-psychological theories may be useful in understanding individuals' decisions in respect of complying with a given set of regulations (Sutinen and Kuperan, 1999; Keane et al., 2008).

One social-psychological theory that is often drawn on in conservation research is the theory of planned behavior (TOPB) (Ajzen, 1991). The theory applies three socio-psychological and behavior-specific factors (from now on referred as psychological factors): attitudes, subjective norms and perceived behavioral control as predictors of intention. Intention, in turn, predicts behavior (see Figure 1). Attitude is defined as a person's favorable or unfavorable evaluation of the behavior, subjective norm is the perceived social pressure to engage or not engage in the behavior while perceived behavioral control reflects the extent to which the individual feels he or she is able to actually carry out the behavior (Ajzen, 1991). According to the theory, intention is the immediate antecedent of behavior and completely mediates the effects of attitude and subjective norm on behavior. Perceived behavior control, however, is supposed to influence behavior both indirectly through intention and directly (Ajzen, 1991). Ajzen (1991) offers at least two reasons for this hypothesis. First, holding intention constant, the effort expended to successfully complete a behavior is likely to increase with perceived behavioral control. For instance, if two persons have equally strong intentions to illegally graze, the individual who is more confident that he or she can carry out this activity is more likely to proceed than is the individual who questions his or her ability. The second rationale is that perceived behavioral control can frequently be used as an alternative for the measure of actual control (Ajzen, 1991).

Figure 1. Theory of planned behavior. Model depicting the theory of planned behavior (Ajzen, 1991).
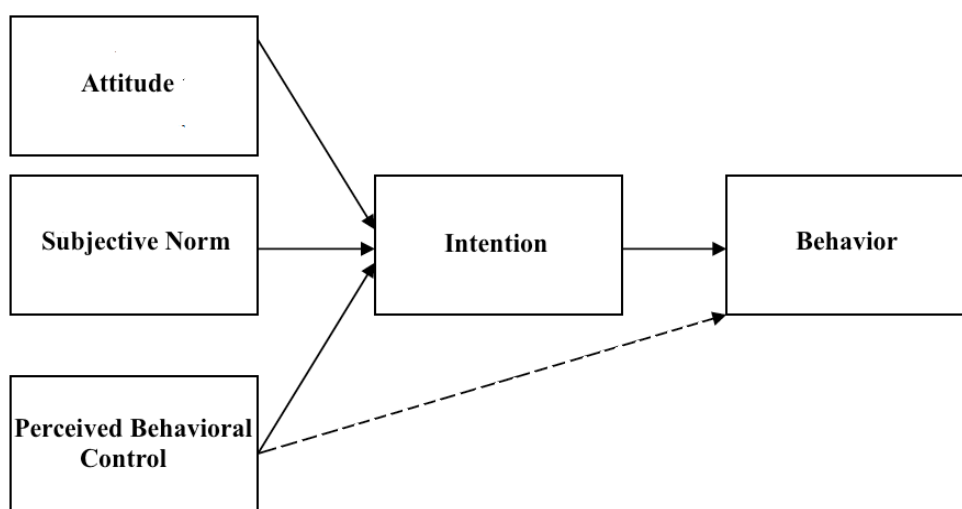
The applicability of the TOPB in predicting the intentions and behavior of people has been documented in various areas of environmental research such as hunting behavior (Hrubes et al., 2001), compliance with wildlife-protection laws (Fairbrass et al., 2016) and national park rules (Goh, 2015) and energy consumption (Clement et al., 2014). Other studies have used the TOPB to investigate the use of public transportation (Heath & Gifford, 2002; de Groot and Steg, 2007), examine the public support for biodiversity conservation (Johansson and Henningsson, 2009) and understand the adoption of agricultural conservation practices (Lynne et al., 1995; Wauters et al., 2010).

Though these studies have contributed to the understanding of conservation intentions and behavior, they have mainly been conducted in developed nations and few have focused on the conservation of biodiversity. The conservation setting in developing countries is faced with multiple challenges. Socioeconomic, developmental and governance pressures experienced by rural communities in these countries may conflict with biodiversity conservation priorities (Kideghesho, 2010). Also, the cultural norms of developing countries may differ and potentially influence decision-making processes and behavioral outcomes (Ormsby and Kaplin, 2005; Nilsson, 2016). Thus, it is critical to develop an understanding of the psychological factors influencing intention and behavior as well as to investigate whether the TOPB framework is actually appropriate in such contexts.

To the best of the author's knowledge only a few studies have applied a TOPB framework to conservation problems in developing countries. This include studies on farm-level tree planting (Zubair & Garforth, 2006; Tesfaye et al., 2012; Meijer et al., 2015), forest conservation (Meijer et al., 2016), conservation of endangered species (Nilsson, 2016) and opposition towards PAs (Stern, 2008). For example, Tesfaye et al. (2012) applied the TOPB to predict the intention of forest user groups in Ethiopia to participate in tree planting. They found attitude, perceived behavioral control and subjective norm significant in predicting intentions. In addition to the above-mentioned studies, Steinmetz et al. (2014) used the TOPB to develop a conservation outreach program in a reserve in Thailand that might have suppressed poaching and initiated wildlife recovery in a wildlife reserve in Thailand. These limited examples demonstrate the potential of the TOPB in improving the understanding of conservation behavior and the effectiveness of conservation programs.

Although many studies have demonstrated the applicability of TOPB in predicting intentions and behavior (Armitage and Conner, 2001), the relationship between attitude, intention and behavior in TOPB is conditioned on the notion that that people assesses the consequences of performing a behavior before choosing to engage in it or not and makes rational decisions on the basis of an evaluation of available information (Ajzen and Fishbein, 1980). These assumptions are similar to those made in economic models, e.g. utility maximizing, except that the TOPB uses quite different predictors of behavior (Cao and Mokhtarian, 2005). In this regard, it has been argued that this process of reasoning and evaluation may require cognitive effort and time which is often not feasible in real-life decisions and preferences (Eiser et al., 2010). Similarly, Barr et al. (2001) stressed that a limitation of the TOPB is that it is based on psychological factors only.

Therefore, to understand the motivational drivers behind a specific behavior, general attitude factors e.g. attitude towards PAs (Karki and Hubacek, 2015), conservation in general (Lee et al., 2009) and resource extraction from PAs (Karki and Hubacek, 2015) as well as socioeconomic factors (Emtage and Suh, 2004; Barr and Gilg, 2007; Sniehotta, 2009) must be considered in addition to psychological factors (Stern, 1999; Barr et al., 2001; Barr and Gilg, 2007). For example, Meijer et al. (2016) found that extensive resource extraction in forests remained among farmers in Malawi despite showing negative attitudes, unfavorable subjective norms and low perceived behavioral control as well as negative intentions towards cutting down trees. The authors attributed these results to poverty and high levels of resource dependency.

The effectiveness of PAs in protecting the biodiversity of Tanzania relies among others on engaging with local communities and individuals to reduce harmful behaviors such as illegal grazing as well as encouraging and incentivizing active involvement in conservation and the sustainable management of resources (Kideghesho, 2010). This requires knowledge of which factors influence attitudes towards PAs but also of how well these attitudes translate into intention and actual behaviors. It is however also clear that successfully influencing intention and behavior depends on appropriately identifying other predictors of human behavior such as psychological and socioeconomic factors (Ajzen, 1991; Vlek and Steg, 2007; St John et al., 2011). Only by understanding the predictors of behavior, can conservation agencies develop interventions that effectively target and promote conservation actions (St John et al., 2011).

This study adopts a holistic social-psychological approach to investigate the attitudes, intentions and behavior of local communities bordering PAs in the Serengeti ecosystem, Tanzania, and will address the following specific objectives: 1) examine households' attitudes and perceptions related to the PAs, conservation and illegal grazing, 2) determine which factors influence the attitudes of households towards the PAs and 3) investigate the role of psychological, general attitude and socioeconomic factors in predicting intention and behavior of households with respect to illegal grazing.

2. METHODOLOGY

2.1. Study Area

The Serengeti ecosystem, covering approximately 25.000 km^2, is located in the northwestern part of Tanzania. The Serengeti is a highland savanna region with woodlands and plains ranging from 900m - 1.500m a.s.l. Four different categories of PAs protect the ecosystem, each with specific restrictions on natural resource use (Kideghesho, 2010). At its core lie the Serengeti National Park (SNP), which is buffered by four Game Reserves (Maswa, Grumeti Ikorongo and Kijereshi), the Loliondo Game Controlled Area, the Ngorongoro Conservation Area and the Maasai Mara National Reserve in Kenya (Schmitt, 2010). The Serengeti is a globally important conservation area due to its high diversity and abundance of wildlife species and unique habitat types. The ecosystem is home to the largest migrating ungulate population in the world, a high concentration of resident herbivores and large predators and over 500 species of birds and numerous other ecological features (Kideghesho, 2010).

The Serengeti ecosystem is a multi-ethnic area containing over 30 ethnicities. Examples are the Ikoma and Sukuma living in the western part and the Maasai in the eastern part. While the Maasai are pure pastoralists, the tribes in the western Serengeti are typically agro-pastoralists (Kideghesho, 2010; Schmitt, 2010). The ecosystem has more than a hundred villages located adjacent to the game reserves and national park as well as within the NCA. Many people in the ecosystem have been around since before the inception of the PAs and have thus experienced their traditional grazing lands being taken away from them (Kideghesho, 2010). Benefit-sharing mechanisms have been implemented by various organizations including Serengeti National Parks, the Wildlife Division, private hunting companies and various NGOs (Schmitt, 2010). Benefits are provided to the communities surrounding the ecosystem mainly

in the form of infrastructure projects such as the building of classrooms, dispensaries or boreholes for water and the provision of education on natural resource related matters (D. Nuhu, Personal communication, March 25th 2016).

The Southwestern part of the Serengeti ecosystem was chosen as case study area after informal talks with Frankfurt Zoological Society and academic staff from Sokoine University of Agriculture. The main ethnic group is in this area is the Sukuma. The Sukuma are typically agro-pastoralist and rely on farming and livestock-holding to meet subsistence needs. This area is considerably less studied than other parts of the ecosystem (e.g. the Northwestern part) despite high human population and increasing pressure on the ecosystem (G. Soka, personal communication, March 20th 2016; D. Rentch, personal communication, March 28th 2016). For example, illegal grazing is common in villages located close to the SNP and Maswa Game Reserve (MGR) (Kideghesho, 2012; G. Soka, personal communication, March 20th 2016; personal observation, April 2016). Hence, the findings of this research seemed highly relevant for the management of this part of the ecosystem and could contribute to the development of conservation policies, strategies and interventions aimed at improving attitudes towards the PAs and changing the behavior of the local communities.

Figure 2. Study villages. Map of study villages in the Serengeti ecosystem. Adapted from Kideghesho et al. (2007) and Schmitt (2010).
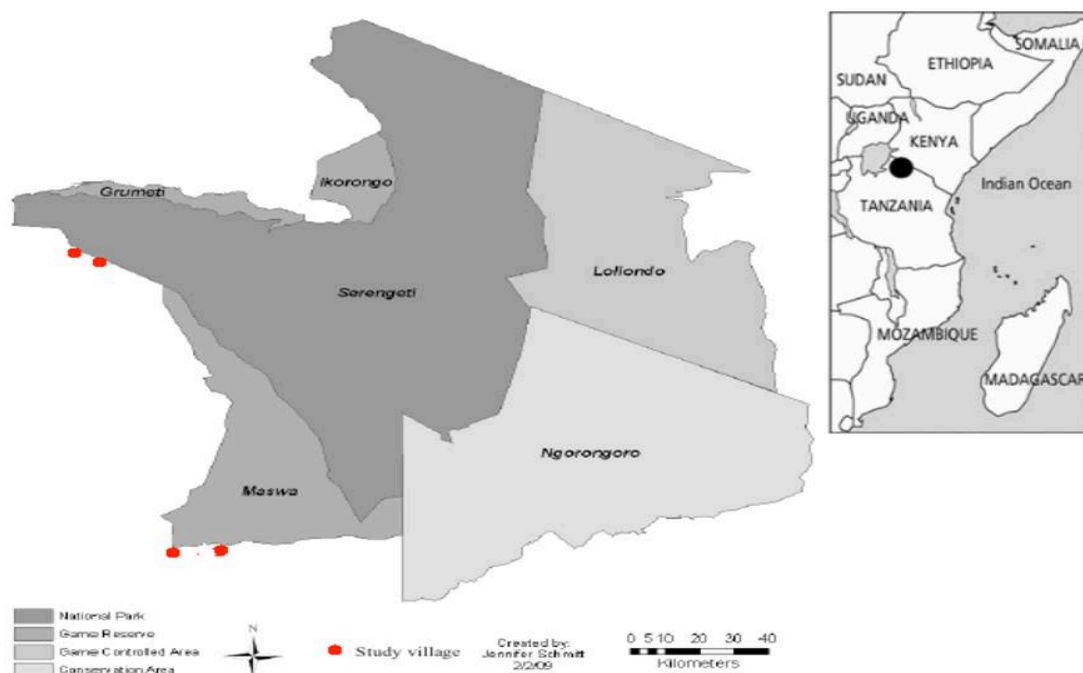
Four villages were selected for this study (see Figure 2 for location), namely, Matongo and Salalilya bordering SNP in Bariadi district and Mwanyahina and Buganza bordering MGR in Meatu district (village characteristics can be found in Table 1). The study villages were selected on the basis of three criteria: 1) villages bordering SNP and MGR, respectively, would be included, 2) distance to the PAs as we assumed that the local communities living close to the PAs would be more affected and therefore more knowledgeable about the PAs and 3) ease of access as public transportation or basic private transport was necessary.

Table 1. Village characteristics. Contextual and socioeconomic characteristics of study villages

	Matongo	Salalilya	Mwanyahina	Buganza
District	Bariardi	Bariardi	Meatu	Meatu
Region	Simuyi	Simuyi	Simuyi	Simuyi
Distance from nearest PA (km)	0	0	0	0
Number of HHs	870	500+	536	564
Population	6700	5000	3388	5470
Village formation (year)	1959	2014	1974	1993
Mean education level	Primary	Primary	Primary	Primary
Main ethnic group	Sukuma	Sukuma	Sukuma	Sukuma

2.2. Sampling and Data Collection

2.2.1. Questionnaire design

The questionnaire developed to collect information on household level (see Appendix I) contained both closed and open-ended questions and comprised six sections (a-f), which aimed to elicit the following information:

a) Introductory information on location and interviewee

b) Socioeconomic characteristics (e.g. age, residential status, ethnicity, main occupation, education, household income-generating activities and household assets)

c) Knowledge of, interaction with and perceptions of the PAs (e.g. perceptions of costs and benefits of the PAs, interaction with PA staff and awareness of local NGOs):

d) Attitude towards the PAs (5 items), attitude towards resource extraction in the PAs (1 item) and attitude towards conservation in general (6 items), using 12 items answered on a 5-point Likert-type scale ranging from strongly disagree to strongly agree;

e) Attitude (5 items), subjective norm (4 items), perceived behavioral control (4 items) and intention (2 items) with respect to illegal grazing using 15 items answered on a 5-point Likert-type scale ranging from strongly disagree to strongly agree and

f) Illegal grazing behavior (i.e. yes/no, reason and frequency)

2.2.2. Sampling technique

Households were selected using a modified random route sampling technique. Random route is a non-probability sampling technique where the research team chooses a geographical point within a predetermined sample area and selects households moving in a specified direction away from this point (Bauer, 2014). Despite the statistical inferiority of non-probabilistic to probabilistic sampling techniques, this approach was chosen because of time and budget limitations. In addition, village lists were not provided by the village leaders and creating such lists or other sampling frames in order to perform random sampling was deemed too resource demanding. The sample area, i.e. the study villages, was divided into two separate areas: the village center and village periphery. Households located in and around the village center were sampled by one field team and households located along the village periphery by another field team. By this method, potential variation in households caused by their geographic location within the villages was captured. The research team aimed to select a minimum of 30 households in each village. However, this target was not reached in one village due to extensive rainfall.

2.2.3. Questionnaire administration

During April 2016, a total of 122 households were surveyed in the four study villages. The number of households sampled in each village ranged from 21 – 36. On average, each questionnaire took about 45 minutes to complete and was carried out in Kiswahili. The field research team consisted of two Danish masters' students (the author included) and two Tanzanian research assistants/interpreters native in Kiswahili.

A household was defined as a group of individuals that eat together from the same pot. At each household, the field team asked for the household head. If unavailable, the field team interviewed someone else in the household over age 18 who was knowledgeable about household affairs. If the respondent did not have a basic understanding of Kiswahili, the questionnaire was not administered and the field team continued to the next household.

Accompanied by a local person knowledgeable of the area, the households located close to the village center were accessed by foot. The households located in the village periphery were accessed by motorbike with the assistance of local drivers familiar with the area. Being accompanied by locally hired assistants enhanced cooperation with the respondents. Before

the administration of each questionnaire, the assistants gave a short introduction with an emphasis on the researchers' affiliation with an academic institution from Denmark and Tanzania, the purpose of the research and the anonymous character of the questionnaire. If the respondent was not aware of the nearest PA (e.g. SNP or MGR) the interview was concluded after the sections in the questionnaire about socioeconomic characteristics (sections a, b and c). If the respondent was aware of the nearest PA but did not own livestock, the respondent was not asked about illegal grazing (sections e and f). Additionally, because of the illegal nature of this behavior, the research assistant asked informally about actual behavior (section f), either during or upon finishing the interview.

2.2.4 Structured village leader discussions

Together with the household questionnaire, structured village leader discussions (see Appendix II for guide) were held in the four villages to gain a better understanding of the people's attitudes and perceptions as well as the relationship between study village and the PAs. The discussions took an average 45 minutes to complete and contained the following topics: village demographics, livelihood factors, natural resource use and knowledge of, interaction and relationship with the PA.

2.3. Data Analysis

2.3.1 Descriptive statistics

Household responses are presented in percentages and descriptive statistics were calculated in SPSS 23. Chi-square tests were used to test for differences in the distribution in the proportions of responses e.g. the level of education among the study villages. Fisher's exact test, which corrects for small cell counts, was performed if the expected cell count was less than five. ANOVA was used to test whether there existed differences in the means of responses among the study villages e.g. household size or number of livestock. However, if the underlying assumptions (i.e. normality and homoscedacity) for ANOVA were not met Welch's ANOVA was applied to data instead. The significance level for the statistical test of hypothesis was set at a p-value of 0.05 - only significant differences are reported and explained.

2.3.2 Household asset index

As a measure of material wealth, a household asset index of the enumerated household assets was created using the method developed by Filmer and Pritchett (2001). The assets chosen for the index were based upon a list generated by Schmitt (2010) and used as indicators of material wealth in previous studies (Filmer et al., 2001; Ellis and Mdoe, 2003; Booysen et al, 2008)(see Table 6 for the household assets included in the index). According to the method described in Filmer and Pritchett (2001), principal components analysis (PCA) was used to determine the weights for an index of the asset ownership (dichotomous) variables. PCA is a technique for extracting from a set of variables those orthogonal linear combinations of the variables that explain the shared information most successfully (Filmer and Pritchett, 2001). The first principal component is the linear index of all variables that explains the largest amount of information (Filmer and Pritchett, 2001).

This is an attractive method for creating an index for two reasons. Firstly, it is technically similar to a regression in terms of minimizing residuals, but in this case the residuals are measured against all of the variables (Johnston and Abreu, 2013). Second, the coefficients or scoring factors offer fairly easy interpretation. The scoring factors of the variables are related to how much information they provide about the other variables. For example, if ownership of one type of asset is highly indicative of ownership of other assets, then it receives a positive scoring factor. Conversely, it receives a negative coefficient if ownership of an asset indicates that a household is likely to own few other assets. Because all the asset ownership variables are dichotomous, the weights have a fairly easy interpretation and the ownership of an asset (e.g. moving from 0 to 1) changes the index by the scoring factor divided by the standard deviation (Filmer and Pritchett, 2001). As a note, the household asset index is denoted as 'wealth' in the subsequent sections.

2.3.3. Factors influencing attitudes towards the PAs

Multiple linear regression analysis was performed to determine which factors influenced the households' attitudes towards the PAs. The choice of independent variables included in the regression model was based on their significance in influencing attitudes, as reported in the Introduction. These were socioeconomic variables, awareness of NGOs, interaction with PA staff, perception of benefits and problems from the PAs and attitudes towards conservation.

Assessment of construct validity

Attitude towards the PAs (ATTPA) and attitude towards conservation (ATTCON) were measured by multiple items (five and six items for ATTPA and ATTCON, respectively) in order to capture a more inclusive notion of the constructs than could be achieved with only a single item (Mehta and Heinen, 2001). As such, confirmatory factor analysis (CFA) was conducted in AMOS 23.0 to assess the construct validity of questionnaire items to the corresponding latent constructs. CFA is a multivariate statistical procedure which is used to test how well measured items/variables represent their corresponding latent constructs. In CFA the researcher can therefore specify the number of latent constructs that represent the data and specify the relationship between the measured items and the latent constructs (Kline, 2005). Thus, the objective of CFA is to test whether the data fit a hypothesized measurement model. Prior to conducting the CFA, scores on items connoting negative attitudes toward the PA (e.g. '*the protected area should be abolished*') were reversed to ensure that scoring on all items were uniform in direction. The Chi-squared test, the standardized root mean squared error of approximation (RMSEA) and the comparative fit index (CFI) were used to assess the goodness-of-fit of the measurement model to the data. If the standardized factor loading value for an item did not meet the minimum criterion of 0.40, the item was eliminated to increase reliability and decrease measurement error (Stevens, 1992). The composite reliability as well discriminant and convergent validity for each construct was assessed. The scores for each latent construct were imputed in AMOS 23.0 and used in the subsequent analyses.

Preliminary analyses

Although it would be preferable to include all examined socioeconomic factors in the multivariate analysis described below this was not possible due to the relatively small sample size (n=113). Subsequently, correlations (Pearson's) were performed to determine which socioeconomic variables were significantly correlated with ATTPA. The examined socioeconomic variables were age, gender, education, residential status, wealth (i.e. the household asset index) and income-generating activities. It should be noted that other socioeconomic characteristics such as ethnicity and main occupation were not examined due to very low variation among the respondents in these characteristics. Gender and household size were the only socioeconomic variables significantly associated with ATTPA and therefore included in the subsequent analyses. Correlations (Pearson's) were then used to

examine the bivariate relationships between the independent variables and ATTPA.

Multiple linear regression analysis

Multiple linear regression analysis with ATTPA as the dependent variable was then performed to determine which factors influenced the households' attitudes towards the PAs. The independent variables included in the regression model were gender, household size, awareness of NGOs, interaction with PA staff, perception of benefits and problems from the PAs and ATTCON. In addition, the specific study site/protected area (i.e. villages bordering SNP and villages bordering Maswa) was controlled for using a dummy variable. Thus, the multiple linear regression analysis was employed to test the following regression equation:

$Y_{ATTPA} = \beta_0 + \beta_1*$study site $+ \beta_2*$gender $+ \beta_3*$household size $+ \beta_4*$interaction with PA staff $* + \beta_5*$awareness of NGOs $+ \beta_6*$perception of benefits $+ \beta_7*$perception of problems $+ \beta_8*$ATTCON $+ e$

Data was screened using histograms, scatter plots and various statistics (e.g. tolerance and variance inflation factor) to ensure that there were no violations in the assumptions (i.e. normality of residuals, linearity, homoscedacity and multicollinarity) of multiple regression (Osborne et al., 2002). Only respondents knowledgeable of the PAs who answered section d of the household questionnaire were included in the analysis. The sample size (n=113) was therefore just below the recommended sample size for multiple linear regression using the formula n= 50 + 8 * k, where k is the number of independent variables, set forward by Tabachnick and Fidell (2007).

2.3.4. The role of psychological, general attitude and socioeconomic factors in predicting the intention and behavior of illegal grazing

Multiple logistic regression analyses were performed to investigate the role of psychological, general attitude and socioeconomic variables in predicting the households' intention and behavior with respect to illegal grazing. The choice of variables was based on the theoretical framework and their significance in influencing intention and behavior as reported in the Introduction.

Assessment of construct validity

Multiple items measured the attitude towards illegal grazing (ATT), the subjective norm towards illegal grazing (SN) and the perceived behavioral control over illegal grazing (PBC). Five items measured ATT while four items each measured PBC and SN. Multiple items were used to measure each latent construct as recommended by Ajzen (1991). While the items used to measure attitudes, subjective norm and perceived behavioral control in this study were simplified and not worded precisely as suggested by Fishbein and Ajzen (2010), it is believed that they not only captured the essence of these concepts but reduced respondent fatigue. The assessment of the construct validity of the questionnaire items to the corresponding latent constructs followed the procedure outlined in the previous section (section 2.3.3) and as suggested by Fishbein and Ajzen (2010). The scores for each latent construct were imputed in AMOS 23.0 and used in the subsequent analyses.

Intention to illegally graze was not included in the CFA, as the item to factor ratio of 2:1 was below the recommended ratio of 3:1 which is required to ensure acceptable reliability and increase the replicability of the factor (Raubenheimer, 2004). Instead, the two items measuring intention were summed and thereafter dichotomized (i.e. scores under 7 coded as 0 (no intent) and scores over 7 coded as 1 (intent)) in order to achieve scale correspondence with behavior as recommended by Topa and Moriano (2010). The self-reported behavior of illegal grazing, obtained from section f of the questionnaire, was used as a measure of behavior. Thus, the intention variable was a measure of whether the respondent intended to graze illegally or not while the behavior variable measured whether the respondent actually illegally grazed or not.

Preliminary analyses

As in the previous analysis (see section 2.3.3), it would be preferable to include all socioeconomic variables in the multivariate analyses described below. Yet the relatively small sample size (n=82) did not allow this. Instead, cross tabulations with Fisher's exact tests and correlations (Pearson's) were performed to determine the significant associations between socioeconomic variables (age, gender, education, residential status, wealth and income-generating activities) and intention and behavior, respectively. Household size was significantly correlated with intention while both household size and wealth were

significantly associated with behavior. Only these socioeconomic variables were therefore included in the subsequent analyses. Correlations (Pearson's) were then used to examine the bivariate relationships among the independent variables and intention and behavior, respectively. Only variables that were significantly ($p<0.1$) associated with intention and behavior, respectively, were included in the subsequent analyses

Multiple logistic regression analyses

Multiple logistic regression analyses were then used to investigate the role of psychological (i.e. ATT, SN and PBC), general attitude (i.e. ATTPA, attitude towards resource extraction in PAs (ATTRE) and ATTCON) and socioeconomic variables (i.e. household size and wealth) in predicting intention and behavior, respectively. Logistic regression was chosen because the dependent variables, intention and behavior, were dichotomous.

Prediction of intention

Three logistic regression models were performed to separately investigate the role of psychological, general attitude and socioeconomic variables in predicting intention. The first model (a) contained the psychological variables as predictors; the second model (b) contained the general attitude variables while the third model (c) contained the socioeconomic variables. The study site was controlled for using a dummy variable in all models. The regression equations for model a-c are provided below:

(a) Logit ($P_{\text{Intention}}$)= $\beta_0 + \beta_1$*study site + β_2*ATT + β_3*SN + β_4*PBC + e

(b) Logit ($P_{\text{Intention}}$)= $\beta_0 + \beta_1$*study site + β_2*ATTPA + β_3*ATTRE + β_4*ATTCON + e

(c) Logit ($P_{\text{Intention}}$)= $\beta_0 + \beta_1$*study site + β_2*household size* + e

A sequential approach was then used to investigate the relationship between all predictors and intention. Accordingly, the psychological variables were entered in the first step (Step 1), general attitude variables in the second (Step 2) and socioeconomic in the third step (Step 3). In the last step (Step 4) and similarly to what was done by Poobalan (2012), it was examined whether a model which only contained significant variables from the best model in the three previous three steps, showed a better fit to the data. Study site was controlled for using a dummy variable in all steps.

Prediction of behavior

Three logistic regression models were used to investigate the respective role of intention, psychological and socioeconomic variables in predicting behavior. As a note, the general attitude variables were not significantly associated with behavior and therefore not included in the models predicting behavior. Intention was included as predictor in the first model (i). The second model (ii) contained the psychological variables and the third model (iii) socioeconomic variables. The regression equations for model i-iii are provided below:

(i) Logit ($P_{Behavior}$)= β_0 + β_2*study site + β_1*Intention + e

(ii) Logit ($P_{Behavior}$)= β_0 + β_2*study site + β_1*ATT + β_2*SN + β_3*PBC + e

 (iii) Logit ($P_{Behavior}$)= β_0 + β_1*study site + β_2*wealth + β_3*household size + e

Similarly to prediction of intention, a sequential approach with all predictors was performed. Intention was entered in the first step; the psychological variables in the second step and socioeconomic variables in the third step. It was then examined whether a model, which only contained the significant variables from the sequential approach, showed the better fit to the data. Again, the study site was controlled for using a dummy variable

Model fit and model comparisons for the predictions of intention and behavior were assessed using the chi-square statistic, the Akaike Information Criterion (AIC) and Nagelkerke's pseudo R^2. In itself, the value of the AIC for a given model has no meaning and can only be used when compared to the AIC of a series of models. The model with the lowest AIC being the best model among all models specified for the data at hand (Burnham, 2011). If two models exhibited similar values of the AIC, the delta AIC approach, as described in Burnham (2011), was utilized to choose the best model. Similarly, the Nagelkerke's R^2 should be interpreted with care when specifying for a single model, though the measure is useful when comparing models (Peng et al., 2002). Only respondents who owned livestock and answered section e and f of the household questionnaire were included in the analysis. Thus, the sample size used in the logistic regressions was small (n=82) although it did meet the recommended sample size of 10 cases for each predictor/independent variable (Agresti, 2007). The independent variables were screened for levels of tolerance and the variance inflation factor (VIF) to ensure that there was no multicollinarity among the variables in the multiple logistic regression models.

3. RESULTS

3.1. Descriptive Statistics

3.1.1. Socioeconomic factors

The socioeconomic characteristics of the surveyed households are found in Table 2. Approximately 74% of the 122 respondents were male and 26% female while the average age of the respondents was 44. The average number of people living in the households was 9. Of the 122 respondents, 75% had attended primary school, 11% secondary school while 14 % had no formal education. The main ethnicity of the respondents was Sukuma (97%) with only 3% being of other ethnicities. Only 45% of the respondents were born in their respective villages while 55 % had emigrated from surrounding areas. The main occupation of the household head in the surveyed households was predominately farming (93%) while only 7% engaged in other activities as their main occupation (i.e. livestock keeping, wage labor, own business and other activities). All households were engaged in at least one income generating activity, 49% in two income generating activities while only 3% of the households engaged in three or more income-generating activities.

Table 2. Socioeconomic characteristics. Demographic and socioeconomic characteristics of the surveyed households in the four study villages (n=122).

	Matongo	Salalilya	Mwanyahina	Buganza	Total
Total number of HHs					
Number of HHs interviewed	36	21	34	31	122
Mean HH size (+SD)	9+4.4	11+12.0	9+5.9	8+3.3	9+6.6
Mean age (+SD)	40+13.27	43+14.7	46+12.3	45+16.3	44+14.1
Gender (female %)	31	10	29	26	26
Education (%)					
None	11	5	12	25	14
Primary	81	85	76	62	75
Secondary	8	10	12	13	11
Ethnicity					
Sukuma	100	100	97	90	97
Other	0	0	3	10	3
Mean wealth (+SD)	3.64+3.77	3.48+3.28	5.20+4.21	5.07+4.34	4.45+4.00
Residential status (%)					
Local inhabitant	49	56	56	19	45
Migrant	51	44	44	81	55
Main occupation of HH head (%)					
Farming	94	95	94	88	93
Livestock	3	0	3	3	2
Wage labor	0	5	0	3	2
Own business	0	0	3	3	2
Other	3	0	3	3	2
Combination of IGAs in HH (%)					
One IGA	100	100	100	100	100
Two IGAs	50	43	62	39	49
Three or more IGAs	6	5	0	3	3

3.1.3. Knowledge, interaction and perceptions of the PAs

Of the 122 respondents included in our household survey, 95% were aware that there was a PA near their village (see Table 3). Approximately 83% of the respondents could correctly name the PA (i.e. SNP or MGR respectively). Interaction with the PA staff was mentioned by only 20% of the households. The most frequent types of interaction with the PA staff mentioned were village projects (11%) and provision of information (4%). Other types of interactions stated by respondents were the purchasing of food by PA staff (n=2) and village meetings (n=1). The main source of information about the nearest PA was the village council for 39% of the respondents and the PA staff for 11%. Ten percent were uncertain about the source of information whereas 34% had not received any information about the PA. The main source of information showed a statistical difference among the study villages (χ^2 = 23.17, d.f.= 9, p<0.01) indicating that different information channels about the PAs are used in the study villages. Awareness of NGOs working in or near their village was reported by 26% of the respondents. A statistical difference was found among the villages (χ^2= 11.83, d.f.= 3, p<0.01) with respondents in Matongo and Salalilya bordering the SNP appearing to be less aware of NGOs working in or near their village.

Table 3. Knowledge and interaction. Knowledge of and interaction with the protected areas and NGOs (in percent, n=122).

	Matongo	Salalilya	Mwanyahina	Buganza	Total
Knowledge of PA					
Yes	83	100	100	100	95
No	17	0	0	0	5
Name of PA					
Yes	81	100	71	87	83
No	3	0	29	13	12
Interaction with PA staff					
Yes	22	0	29	19	20
No	61	100	71	81	75
Type of interaction with PA staff					
Providing information	8	0	6	0	4
Purchasing food etc.	0	0	6	0	2
Village meeting	3	0	0	0	1
Village project	8	0	15	16	11
Uncertain	0	0	0	3	1
Other	3	0	3	0	2
Main source of info					
PA staff	19	0	12	10	11
VC	44	57	29	29	39
Uncertain	8	0	21	6	10
No information	11	43	38	52	34
Aware of NGO					
Yes	14	5	47	32	26
No	69	95	53	68	69

Only 34% of the 122 households reported obtaining benefits from the PAs (see Table 4). A significant difference ($\chi^2 = 7.941$, d.f.= 3, p<0.01) was found among the study villages with much fewer households (one household) in Salalilya reporting benefits. As one of the respondents noted:

'Once there is cooperation between the park and the local communities, benefits can be observed. Otherwise there is no benefits' (Matongo Village)

Infrastructure projects (e.g. building of bore holes, offices and dispensaries) were the most commonly cited benefits from the PAs. Twenty-three percent reported infrastructure projects as a benefit. School related projects (e.g. building of classrooms, dormitories and supply of material) were cited as the second most common benefit (21%). Access to PA resources (i.e. access to pasture and fuelwood) was reported by 9% of the respondents. Other benefits reported (7%) were conservation (n=2), education on sustainability (n=2) and employment (n=1). When reporting benefits, some of the respondents claimed that PA staff or the government were the main beneficiaries as exemplified in the following response of one respondent:

'The workers of the park benefit because when the local people graze in the park, the PA staff take their livestock and they can't get them back before they pay for it' (Matongo Village)

Two thirds (66%) of the 122 households included in the household survey had experienced problems with the PAs. Human-wildlife conflicts were reported by almost half (48%) of the respondents. The most frequently mentioned type of human-wildlife conflict was crop raiding (44%) followed by livestock depredation (n=3) and killing of people by animals (n=1). Getting arrested by PA staff was cited as the second most common problem (33% of respondents) followed by loss of access to natural resources within the PA reported by 8% and conflicts with the PA staff (4%). The type of conflicts with the PA staff were the killing of local villagers (n=1), beatings (n=2), false charges, (n=1) and demolition of a house (n=1). Comparison of villages revealed a statistical difference ($\chi^2 = 28.242$, p<0.01) with respondents in Mwanyahina and Buganza more frequently reporting arrests. The level of conflict among the local villagers and PA staff is conveyed in the response of one respondent:

'If caught grazing in the park you might be beaten to death and they come take our livestock and when we go get them the numbers are reduced' (Buganza Village

Table 4. Benefits and problems. Perceptions of benefits and problems from the protected area (in percent, n=122).

	Matongo	Salalilya	Mwanyahina	Buganza	Total
Benefit					
Yes	33	5	50	39	34
No	50	95	50	61	61
Type of benefit					
School related project	17	0	47	16	21
Infrastructure	25	0	32	23	23
Access to PA resource	8	5	9	6	7
Other	17	0	0	3	6
Problem					
Yes	67	57	65	71	66
No	17	43	35	29	30
Type of problem					
Human wildlife conflict	58	52	26	48	48
Arrested	8	14	50	42	33
Conflict with PA	3	0	0	13	4
Loss of PA resource	8	14	0	13	8

3.1.4. General attitude factors

Attitude towards the PAs

Five statements (Figure 3) were used to measure the respondent's attitudes towards the PAs. Fifty-three percent of the 113 households disagreed with the proposition that '*the protected area should be abolished*' while 44% agreed. A significant difference was observed between the responses of the individual villages ($\chi^2 = 15.241$, d.f.= 3, p<0.05); where households in Matongo and Salalilya were more likely to disagree (58% and 53%, respectively) with the proposition. On the other hand, 44% of the respondents claimed that '*the protected area has disrupted our relationship with nature*' while only 35% disagreed with this statement. According to one of the respondents:

'*The border extension has led to reduction is the land that we owned since the time of our fathers*' (Mwanyahina Village)

Moreover, forty-nine percent of the households disagreed with the proposition that '*protected area rules and penalties are essential for the protection of natural resources and wildlife*' while 37% agreed. We found a significant difference between the villages in this statement ($\chi^2 = 2.640$, d.f.= 3, p<0.05); where households in Matongo and Salalilya appear to agree more (47% and 34%, respectively) with the proposition. A high number of households in Salalilya were neutral of the statement (29%). Half of the respondents (50%) disagreed with the statement, '*the protected area managers are very helpful and give priority to our problems*' while 37% stated a positive attitude. In a similar vein, 62% agreed to the statement that '*local*

communities should manage the protected area, not protected area managers' and only 26% disagreed. According to one of the respondents:

'The PA staff are not doing it properly, they don't care about our crops are raided and they always catch our livestock and lock them until we pay. If we don't, they let them to die' (Matongo Village)

Figure 3. Items measuring general attitude factors. Bar chart representing the responses of respondents regarding attitudes towards the PAs, attitude towards resource extraction in the PAs and attitude towards conservation. (n=113)

■Strongly disagree □Disagree ■Neutral ■Agree ■Strongly agree
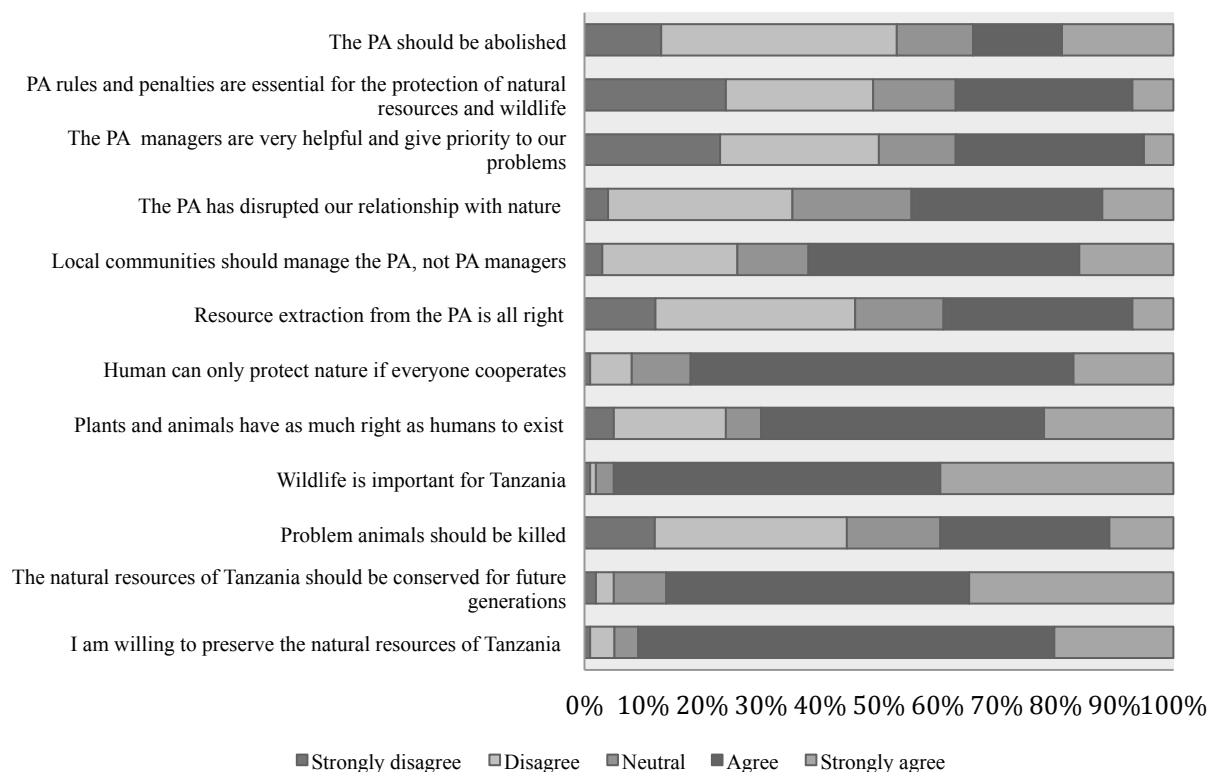
Attitude towards resource extraction in the PAs

Almost half of the households (46%) disagreed to the proposition that '*resource extraction from the protected area is all right'* while 39% agreed (see Figure 3 for results).

Attitude towards conservation

In order to elicit the respondents' attitudes towards conservation, six statements were asked as specified in Figure 3. It was found that many respondents agreed with the propositions that '*plants and animals have as much right as humans to exist'* (70%) and '*human can only protect nature if everyone cooperates'* (82%). According to the response of a respondent:

'Cooperation is needed between local communities and Park workers to protect nature'
(Salalilya Village)

While almost all of the respondents (96%) agreed that *'wildlife is important for Tanzania'*, 40% expressed a negative attitude toward problem animals, agreeing that *'problem animals should be killed'*. Sixteen percent of the respondents were neutral as to whether problem animals should be killed. The majority of respondents (87%) agreed with the proposition that *'the natural resources of Tanzania should be conserved for future generations'*. A difference among villages was observed (χ^2= 14.20, d.f.= 3, p<0.05); where the households at Buganza seem to be more in disagreement and neutrality about the proposition. Ninety percent of the 113 households agreed to the statement that *'I am willing to preserve the natural resources of Tanzania'*

The above-mentioned results are in line with the structured discussions with village leaders. The leaders emphasized the lack of cooperation between PA staff and local communities on issues such as resource use and land planning as one of the major challenges confronting the current status of the PAs. The discussions also revealed that the relationship between the PAs and local communities had worsened in the past fifty years. The unconsented extension of PA borders and the ensuing decline in the natural resources (e.g. grasses for grazing and fuelwood) on village lands were the main reasons mentioned by the village leaders. Resource extraction from the PAs is therefore seen as one of the only options for local villagers to maintain their livelihoods. Allowing restricted resource extraction in the PAs, education and more cooperation with PA staff were mentioned as means to improve the relationship.

3.1.5. Psychological factors

Attitude towards illegal grazing

Five statements were used to measure the respondents' attitudes towards illegal grazing (see Figure 4). The majority (62%) of the 82 households agreed with the statement that *'I think livestock grazing in the protected area is all right'*. According to one of the respondents:

'Since the Maasai graze their cattle in the NCA I will also graze my cows in the park'
(Matongo Village)

Forty-three percent and 40% of the respondents, respectively, disagreed with the propositions that '*livestock grazing in the protected area has a negative effect on natural animal populations*' and ' *livestock grazing in the protected area is harmful to the environment*'. There was a significant difference between the villages in the responses of the first statement (χ^2=16.614, d.f.= 3, p<0.05); where most households in Buganza were neutral (57%) of the proposition. Almost a quarter of the respondents were neutral in respect to these two statements (26% and 21% respectively) indicating they might not have understood or refrained from answering the question due to cultural reasons and/or being conflicted about what they expected the researchers to hear (see more in the Discussion). 59% and 65%, respectively, of the respondents agreed with the two statements '*livestock grazing in the protected area will benefit my household*' and '*livestock grazing in the protected area is important for my livelihood*'. The importance of illegal grazing is reflected in the response of one of the respondents:

'*I only wish if the park could allow us to graze in the park – that's all I wish*' (Matongo Village)

Subjective norm towards illegal grazing

The respondents' subjective norm towards illegal grazing was measured using four statements as specified in Figure 4. Forty-one percent of the respondents claimed that '*I will not be looked down upon if I graze livestock in the protected area*' although almost a quarter (22%) were neutral in relation to the statement. On the other hand, the proposition that '*other people (e.g. family, friends) encourage me to graze livestock in the protected area*' was disagreed upon by 59% of the households. Fifty-five percent of the respondents claimed that '*it is very normal in my village to graze livestock in the protected area*'. Twenty-eight percent disagreed that it was normal to illegally graze. Furthermore, 59% claimed that '*my village has always grazed their livestock in the area where the protected area now lies*' highlighting the historical relationship between respondents and the land that now belongs to the PA.

Figure 4. Items measuring psychological factors and intention. Bar chart representing the responses of the respondents regarding attitude, subjective norm, perceived behavioral control and intention towards illegal grazing (in percent, n=82).
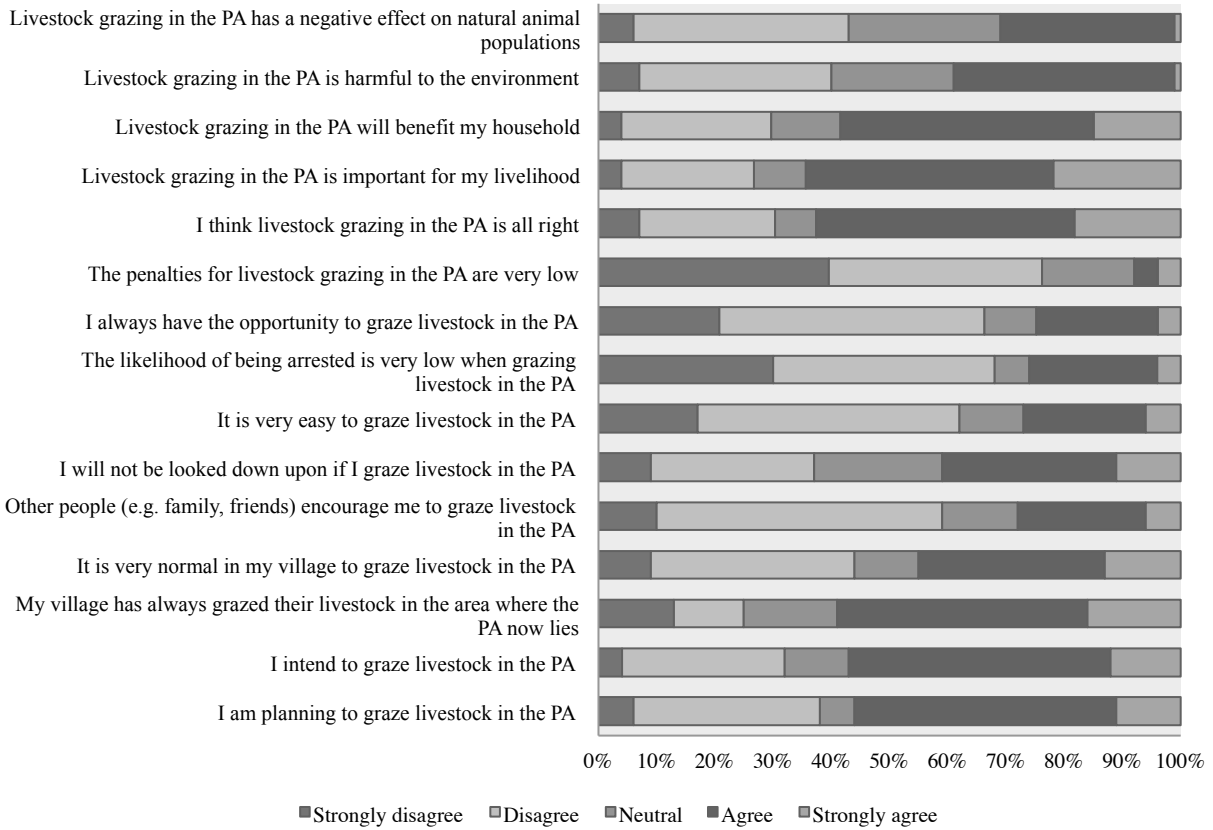
Perceived behavioral control over illegal grazing

In order to elicit the respondents' perceived behavioral control over illegal grazing, four statements were asked (see Figure 4). Most of the respondents (77%) disagreed with the proposition that '*the penalties for grazing in the protected area are very low*' while only 8% agreed. A high number of households (68%) also disagreed that '*the likelihood of being arrested is very low when grazing in the protected area*'. A significant difference was found among the villages with respect to this statement (χ^2=14.516, d.f.= 3, p<0.05); where a higher number of households in Matongo and Salalilya appear to agree with the statement. This is also reflected in the responses regarding the more direct statements measuring perceived behavioral control. Sixty-seven percent disagreed with the statement '*I always have the opportunity to graze in the protected area*' while 62 % disagreed that '*it is very easy to graze in the protected area*'.

3.1.6 Intention of illegal grazing

Two statements provided in Figure 4 were used to measure the respondents' intention to illegally graze. Over half of the 82 respondents which answered this part of the questionnaire (57%) agreed with the statement that '*I intend to graze livestock in the protected area*' while 56% agreed with '*I am planning to graze livestock in the protected area*'. Thirty-two percent and 38% of the respondents disagreed with the statements, respectively.

3.1.7 Behavior of illegal grazing

Fifty-two percent of the 87 households, which owned livestock, cited that they illegally grazed their livestock in the PAs (see Table 5 for results). The lack of pasture in village lands was the most commonly cited reason (37% of the respondents who owned livestock) for grazing livestock in the PAs. Other reasons mentioned were the quality of pasture in the PA (3%) and tradition (2%). This is reflected in the answer of one of the respondents:

'There was no rain so the grasses for animals were scarce - the only option was to graze in the park' (Matongo Village)

The daily grazing of livestock in the PAs was reported by as much as 20% of the respondents. Nine percent mentioned weekly while monthly and dry season was cited by 8% and 6% of the households, respectively.

Table 5. Illegal grazing behavior. Respondents' behavior, reason and frequency of illegal grazing (in percent, n=87).

	Matongo	Salalilya	Mwanyahina	Buganza	Total
Illegal grazing					
Yes	45	36	61	62	52
No	55	64	39	43	48
Reason					
Lack of pasture	23	29	43	52	37
Quality of pasture	0	7	0	10	3
Tradition	5	0	4	0	2
Frequency					
Daily	18	21	21	19	20
Weekly	9	7	7	14	9
Monthly	9	7	4	14	8
Dry season	0	0	7	14	6

The above-mentioned results are consistent with the structured village leader discussions. These identified livestock grazing and fuelwood extraction as the main extractive activities carried out by villagers in the PAs. Increasing pressure on the natural resources of the villages due to a rise in human population as well as a lack of education and alternative livelihood options were mentioned as the main reasons why villagers graze their livestock in the PAs.

3.2. Household Asset Index

The descriptive statistics for household assets of the surveyed households can be found in Table 6. No significant differences were found among the study villages in terms of asset ownership and average number of assets owned by households. The results of the PCA of the asset ownership variables can be found in the Appendix (see appendix III) and the mean wealth (i.e. household asset index values) values for each study villages are displayed in Table 2.

Table 6. Household assets. Asset ownership and average number of assets of surveyed households (n=122).

	Matongo			Salalilya			Mwanyahina			Buganza			Total		
	% own	Avg #	SD	% own	Avg #	SD	% own	Avg #	SD	% own	Avg #	SD	% own	Avg #	SD
Livestock	66			67			82			71			72		
Cattle	60	38	65	55	24	24	76	13	15	58	25	19	63	24	15
Shoats	46	9	20	57	9	17	67	20	28	68	20	22	61	14	23
Chickens	86	16	15	86	16	9	76	21	25	94	17	17	85	18	9
Cult. farm land (ha)	89	13	20	90	10	16	100	27	43	84	27	31	91	20	14
House	92	3	7	95	4	2	94	3	2	90	3	1	93	3	1
Generator	0	0		0	0		9	1	0	0	0		2	1	0
Radio	31	1	0	52	1	0	21	1	1	45	1	0	35	1	0
Water tank	0	0		0	0		3	1	0	3	1	0	2	1	0
Improved CC stove	14	1	1	24	1	0	35	1	1	42	1	1	29	1	1
Cellphone	92	2	1	86	2	1	85	3	2	90	2	1	89	2	1
Sewing machine	3	1		19	2	1	9	1	0	19	1	0	12	1	0
Motorbike	28	1	1	10	1	0	21	1	0	19	1	0	21	1	0
Bicycle	56	1	1	76	1	1	85	1	1	84	2	1	75	1	1
Monetary Savings	11			5			12			26			14		

3.3. Factors Influencing Attitudes Towards the PAs

Assessment of construct validity

The initial CFA results indicated that the measurement model yielded an unacceptable model fit (χ^2= 133.600, χ^2/d.f.= 3.107, CFI= 0.641, RMSEA= 0.137). This was likely the result of the standardized factor loading value for one of the ATTCON items (*'problem animals should be killed'*) and one of the ATTPA items ('*local communities should manage the protected area, not protected area managers'*) that did not meet the minimum criteria of 0.4. After the exclusion of these items, the remaining items were again subjected to CFA. The measurement model still did not show a satisfactory fit to the data (χ^2= 44.844, χ^2/d.f.= 1.950, CFI= 0.895, RMSEA= 0.092). However, the modification indices indicated covariance from the error terms of two items from ATTPA to the error term of one item from ATTCON. Upon exclusion of the item ("*plants and animals have as much right as humans to exist*"), the model showed acceptable fit to the data (χ^2= 32.362, χ^2/d.f.= 1.927, CFI= 0.906, RMSEA=

0.092). All items loaded above 0.40 on their assigned constructs. The composite reliability of the study constructs, indicating the internal consistency of multiple indicators for each construct, was 0.736 and 0.664 for ATTCON and ATTPA, respectively, in accordance with recommended threshold suggested by Kline (2005). In order to confirm convergent validity, the average variance extracted (AVE) was calculated for ATTCON (0.413) and ATTPA (0.341). The AVE values were below the recommended value of 0.50 (Kline, 2005) yet considered acceptable for the purpose of this study. In addition, the AVE value for each construct was greater than the squared correlation between constructs, indicating that discriminant validity was achieved (Kline, 2005).

Preliminary analyses

Correlations between the socioeconomic variables and ATTPA can be found in Table 7. Of the variables, only household size and gender were significantly correlated with ATTPA.

Table 7. Socioeconomic factors and PA attitudes. Correlations between socioeconomic factors and attitude towards the PAs .

	Age	Household size	Gender[a]	Education[b]	Residential status[c]	Wealth	IGAs[d]
ATTPA	-0.12	-0.207**	0.176*	0.050	-0.099	-0.147	0.068

*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=male, 1=female
[b] coded as 0=no, 1=yes
[c] coded as 0=original resident, 1=immigrant
[d] coded as 0=one or no income-generating activity, 1=two or more income-generating activities

Correlations between the variables included in the multiple linear regression analysis can be found in Table 8. It shows that ATTPA was positively and significantly correlated with gender, interaction with PA staff, awareness of NGOs, perception of benefits and ATTCON. On the other hand, ATTPA was negatively and significantly correlated with study site and household size. Perception of problems was almost significant and negatively correlated with ATTPA at the 10%-significance level. Although some of the independent variables were significantly correlated with each other e.g. household size was significantly correlated to perception of problems and ATTCON, the assumption of multicollinarity was not violated and all independent variables displayed tolerance levels > 0.1 and VIFs < 10 (Tabachnick and Fidell, 2007).

Table 8. Independent variables and PA attitudes. Correlations between the dependent and independent variables included in multiple linear regression analysis predicting attitude towards the PAs.

	ATTPA	Study site[a]	Gender[b]	Household size	IntPAstaff[c]	Aware NGOs[c]	Perp of benefits[d]	Perp, of problems[d]	ATTCON
ATTPA	1								
Study site[a]	0.312***	1							
Gender[b]	0.176*	0.073*	1						
Household size	-0.207**	-0.151	-0.129	1					
Interaction with PA staff[c]	0.203**	0.105	0.172*	-0.128	1				
Awareness of NGOs	0.161*	0.319***	-0.148	0.05	0.231**	1			
Perception of benefits[d]	0.329***	0.210**	0.013	-0.005	0.501***	0.316***	1		
Perception of problems[d]	-0.144	0.044	-0.214**	0.259***	0.08	0.191**	0.129	1	
ATTCON	0.237**	-0.206**	-0.104	0.219**	0.043	0.147	0.330***	0.237**	1

*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=SNP, 1=MGR
[b] coded as 0=male, 1=female
[c] coded as 0=no, 1=yes
[d] perceived number of type of benefit/problem e.g. school, infrastructure, arrested and human-wildlife conflict.

Multiple linear regression analysis

The results of the multiple linear regression model are displayed in Table 9. The model explained 43.5% of the variation in respondent's attitudes towards the PAs (R=0.660, R^2=0.435, Adjusted R^2=0.392). The independent variables were statistically significant in explaining the respondents' attitudes [$F_{(8,112)}$ = 10.022 p < 0.01]. Of the eight variables included in the model, six were significantly associated with ATTPA. These included study site, household size, gender, awareness of NGOs, perception of benefits and perception of problems. Among these variables, the study site had the strongest influence on ATTPA followed by perception of benefits, awareness of NGOs, household size, gender and perception of problems as showed by the standardized regression coefficients in Table 9. Interaction with PA staff and ATTCON did not significantly influence the respondent's attitudes in the multiple linear regression analysis.

Table 9. Linear regression. Multiple linear regression predicting attitude towards the PAs (n=113)

Variable		β	Std. Error	Standardized β[e]	t
Study site[a]		-1.899***	0.326	-0.489	-5.819
Household size		-0.106***	0.034	-0.248	-3.119
Gender[b]		0.945**	0.361	0.206	2.618
Interaction with PA staff[c]		0.253	0.431	0.053	0.588
Awareness of NGOs[c]		1.132***	0.362	0.262	3.130
Perception of benefits[d]		0.731***	0.235	0.302	3.111
Perception of problems[d]		-0.324*	0.199	-0.131	-1.629
ATTCON		0.117	0.099	0.102	1.184
R	0.66				
R^2	0.435				
Adjusted R^2	0.392				

Dependent variable: ATTPA
*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=SNP, 1=MGR
[b] coded as 0=male, 1=female
[c] coded as 0=no, 1=yes
[d] perceived number of type of benefit/problem e.g. school, infrastructure, arrested and human-wildlife conflict.
[e] all of the variables in the regression, including the dependent and all of the independent variables, are standardized before running the regression

3.4 The Role of Psychological, General Attitude and Socioeconomic Factors in Predicting Intention and Behavior of Illegal Grazing

Assessment of construct validity

The initial CFA results indicated that the measurement model poorly fitted the data (χ^2= 155.866, χ^2/d.f.= 2.514, CFI= 0.764, RMSEA= 0.137). However, the standardized factor loading value for one of the ATT items ('*grazing in the protected area is harmful to the environment'),* one of the SN items ('*my village has always grazed their livestock in the area where the protected area now lies'*) and one of the PBC items ('*the penalties for grazing in the protected area are very low*') did not meet the minimum criteria of 0.40 and were consequently omitted from further analyses. After removal of these items, the remaining items were again subjected to CFA. The results showed a satisfactory fit to the data (χ^2=50.614, χ^2/d.f.=1.582, CFI=0.938, RMSEA=0.085). All items loaded above 0.50 on their assigned constructs. The composite reliability ranged from 0.728 to 0.836, exceeding the recommended threshold suggested by Kline (2005). The average variance extracted (AVE) for the measures ranged from 0.475 to 0.575 satisfying the minimum recommended value of 0.50 and the AVE value for each construct was greater than the squared correlation between constructs, indicating that discriminant validity was also achieved (Kline, 2005).

Preliminary analyses

The results of the cross-tabulations with Fisher's exact tests and correlations between the socioeconomic variables and intention and behavior, respectively, can be found in Table 10. Only household size and household size and wealth showed significant associations with intention and behavior, respectively.

Table 10. Socioeconomic factors, intention and behavior. Correlations and Fisher's exact test between socioeconomic factors and the intention and behavior of illegal grazing.

	Age	Houshold size	Gender[c]	Education[d]	Residential status[e]	Wealth	IGAs[f]
Intention[a]	0.161[g]	0.185[g]*	0.796[h]	1[h]	0.248[h]	0.148[g]	0.489[h]
Behavior[b]	0.094[g]	0.216[g]**	0.775[h]	0.715[h]	0.250[h]	0.371[g]***	0.647[h]

*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=no intent, 1=intent
[b] coded as 0=no reported behavior, 1=reported behavior
[c] coded as 0=male, 1=female
[d] coded as 0=yes, 1=no
[e] coded as 0=original resident, 1=immigrant
[f] coded as 0=one or no income-generating activity, 1=two or more income-generating activities
[g] Pearson's correlation; correlation coefficient
[h] Fisher's exact test; p-value

The correlations between the dependent and independent variables to be included in the multiple logistic regression analyses can be found in Table 11. It shows that intention was positively and significantly correlated with ATT, SN, PBC, ATTRE, ATTCON and household size. On the other hand, intention was negatively and significantly correlated with ATTPA. Behavior was positively and significantly correlated with intention, ATT, SN, PBC, wealth and household size. Although some of the independent variables were significantly correlated with each other e.g. SN was significantly correlated to both ATT and PBC, the assumption of multicollinarity was not violated and all independent variables displayed tolerance levels > 0.1 and variance inflation factors < 10 (Tabachnick and Fidell, 2007).

Table 11. Independent variables, intention and behavior. Correlations between dependent and independent variables included in the multiple logistic regressions predicting intention and behavior of illegal grazing.

	Intention	Behavior	ATT	SN	PBC	ATTPA	ATTRE	ATTCON	Wealth	Household size
Intention[a]	1									
Behavior[b]	0,584***	1								
ATT	0,777***	0,455***	1							
SN	0,443***	0,340***	0,403***	1						
PBC	0,222**	0,192*	0,127	0,478***	1					
ATTPA	-0,21**	-0,103	-0,176	-0,114	0,002	1				
ATTRE[c]	0,246**	0,157	0,104	-0,027	0,091	0,058	1			
ATTCON	0,246**	0,049	0,263**	0,162	-0,073	0,058	-0,216	1		
Wealth	0,148	0,371***	0,072	0,089	0,055	-0,235	-0,068	0.021	1	
Household size	0,185*	0,216**	0,144	0,245**	0,068	-0,1	-0,033	0,13	0,299***	1

*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=no intent, 1=intent
[b] coded as 0=no reported behavior, 1=reported behavior
[c] coded as 0=not positive attitude, 1=positive attitude

Multiple logistic regression analyses

Multiple logistic regression analyses were performed to investigate the role of psychological general attitude and socioeconomic variables in predicting intention and behavior, respectively.

Prediction of intention

The first logistic regression model, which included the psychological factors as predictors, was statistically significant (χ^2 = 72,821 (3), p < 0.01) and explained approximately 78.9% (Nagelkerke R^2 = 0.789) of the variance in the respondent's intention to illegally graze (see Table for 12 for results). ATT was the only significant variable in the model although PBC was almost significant at the 10%-significance level. This indicates that respondents with more favorable attitudes towards illegal grazing as well as more perceived behavioral control over this behavior were more likely to intend the behavior. The second model, which contained ATTPA, ATTRE and ATTCON as predictors in addition to study site, was also

highly significant ($\chi^2 = 21.253$ (5), $p < 0.01$). The four predictors explained approximately 30.6 % of the variation in intention (Nagelkerke $R^2 = 0.306$). Having more favorable attitudes towards the PAs decreased the likelihood of intention while having more favorable attitudes towards resource extraction and conservation increased the likelihood of intention. In the third model, household size significantly predicted intention at the 10%-significance level. Of the three models described above, the model containing the psychological variables displayed the best fit as suggested by the substantially lower value of AIC and higher Nagelkerke R^2.

Table 12. Logistic regression of intention. Multiple logistic regression analyses predicting the intention to illegally graze from psychological, general attitude and socioeconomic variables (n=82).

	Psychological		**General attitude**		**Socioeconomic**	
	β	Exp(β)	β	Exp(β)	β	Exp(β)
Study site[a]	1.007		0.589		0.482	
ATT	1.471***	4.354				
SN	0.228					
PBC	0.439	1.552				
ATTPA			-0.425***	0.654		
ATTRE[b]			1.727**	5.622		
ATTCON			0.648***	1.912		
Household size					0.092*	1.096
AIC	47.643		99.200		109.745	
Nagelkerke R^2	0.789		0.306		0.075	
χ^2 (df)	72.821 (4)***		21.253 (4)***		4.709 (2) *	

Dependent variable: Intention (coded as 0=no intent, 1=intent)
*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=SNP, 1=MGR
[b] coded as 0=not positive attitude, 1=positive attitude

The results of sequential approach, displayed in Table 13, revealed that the addition of general attitude variables to the model containing only the psychological variables, significantly improved model fit as observed in the significant change in chi-square statistics ($\chi^2 = 9.062$ (3), $p < 0.05$), higher Nagelkerke R^2 (Nagelkerke $R^2 = 0.843$) and lower value of the AIC (AIC = 44.571). ATT and ATTRE were significant variables although PBC was almost significant at the 10%-significance level. The addition of household size in the third step did not significantly improve model fit and displayed a higher value of AIC compared to the second step. Although the AIC values of step 1 and step 2 were similar, the delta AIC (the difference between the proposed model and the model with lowest AIC) was above 2, indicating step 2 had better fit. However, the model containing only the significant variables from the second step (i.e. ATT, PBC and ATTRE) showed the best fit of all models as indicated by the much lower AIC value. ATT, PBC and ATTRE were statistically significant in predicting intention with odds ratios of 6.889, 1.729 and 14.370, respectively.

Table 13. Sequential analysis of intention. Sequential logistic regression analysis of intention to illegally graze l (n=82).

	Step 1		Step 2		Step 3		Step 4	
	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)
Study site[a]	1.007		0.791		1.248		0.743	
ATT	1.471***	4.354	1.666***	5.29	1.67***	5.31	1.930***	6.889
SN	0.228	1.255	0.302		0.551			
PBC	0.439	1.552	0.523	1.687	0.208	1.232	0.547**	1.729
ATTPA			-0.078		-0.082			
ATTRE[b]			2.896**	18.104	2.985**	19.787	2.665**	14.370
ATTCON			0.499		0.51			
Household size					0.098			
AIC	47.643		44.571		45.676		40.947	
Nagelkerke R^2	0.789		0.846		0.852		0.832	
χ^2 (df)	72.821 (4)***		81.833 (7)***		82.778(8)***		79.506 (4)***	
χ^2 –step (df)	72.821 (4)* **		9.063 (3)**		0.895 (2)			

Dependent variable: Intention (coded as 0=no intent, 1=intent)
*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=SNP, 1=MGR
[b] coded as 0=not positive attitude, 1=positive attitude

Prediction of behavior

The first model, which included intention as predictor, was statistically significant (χ^2 = 31.590 (2), p < 0.01) explaining approximately 42.7% (Nagelkerke R^2 = 0.427) of the variation in the respondents' behavior (see Table 14 for results). As such, households that intended to illegally graze were more likely to perform the behavior hence validating, to some extent, the constructs and the theoretical approach. The psychological factors in the second model explained approximately 34.5% (Nagelkerke=0.345) of the variation in behavior and model fit was significant (χ^2 = 93.924 (4), p < 0.01). ATT was the only significant predictor. The third model, which contained wealth and household size as predictors, was also statistically significant (χ^2 = 14.714 (3), p < 0.01) and explained approximately 21.9 % of the variation in the dependent variable. Wealth was the only significant predictor and positively associated with behavior in the model. Of the three models explained above, the first model displayed the best fit as indicated by the much lower value of AIC and highest Nagelkerke R^2.

Table 14. Logistic regression of behavior. Multiple logistic regression analyses predicting illegal grazing behavior from intention, psychological and socioeconomic variables (n=82).

	Intention		Psychological		Socioeconomic	
	β	Exp(β)	β	Exp(β)	β	Exp(β)
Study site[a]	0.733		0.836		0.566	
Intention	2.72***	15.178				
ATT			0.387***	1.472		
SN			0.184			
PBC			0.154			
Wealth					0.229**	1.257
Household size					0.073	
AIC	85.891		96.924		104.767	
Nagelkerke R^2	0.427		0.345		0.219	
χ^2 (df)	31.590 (2)***		24.557 (4)***		14.714 (3)***	

Dependent variable: Behavior (coded as 0=no reported behavior, 1=reported behavior)
*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=SNP, 1=MGR

The addition of the psychological variables to intention in step 2 of the sequential approach (see Table 15) did not significantly improve model fit and the AIC was increased. Intention remained as the only significant variable. However, the addition of wealth and household size in the third step significantly improved model fit ($\chi^2 = 9.133$ (2), p<0.01), explaining most variation in behavior and displayed the lowest value of AIC. Intention and wealth were positive and significant variables in the third step. As table 15 shows, the AIC values of step 1 and step 3 were almost identical and the delta AIC (the difference between the proposed model and the model with lowest AIC) was under 2, indicating support for both models. However, taking Nagelkerke R^2 and the chi-square statistic into consideration, the third step containing all predictor showed the best overall fit. Hence, both intention and wealth were included as predictors in the last step. This model was highly significant ($\chi^2 = 14.714$ (3), p<0.01). Although explaining less variance (1.5%) compared to the model containing all predictors (i.e. step 3), it had a considerable lower value of AIC and so displayed the best fit of all models. Both intention and wealth were statistically significant in predicting behavior with odds ratios of 17.720 and 1.360, respectively.

Table 15. Sequential analysis of behavior. Sequential logistic regression analysis of illegal grazing behavior (n=82).

	Step 1		Step 2		Step 3		Step 4	
	β	Exp(β)	β	Exp(β)	β	Exp(β)	β	Exp(β)
Study site[a]	0.733		0.836		0.537		0.409	
Intention	2.72***	15.178	2.48***	11.945	2.379**	10.795	2.875***	17.720
ATT			-0.002		0.063			
SN			0.124		0.086			
PBC			0.09		0.131			
Wealth					0.292**	1.339	0.308***	1.360
Household size					0.029			
AIC	85.891		90.400		85.276		78.800	
Nagelkerke R^2	0.427		0.443		0.537		0.522	
χ^2 (df)	31.590 (2)***		33.081 (5)***		42.213 (7)***		40.681 (3)***	
χ^2 –step (df)	31.590 (2)***		1.491 (3)		9.133 (2)***			

Dependent variable: Behavior (coded as 0=no reported behavior, 1=reported behavior)
*p<0.1, **p<0.05, ***p<0.01
[a] coded as 0=SNP, 1=MGR

4. DISCUSSION

This study investigates the factors influencing the attitude, intention and illegal grazing behavior of local communities bordering PAs in the southwestern part of the Serengeti ecosystem. With respect to the attitude towards the PAs, the study site itself turned out to be the most important determinant. This suggests that local conditions significantly affect attitude. Similar to the findings of Kideghesho (2007), households bordering the MGR

showed more negative attitudes than households living adjacent to SNP. One explanation may be the difference in the age and history of the management of the two PAs (Ormsby and Kaplin, 2005; Kideghesho, 2007). The SNP, which was gazetted as a partial Game Reserve in 1921, elevated to National Park and expanded to its current size in 1951, involved relocation of the communities similarly to what occurred for MGR in 1962 (B. Ngilangwa, personal communication, April 2016; Yesaya, undated). However, because the land and other resources around SNP were more abundant and more able to sustain low human and livestock population, people were perhaps more favorably disposed to the creation of SNP (Kideghesho, 2007). Furthermore, most of the respondents in the present study were too young to have experienced the eviction from the SNP area upon its creation. On the other hand, MGR has extended its borders multiple times since its creation, most recently in 1980, due to agricultural migrations to fairly virgin lands by local communities bordering the reserve (B. Ngilangwa, personal communication, September 10th 2016; Yesaya, undated). The pain of relocation may therefore still invoke strong negative attitudes towards the MGR. In their study on Moasala National Park in Madagascar, Ormsby and Kaplin (2005) similarly found the history of management to be one of the main factors influencing community perceptions towards the park. These findings confirm the importance of adopting site-specific conservation strategies as the interaction between local communities and PAs can vary from site to site.

The perception of benefits from the PAs was the second most important predictor of the respondents' attitudes. Respondents perceiving benefits from the PAs had more positive attitudes compared to those who did not perceive any benefits. The importance of perceiving benefits is documented in numerous other studies (Holmes 2003; Ormsby and Kaplin, 2005; Allendorf, 2007; Schmitt, 2010) and supports the claim that achieving positive conservation outcomes and ensuring long-term success of PAs are more likely when socioeconomic benefits accrue to local communities (Oldekop et al., 2016). Interestingly, only two respondents directly mentioned protection of nature as a benefit of the PAs while 9% mentioned access to resources within the PAs. This could indicate that the respondents were either not aware of the purpose of the PAs or did not perceive biodiversity conservation as a benefit to them. Instead, and similar to the findings of Schmitt (2010), infrastructure and school-related projects were the most commonly reported type of benefit by households. This suggests that management authorities and other relevant organizations need to ensure the

provision of tangible benefits. Considering the strong and consistent influence of the perception of benefits on protected area attitude (Allendorf, 2007) and the fact that only one third of the households in this study reported benefits from the PAs, it would be advisable to allocate more resources to community outreach services and to create awareness of the services and their link to the PAs (Holmes, 2003; Kideghesho, 2007). However, if a benefit-based approach is to succeed some major challenges are worth addressing. For example, the benefits should be provided to as many villages as possible as success unlikely if attitudes are changed in just a part of communities. The benefits should also compensate sufficiently for the direct and indirect costs resulting from conservation, must be equitably distributed and their future access guaranteed (Kideghesho, 2007). Nonetheless, conservation outreach benefits in the tropics may arguably defeat their purpose by promoting human immigration to areas bordering PAs (Wittemyer et al., 2008), however, Salerno et al. (2014) did not find elevated rates of in-migration to areas bordering national parks in Tanzania.

The perception of problems from the PAs negatively influenced ATTPA albeit only at significance threshold of 10% and not 5% as reported in similar studies (Allendorf, 2007; Kideghesho, 2007; Schmitt, 2010; Karki and Hubacek, 2015). This implies that conservation efforts should not ignore the costs they impose on local households. They should attempt to reduce the number and impact of human-wildlife and local resident-PA staff conflicts, as these were the most frequent type of problems mentioned by the households in this study.

The relationship between local communities and PAs encompasses not only the interactions with the PA itself but also those with NGOs and PA staff (Holmes, 2003; Allendorf, 2010; Karki and Hubacek, 2015). Despite being reported by only a quarter of the respondents, the awareness of NGOs working in or near their village had a strong positive influence on the PA attitudes. It remains unclear whether this influence was direct, i.e. the NGOs were recognized as an integral part of the households' relationship with the PAs, or indirect, i.e. the NGOs were present in the study area but households did not identify them as part of the PAs. NGOs also play a considerable role in distributing benefits in the Serengeti ecosystem mainly in the form of development projects (D. Rentch, personal communication, March 28th 2016). It may therefore not only be important to consult and involve local communities and PA staff in designing and implementing the projects (Karki and Hubacek, 2015) but also to create awareness of the projects and their benefits, reasons and sources.

Though mentioned by only one fifth of the respondents, interaction with PA staff was positively correlated with ATTPA in the preliminary analysis. Interestingly, village projects were the most frequent type of interaction stated by the households despite almost one third of the respondents reporting arrests. These observations concur with Holmes' (2003) findings that increased interaction carried out in good faith was an important factor for improving the understanding and trust between PA staff and local communities around Katavi National Park in Tanzania. Hence, positive attitudes toward the PAs may be enhanced by regular and positive contact with the PA staff. However, interaction with PA staff did not significantly influence attitudes in the multiple linear regression analysis.

Similar to Sohdi et al. (2010) and Karki and Hubacek (2015), the respondents' attitudes towards conservation were positively correlated with ATTPA. As such, households, which had more positive attitudes towards wildlife and conservation efforts, showed more positive attitudes towards the PAs implying that conservation interventions such as educational programs in schools should among others aim to foster positive attitudes towards conservation in general and wildlife among the local residents. The effect of conservation attitudes disappeared in the multiple linear regression analysis.

Of the socioeconomic factors examined (age, gender, household size, education, income-generating activities and wealth) only gender and household size were significantly correlated with ATTPA in the preliminary analysis. These two factors were also significant predictors in the multivariate analysis. Household size negatively influenced households' attitudes towards the PAs. This is similar to the findings of Mutanga et al. (2015) and Kumssa and Bekele (2014) who found that larger households showed less favorable attitudes towards their nearest PA in Zimbabwe and Ethiopia, respectively. Larger households may require more resources why they may tend to feel more restricted by PAs. The Sukuma are predominately agro-pastoralists and therefore may require large areas of land for subsistence farming and livestock keeping. Thus, when land and related resources become scarce, larger and more resource-dependent households may not consider PAs as an optimal land use alternative.

Studies that include gender as one of the socioeconomic characteristics that influences PA attitudes have shown inconsistent results. Some studies found that men have more positive attitudes towards PAs (Mehta and Heinen, 2001; Allendorf, 2013), others found women more positive (Arjunan et al. 2006; King and Peralvo, 2010) while several did not find a difference

(Kideghesho, 2007; Allendorf, 2007; Schmitt, 2010). In the present study, it was found that female respondents showed more positive attitudes towards the PAs than male respondents. This may not be surprising as men are mainly responsible for livestock grazing and hunting while women, on the other hand, tend to household duties or gathering of fuelwood (Kideghesho, 2007; King and Peralvo, 2010). Thus, men are perhaps more likely to interact with the PAs in a negative way either through restrictive, prohibitive and punitive laws and also more likely to be fined or arrested if found grazing their livestock or hunting illegally in the PAs. Further examination of the data also revealed that women perceived significantly fewer problems from the PAs compared to men. On the other hand, fuelwood can be scarce and is often gathered inside PAs. This could be a source of negative attitudes among women particularly where patrolling is more intensive (Kideghesho, 2007). Nevertheless, the findings that that larger households and male respondents were more negative towards the PAs suggest that attempts to improve attitudes should target these groups of people.

Fostering positive attitudes towards PAs may be an important criteria of long-term success of PAs (Holmes, 2003; Allendorf, 2007; Kideghesho, 2007; Pullin et al., 2013). Identifying which factors influence PA attitudes is thus highly relevant for the development of conservation interventions. It is equally relevant, however, to identify which factors predict the intentions and behavior of individuals engaging in either pro- or anti-conservation behaviors (McKenzie-Mohr, 2000; St John et al., 2011). The results of this study demonstrated the role of psychological, general attitude and socioeconomic factors in predicting the intention and behavior of households to illegally graze in the PAs.

Although the three types of factors could significantly predict intention when tested separately, the psychological factors emerged as the best predictors of intention. This supports the recommendations of, among others, McKenzie-Mohr (2000) and St. John et al. (2011) that when examining specific behaviors one should focus on psychological and behavior-specific factors. Although ATT was the only significant predictor of intention, PBC was almost significant at the 10%-significance level. This is similar to the finding of Meijer et al. (2016), who found that attitude towards behavior was the most important predictor of tree planting intentions in Malawi. It is also consistent with many other studies using the TOPB framework which have shown that attitude and perceived behavioral control have powerful influence on intentions (Armitage and Conner, 2001). Nonetheless, further examination of the data using

the PROCESS (Hayes and Preacher, 2014) macro for SPSS indicated that ATT completely mediated the effects of SN on intention. PROCESS uses an ordinary least squares or logistic regression-based path analytic framework to among others estimate the direct and indirect effects mediator models and implements bootstrap and Monte Carlo confidence intervals for inference about indirect effects (Hayes and Preacher, 2014). This finding, which is consistent with previous studies (Vallerand et al., 1992; Chang, 1998; Han et al. 2010), implied that formation of favorable or unfavorable attitudes toward illegal grazing may be influenced by social pressure and acceptance and how one's important others consider the behavior. Thus, the effect of these factors on attitude should not be ignored in future research designs and conservation interventions.

The three general attitude factors were significant in predicting intention. Similar to the findings of Karki and Hubacek (2015), it was found that ATTPA negatively influenced intention. This implies that the attitude towards the PAs is related to intention as suggested by Holmes (2003). Improving attitudes through conservation interventions may thus reduce community or individual engagement in harmful behaviors such as illegal grazing (Holmes, 2003). Having a more favorable attitude towards resource extraction in the PAs increased the likelihood of intending to engage in such a behavior. This corresponds to a study by Karki and Hubacek (2015), who found that the perceived impact of resource extraction had strong influence on intention and behavior. In contrast to similar studies (Hrubes, 2001; Lee et al., 2009; Karki and Hubacek, 2015), households with more positive conservation attitudes were more likely to intend to illegally graze. The reason for this controversial result is unclear and may be attributed to the fact that the conservation attitudes held by households in the study were generally very positive. Also, it is not clear whether the respondents actually linked these presumably held conservation attitudes to illegal grazing.

Household size, which was the only socioeconomic factor correlated with intention in the preliminary analyses, could positively predict intention, albeit at the 10%-significance level, in the logistic regression model containing this variable. As mentioned, larger households are more resource-dependent and may tend to have more livestock and therefore require more resources from the PAs.

The results of the sequential approach revealed that a combination of psychological and general attitude factors significantly improved the predictive ability of intention and showed the best model fit consistent with the recommendations of Stern (1999) and Barr and Gilg (2007). ATT, PBC and ATTRE emerged as the most consistent predictors of intention and the model containing only these factors also displayed the best overall fit. These results indicate that in order to change the intention of illegal grazing, it may be effective for management authorities not only to pay more attention to ways to decrease positive attitudes towards illegal grazing but also towards resource extraction within the PAs in general. Environmental education and persuasive communication programs at the community or household level, provided by PA managers, NGOs or village council, might be methods to create awareness about how illegal resource extraction behaviors such as illegal grazing threatens the existence of the PAs, its unique natural resources and potential benefits as people need to see the impact of their behavior on themselves (Monroe, 2003). Over a third of the respondents in the study reported that they had not received any information about the PAs highlighting the potential of these information transfer approaches. Clearly demarcating the PA borders (e.g. by using signposts), intensifying patrolling efforts and/or increasing fines may among others be means to decrease the perceived control individuals have over their behavior (Nyahongo, 2005; Jachmann, 2008; Keane, 2008). However, the effect of enforcement on illegal resource extraction within PAs in developing countries remains contentious and increasing enforcement efforts is both costly and might exacerbate conflict with local communities or individuals (Robinson et al., 2010). In addition, most of the respondents agreed that fines for illegal grazing and the likelihood of being arrested when illegally grazing were already high.

Consistent with the TOPB framework (Ajzen, 1991) and numerous other studies applying the TOPB to predict behavior (see Armitage and Conner (2001) for review), the present study found intention to be the most important predictor of behavior. The model containing the psychological factors could also significantly predict behavior, although with less predictive power than intention, and ATT was the only significant predictor. Similar to the prediction of intention, further examination of the data using PROCESS indicated that ATT completely mediated the effects of SN on the behavior variable (Hayes and Preacher, 2014). However, in contrast to the TOBP framework (Ajzen, 1991), PBC was not found as a significant predictor of behavior. That is, the likelihood of households to illegally graze as intended did not depend on their confidence in their ability to perform the activity. The model containing the

socioeconomic factors (i.e. wealth and household size) as predictors, albeit significant, showed the poorest fit of the three. Wealth was the only significant variable predicting behavior. As other studies similarly have showed (e.g. Holmes 2003; Coomes et al. 2004; King and Peralvo, 2010), wealthier households, rather than poorer ones, were likelier to illegally graze. This result is not unsurprising, as wealthier households in rural Tanzania tend to have larger land holdings and numbers of livestock (Ellis and Mdoe, 2003). Livestock contributes greatly to the measure and understanding of material wealth in Tanzania (Ellis and Mdoe, 2003). Hence, wealthier households might not have sufficient access to pasture on village lands and left with no good alternative they graze their livestock in the PAs where resources are abundant. This is supported by the fact that the main reason for grazing livestock in the PAs reported by the respondents was lack of pasture.

In contrast to intention, the general attitude factors were not significantly associated to behavior in the preliminary analyses and were therefore not included in the prediction of behavior.

The addition of the psychological factors to intention in the sequential approach predicting behavior did not improve model fit and only intention remained significant. In other words, and similar to the mediated variable regression analysis approach used in Van Hooft et al. (2003) and Martin et al. (2010), ATT was no longer a significant predictor of behavior when intention was added to the model containing only the psychological factors. This supports the mediating role of intention on attitude. These findings are somewhat consistent with the TPB framework, which posits that intention is the immediate antecedent of behavior and completely mediates the effects of attitude and subjective norm and some of the effects of perceived behavioral control on behavior (Ajzen, 1991). Further examination of the data using the approach described by MacKinnon and Dwyer (1993), which can estimate the indirect effects of independent variables on dichotomous outcomes through dichotomous mediators, also supported the premise that intention mediated the effects of ATT on behavior. Nevertheless, the prediction of behavior was greatly improved by adding the socioeconomic factors to the model. Thus, intention and wealth emerged as the most important and consistent predictors of behavior, and the model containing only these factors also displayed the best overall fit.

The above-mentioned results emphasize the need to understand and incorporate psychological, general attitude and socioeconomic factors in the development of conservation interventions as suggested by Karki and Hubacek (2015). For example, Steinmetz et al. (2014) demonstrated that scientifically designed and proactive park outreach activities based upon the psychological factors from the TOPB framework may have suppressed poaching and initiated wildlife recovery in South-East Asia. Furthermore, in their review of 30 papers citing behavior change interventions based upon the TOPB, Hardeman et al. (2002) found that half of the interventions, based on persuasive communication programs and information dissemination, may have been effective in changing intention and two-thirds in changing behavior. Such efficacy provides evidence that the TOPB may have the potential for developing behavior change interventions.

Conservation efforts must target all parts of the causal chain from socioeconomic factors to attitudes towards PAs, psychological factors, intention and finally to behavior (Karki and Hubacek, 2015). In others words, conservation strategies based purely upon economic assumptions may not be effective in changing conservation behavior (Stern, 2008). Similarly, in their socioeconomic framework on regulatory compliance, Sutinen and Kuperan (1999) integrated economic theory with theories from psychology and sociology to incorporate moral obligation and social influence in addition to the conventional benefits and costs associated with illegal behavior. Interestingly, their framework posits that the willingness to comply with regulations is, among others, based on the perceived legitimacy of the authorities charged with implementing the regulations. Local communities who view the authority as legitimate feel a strong obligation to comply even when the goals and activities of the authority do not directly benefit them. In the present study, almost two-thirds of the respondents were discontent with the management authorities, perhaps indicating a low level of legitimacy among the respondents. Hence, the authorities responsible for the management of the PAs (e.g. TANAPA and the Wildlife Division) should perhaps dedicate more time and effort to developing legitimacy. Co-management regimes, in which local communities are empowered to play a prominent role in decision-making, may be a means of achieving this end (Sutinen and Kuperan, 1999).

Improving the above-mentioned factors alone does not guarantee behavioral change. Many respondents as well as the village leaders in the study expressed that they highly depended on the PA resources for their livelihoods and did not have access to alternatives. They complained that the PAs restricted access to pasture and fuelwood, among others. These negative perceptions of the PAs as a resource constraint was particularly strong among livestock owners who mentioned that population growth was reducing available land for grazing and natural resource collection. Thus, a high level of dependency and a lack of access to alternative resource collection could also have influenced their involvement in illegal grazing (Marshall et al., 2010; Karki and Hubacek, 2015). This squares with the finding that wealthier households with more livestock, rather than poorer ones, were more likely to graze their livestock in the PAs.

Alternative livelihood strategies such as small business enterprises, ecotourism and poultry production should therefore be developed to overcome the restrictions that PAs impose on local people in terms of access to resources (Kideghesho, 2007) and increase the opportunity costs of illegal grazing. The responsible management and conservation organizations could help local communities to improve agricultural efficiency on land already under cultivation via education, extension services and technology. Similarly, the construction and maintenance of boreholes in the village lands might could mitigate the problem of lack of water and pasture for livestock. Furthermore, the livestock owners in the study often claimed that the PAs should be opened to provide pasture for grazing, at least seasonally in the event of a drought. However, allowing access into the PAs is inherently problematic for reasons stated in the Introduction. Also, the introduction of new and more productive breeds of livestock might reduce the number of livestock owned by households and decrease the pressure on the PAs. For the Sukuma as well as other ethnicities in Tanzania, livestock are an important resource for families and represent stored capital to be used in the event of an emergency or to meet other household needs (Ellis and Mdoe, 2003). Livestock represents not just economic capital but cultural capital consistent with tradition and associated with power within the community. It may thus be worthwhile, albeit difficult, to create incentives that will motivate and help them to convert livestock into alternative forms of capital with less environmental impact.

Moreover, if the local residents could directly benefit from not grazing in the PAs, some of the pressure to illegally graze could be lessened. The value of the biodiversity in the Serengeti ecosystem is large. Yet it mostly accrues to players other than the local communities (Kideghesho, 2008). Payments for ecosystem services (PES) may have the potential of developing funding mechanisms that help protect PAs, increase the income of the local communities and provide incentives to change harmful attitudes, intentions and behaviors (Silvestri, 2012). PES schemes aim at connecting suppliers of ecosystem services, e.g. local communities or people who would restrain from extracting resources in the PAs, with buyers who would pay for such services, for instance private hunting companies interested in the conservation of wildlife populations (Wunder, 2005). However, the establishment of any PES scheme faces a number of challenges. For example, additionality needs to be demonstrated, which requires that payments should yield environmental benefits that would not have been realized in the absence of payments. Additionality can also be compromised by leakages that arise when the conservation problem being addressed by PES is shifted elsewhere (Wunder, 2005). The implementation of a PES scheme can also create perverse incentives, for example, when local residents are paid to refrain from grazing in the PAs, people who do not receive such payments may decide to illegally graze (Wunder, 2005).

4.1 Reflections and Limitations

This study has several limitations. Firstly, an important limitation is that an attitude is a latent construct and thereby difficult to understand and measure (Milfont and Duckitt, 2010). As an attitude cannot be directly observed, it is intrinsically problematic. There is the risk of social desirability bias where respondents tend to answer questions in a manner that they view will please the researcher instead of providing answers reflective of their true opinions and emotions (Grimm, 2010). Moreover, Bragagnolo et al. (2016) and Allendorf (2007) have demonstrated a diversity of PA attitude concepts across conservation studies. Some studies did not clearly define the concept while others employed a range of issues, such as the attitude towards conservation policies, benefits and management, under the same term. The variety of ways that attitude has been defined and measured makes it difficult to compare people's attitudes and the factors that significantly influence them across attitudinal studies on PAs (Bragagnolo et al., 2016). In addition, the construct validity of the ATTPA and ATTCON constructs in this study was only adequately confirmed which might limit the comparability

and generalizability of the results.

Secondly, the social desirability bias might have extended to the self-reported behavior of illegal grazing where respondents might have underreported their performance of this behavior owing to its illegal nature. The validity of self-reported behavior as an indicator of actual behavior can be problematic and some research suggests that the predictors of self-reported behavior and observed behavior are different (Vining et al., 2002). However, the research team attempted to minimize these biases by taking this into consideration in the phrasing of the survey questions and statements, promising anonymity and by giving a detailed introduction to each respondent prior to the interview explaining that honesty was important and that there were no right or wrong answers. Nevertheless, the collection of data based on direct measures of activity or innovative indirect measures (e.g. see Nuno et al., 2013) should be a top priority for future research designs. Moreover, in deciding how to measure behavior, one must also consider how one plans to work with the collected data afterwards. In the present study, behavior was represented as a dichotomous variable - behavior was either present or not. However, one could also have described behavior in terms of frequency, duration and/or intensity.

Thirdly, although the items used in the present study to measure the latent psychological constructs (i.e. ATT, SN and PBC) seemingly captured the essence of these constructs with construct validity successfully achieved, they were not worded precisely as suggested by Fishbein and Ajzen (2010). For example, both the direct and indirect (i.e. the underlying salient beliefs) items were used to measure the same constructs in this study. In future research designs, it is advisable to use more precise wordings of the items measuring each latent construct, as suggested by Fishbein and Ajzen (2010) and to separate the direct (e.g. attitude towards the behavior) and indirect measures (e.g. salient behavioral beliefs) of the constructs and use validated scales when possible to ensure reliability.

The data collection can best be described as successful. Nonetheless, it was subject to factors that are often connected to field research. Firstly, it was only possible to spend a few days in each village and only a short duration with each respondent, which might have limited the ability to build up trust, establish relationships and to become an observant participant in village life e.g. to observe whether or not people were actually illegally grazing in the PAs. Thus, it was challenging to obtain trustworthy answers from some of the respondents despite

being accompanied by local assistants and experiencing strong support from community leaders. For example, some of the respondents mentioned that they were not aware of the nearest PA. Although this might have been the case, the village chairman later said that some of the respondents feared allegations of bushmeat hunting and that they, therefore, did not want to be affiliated with the PAs. Furthermore, conflict existed between the PA staff and the local residents in the study villages that we visited. Illegal grazing was observed in the villages and many respondents reported arrests, beatings and even killing of local villagers by PA staff. These factors might also have colored some of the responses.

Secondly, the level of understanding of some respondents was low, mainly due to language difficulties. Some of these respondents did not fully comprehend the response-scale used in specific subsections of the questionnaire and it was sometimes necessary to repeat the response-scale for every question asked. Consequently, important information may have been lost during some of the interviews. In addition, the fact that non-Kiswahili speakers were not included in the survey may have caused a biased sample. However, the actual number of respondents rejected due to insufficient language skills was minimal.

Thirdly, the use of a non-probabilistic sampling technique might have caused a biased sample. It was not possible to perform a wealth ranking on the study villages. Hence the sample may also be biased towards households belonging to different wealth categories such as the rich or the poor. Nevertheless, it is believed that the chosen sampling technique ensured fair representation in the sample of the populations of the respective study villages.

Lastly, to establish the generalizability of the results, the study should be replicated in other geographic locations, use larger sample sizes and utilize probabilistic sampling techniques.

5. CONCLUSION AND RECOMMENDATIONS

The findings of this study contribute to the growing literature on interactions between PAs and local peoples by investigating the relationship between the attitude, intention and illegal grazing behavior of local communities bordering PAs in the southwestern part of the Serengeti ecosystem. The study site itself was the most important factor influencing attitudes towards the PAs suggesting that local conditions can have a substantial effect on attitudes and confirming the importance of adopting site-specific conservation strategies. Attitudes were more positive towards Serengeti National Park than Maswa Game Reserve, the latter of which

relatively recently extended its borders. This implies that while an eviction of local residents may have guaranteed conservation success in the past, the current social, political and ecological situation renders the strategy less feasible. The use of force to achieve conservation objectives may incur a counterproductive antipathy towards conservation among local peoples and an erosion of government legitimacy. As the results of the present study indicate, a benefits-based approach may better secure local support for PAs. It may thus be worthwhile to allocate more resources to community outreach services that provide tangible benefits. However, such outreach services should be designed to obtain long-term support of the protected areas. Benefits should be equitably distributed, reflect the actual needs of the people and be visibly linked to the PAs. Immigration to the PA borders as a result of such benefits should also be addressed. The relationship between local communities and the PA is influenced by the interaction with various institutions and organizations including NGOs which provide benefits and development projects. In this study, it was found that the awareness of NGOs had a strong positive influence on households' attitudes. Therefore, the relationship between the local communities, PA management and these institutions needs to be based on a strong common understanding and transparency. This may not only build trust among these stakeholders but will also help to increase support from locals. Gender and household size were significant socioeconomic predictors of attitudes towards the PAs. Larger households and male respondents had more negative attitudes towards the protected areas suggesting that attempts to improve attitudes should target these groups of people.

Identifying the factors influencing PA attitudes is important but not sufficient when developing effective conservation interventions. It is equally crucial to understand the role of these general attitudes as well as psychological and socioeconomic factors in predicting intention and behavior relating to illegal grazing within PAs. Understanding and improving attitudes may be of little use if they do not translate into actual behavior. While the study found that the attitude towards the PAs was related to households' intention to illegally graze, thereby partly supporting the idea that improving PA attitudes leads to subsequent change in behavior, the results of this study showed that psychological factors were the best predictors of both households' intention and behavior. However, the combination of psychological, general attitude and socioeconomic factors improved the prediction of both intention and behavior. As such, attitude towards illegal grazing, perceived behavioral control over illegal grazing and attitudes towards resource extraction in PAs emerged as the strongest predictors

of intention while intention and wealth, in turn, emerged as the most important predictors of behavior. These findings emphasize the need to understand and incorporate psychological, general attitude and socioeconomic factors in the development of conservation interventions. Thus, any intervention to minimize illegal grazing should not only focus on ways to decrease positive attitudes towards livestock grazing and resource extraction in general but also decrease the perceived control that households have over this behavior. Educating households about the value and benefits of conservation and the protected area, making them aware of the impact of resource extraction upon the biodiversity of the PA as well as clearly demarcating the PA boundaries might be means of achieving these ends. However, educational programs and other benefits will hardly deter locals from illegal activities if they do not help locals meet their resource requirements. Human and livestock populations have increased resulting in a scarcity of land and its associated resources. As the study shows, wealthier households with more livestock were more likely to graze their livestock in the PAs. Thus, conservation interventions should also provide alternatives for resource collection, improve agricultural and livestock productivity as well as create incentives for people to either refrain from grazing or convert livestock into alternative forms of capital with less environmental impact.

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APPENDIX

I. Household Questionnaire

Section A: Introductory Information

A1. Questionnaire number _____   *A2.* Date: _____
A3. Village: _____   *A4.* Ward: _____
A5. Household position: 01 Husband ____   02 Wife ____   99 Other (specify) _____

Section B: Socioeconomic Information

B1. Gender: 01 Male ____   02 Female ____
B2. Age: _____   *B3.* Ethnicity:_____
B4. Education level of interviewee: 01 Primary __ 02 Secondary __ 03 High school __ 04
University __ 05 No education __ 99 Other (specify) _____
B5. Nr. of people living in household: ____   *B6.* Average level of education in household: 01
Primary __ 02 Secondary __ 03 High school __ 04 University __ 99 Other (specify)
_____
B7. Main occupation of household head: 01 Farming __ 02 Livestock __ 03 Natural resource
__ 04 Wage labour __ 05 Own business, rental __ 99 Other (please specify) _____
B9. Place of birth: 01 This Village __ 02 Ward __ 03 District ____04 Region __ 99 Other __
B10. If not in the village, why did you move here: 01 Marriage __ 02 Employment __ 03
Grazing __ 04 Family __ 05 Cultivation __ 06 Natural resources (specify) _____
99 Other (specify) _____

B11. Please mention and rank the 3 most important livelihood activities that have contributed
to your household income the last 12 months?

Activities*	Rank

**01 Farming, 02 Livestock, 03 Natural resources, 04 Wage labour or similar, 05 Own
business or similar, 06 Remittance (e.g. support from PA or tourism), 99 Other (specify)*

B12. Which assets does your household own?

Type of asset	Number	Type of asset	Number	Type of asset	Number
Cattle		House		Car	
Sheep		Generator		Motorcycle	
Goats		Radio		Bicycle	
Pigs		Water tank		Tractor	
Chickens		Improved charcoal stove		Monetary savings	
Farm land cultivated (ha)		Cell phone		Other (specify)	
		Sewing machine		Other (specify)	

Section C: Knowledge, Interaction and Perceptions of the Protected Area

C1. Are there any protected areas near your village? 01 Yes __ 02 No __

C2. If yes, do you know the name of the protected area? 01 National Park __ 02 Game Reserve __ 03 Wildlife Management Area___ 04 Do not know __ 99 Other (specify) _____

C3. Have you experienced any interaction with the park staff? 01 Yes __ 02 No __

C4. If yes, which: 01 Providing information __ 02 Purchasing supplies, food, drink etc. __ 03 Village meeting __ 04 Village project __ 05 Uncertain of purpose __ 99 Other (specify) _____

C5. Are there any NGOs or others organisation working in or near your village? 01 Yes __ 02 No _ If yes, please specify? _____

C6. Which is the main source of information about the protected area in your area? 01 PA staff __ 02   Village council __ 03 District council __ 04 Central government __ 05 NGO __ 06 Do not know __ 07 No information __ 99 Other (specify) _____

C7. Have you received any benefits from the protected area? 01 Yes __ 02 No __If yes, 1) please name the 5 most important benefits you have received from the protected area?

C8. Have you experienced any problems with the protected area? 01 Yes __ 02 No __If yes, please name the 5 most important problems you have experienced with the protected area.

Benefits	Comments	Problems	Comments

Section D: Attitudinal Data on Conservation and Protected Areas

List of statements	Score*
Plants and animals have as much right as humans to exist	
The protected area should be abolished	
Human can only protect nature if everyone cooperates	
The protected area has disrupted our relationship with nature	
The natural resources of Tanzania should be conserved for future generations	
Protected area rules and penalties are essential for the protection of natural resources and wildlife	
I am willing to preserve the natural resources of Tanzania	
Local communities should manage the protected area, not protected area managers	
Wildlife is important for Tanzania	
Problem animals should be killed	
Resource extraction from the protected area is all right	
The protected area managers are very helpful and give priority to our problems	

 *1 Strongly disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 Strongly agree

Section E: Theory of Planned Behavior on Livestock Grazing in the Protected Area

List of statements	Score*
I think livestock grazing in the protected area is all right	
Other people (e.g. family, friends) encourage me to graze livestock in the protected area	
I always have the opportunity to graze livestock in the protected area	
My village has always grazed livestock in the area where the protected area now lies	
Livestock grazing in the protected area is harmful to the environment	
Livestock grazing in the protected area will benefit my household	
I will not be looked down upon if I graze livestock in the protected area	
Livestock grazing in the protected area is important for my livelihood	
I am planning to graze livestock in the protected area	
It is very normal in my village to graze livestock in the protected area	
The likelihood of being arrested is very low when grazing livestock in the protected area	
Livestock grazing in the protected area has a negative effect on natural animal populations	
The penalties for grazing livestock in the protected area are very low	
It is very easy to graze livestock in the protected area	
I intend to graze livestock in the protected area	

*1 Strongly disagree, 2 Disagree, 3 Uncertain, 4 Agree and 5 Strongly agree

Section F: Livestock Grazing Behavior in the Protected Area

F1. Do you graze livestock in the protected area? 01 Yes __ 02 No __

F2. If yes, why? 01 Unavailability of land __ 02 Quality of land __ 03 Traditional and cultural reasons __
99 Other (please specify) _____

F3. How often the past 12 months? 01 Daily __ 02 Weekly __ 03 Monthly __ 04 Yearly __
99 Other (please specify) _____

II. Guide for Structured Village Leader Discussions

Village Details

Date _____ Village _____ Ward _____
Division _____ District _____ Region _____
Distance from nearest protected area _____

Demography

Total number of households in the village	
Total population in the village	
What is the total area of your village lands	
When was this village formed?	
Average education level in village	
Ethnic groups in village	

Livelihood activities

List the most common forms of livelihood strategies in this village and then rank them in order of importance

Livelihoods	Tick	Rank
Cash crops		
Subsistence farming		
Small Business		
Wage Employment		
Livestock		
Other (specify)		
Other (specify)		
Other (specify)		

Did your village engage in the same livelihood activities that you mentioned 50 years or more ago or have they changed?

_____

_____

Natural Resources

List which natural resources your village has access to and rank them in order of importance.

Livelihoods	Tick	Rank
Fuelwood		
Grasses		
Animal fodder		
Medicinal plants		
Grass for grazing		
Game meat		
Water		
Timber		
Charcoal		
Land for cultivation		
Other (Specify)		

Do you think the availability of the natural resources that you mentioned has increased or decreased the past 50 years? Can you explain why?

_____

_____

Do you think the availability of the natural resources that you mentioned would increase or decrease in the future?

_____

_____

Which natural resource is your village lacking the most now? _____
… do you think your village is going to lack the most in the future? _____

Do you have any specific rules on the use of natural resources in your village?

_____

_____

Are you interested in learning more about the sustainable use of natural resources?

_____

_____

Relationship with the Protected Area

Are there any restrictions of the use of natural resources in the protected area?

_____

_____

From whom did you get information about the protected area?

_____
_____

Do people in your village extract/use resources from the protected areas?

_____
_____

Are there people in your village who graze their livestock in the protected area?

_____
_____

What actions do you think should be taken to stop people from grazing livestock in the protected area?

_____
_____

What kind of interaction have you experienced with the park staff?

_____
_____

How is the relationship between your village and the park staff? How can it be improved?

_____
_____

Has any other organizations worked in your village? Yes __ No __
If yes, who? _____

If your village could have one thing from the protected area what would it be? _____

Has there been any services/projects provided in your village by the protected area?

_____
_____

III. Principal Components Analysis on the Asset Ownership Variables

Asset Ownership	Scoring factor	Mean	SD	Index Change (scoring factor / SD)
No Cattle	-.825	.367	.484	-1.705
Cattle (1-20)	.365	.417	.495	0.736
Cattle (21+)	.529	.217	.414	1.279
No Shoats	-.691	.408	.494	-1.401
Shoats (1-20)	.162	.358	.482	0.336
Shoats (21+)	.620	.233	.425	1.461
Chickens	.512	.8500	.359	1.428
Farmland (0-3 ha)	-.610	.3250	.470	-1.298
Farmland (4-13 ha)	.047	.4250	.496	0.094
Farmland (14+ ha)	.607	.2500	.435	1.396
House	.302	.917	.278	1.087
Generator	.242	.033	.180	1.344
Radio	.226	.350	.479	0.472
Water tank	.215	.017	.129	1.670
Improved charcaol stove	.232	.292	.456	0.508
Cellphone	.254	.875	.332	0.766
Sewing machine	.142	.117	.322	0.440
Motorbike	.459	.208	.408	1.126
Bicycle	.524	.758	.449	1.166
Monetary savings	.396	.133	.341	1.160

NB: Each variable is dichotomous with 0 indicating no ownership of asset and 1 indicating ownership of asset. The scoring factor is the 'weight' or 'coefficient' assigned to each variable in the combination of the variables that comprised the 1st principal component. The percentage of the covariance explained by the first principal component is 20.07. The ownership of cattle, shoats and farmland were dichotomized according to first and third quartiles e.g. 25 % of the households did either not own cattle or owned over 21 cattle.