Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Natural Sciences
Department of Biology

Henrik Wirsching

# Human wildlife conflicts in Shwesettaw Wildlife Sanctuary, Myanmar. A survey of crop raiding, bushmeat consumption and human perceptions.

Master's thesis in Natural Resources Management
Supervisor: Eivin Røskaft
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# Abbreviations

| | |
|---|---|
| CBD | Convention on Biological Diversity |
| CLMM | Cumulative Link Mixed Model |
| CWS | Chattin Wildlife Sanctuary |
| GLMM | Generalized linear mixed model |
| HWCTF | Human-Wildlife Conflict Task Force |
| IPBES | The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services |
| IUCN | International Union for Conservation of Nature |
| NEA | Norwegian Environment Agency |
| NUPI | Norwegian Institute of international affairs |
| PA | Protected Area |
| PAME | Protected Area Management Effectiveness |
| SPSS | Statistical Package for the Social Science |
| SSC | Species Survival Commission |
| SWS | Shwesettaw Wildlife Sanctuary |
| UN DESA | United Nations Department of Economic and Social Affairs |
| UNEP | United Nations Environment Programme |
| WCMC | World Conservation Monitoring Centre |
| WCPA | World Commission on Protected Areas |
| WWF | World Wildlife Fund |

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To all my Burmese friends, I wish you and your families all the best in these difficult times.

# Abstract

One of the major challenges of conservation is the balance between the needs of local communities and the protection of nature. Human-wildlife conflicts are recognized as an immense challenge globally, impoverishing human communities and diminishing local biodiversity. There is a need to mitigate these conflicts on behalf of all parties involved. Through surveying a total of 250 respondents in 10 villages surrounding Shwesettaw Wildlife Sanctuary (SWS), Myanmar, this study aimed to investigate human-wildlife conflicts in the area. Focusing on crop raiding, bushmeat consumption and human perceptions of three ungulate species, Eld's deer (*Rucervus eldii*), Muntjac (*Muntiacus vaginalis*) and Wild boar (*Sus scrofa*). Findings suggest a partially ongoing human-wildlife conflict between the local population in SWS and the interests of the PA, with ungulate populations potentially threatened by bushmeat consumption. The most consumed bushmeat was Wild boar > Muntjac > Eld's deer, with parameters of age, livestock ownership, farmland ownership and gender affecting people's involvement. The farmland owners in communities surrounding SWS were experiencing a degree of crop raiding from Wild boar, creating a two-way conflict with the animal. Human perceptions of Wild boar were mostly negative and varied with the experience of crop raiding. However, attitudes towards the other ungulates and the PA-staff were mostly positive. With females having negative perceptions of the ungulates more often than men. There were big differences in conflict level between regions of SWS, as crop raiding incidences and bushmeat consumption varied with geographic location of villages.

# Introduction

## Background

The last century has seen a massive increase in human population, projected to reach almost 10 billion over the next 30 years (UN DESA 2019), a growth which intensifies the stress on earth's natural ecosystems (Mora & Sale 2011). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2019) has identified the five direct drivers of human impact on the environment as: (1) changes in land and sea use, (2) direct exploitation of organisms, (3) climate change, (4) pollution and (5) invasive alien species. The same science-policy platform has also stated that a total of 10% (around 1 million) plant and animal species are threatened with extinction, more than ever before in human history (UN SDG Blog 2019)

Our most used means of protecting important ecosystems is through the establishment of protected areas and wildlife parks (Kideghesho et al. 2007; Mascia et al. 2014), and numerous areas has been established to protect nature from anthropogenic threats (Oberosler et al. 2020). The establishment of protected areas is an important step to reduce biodiversity loss and reduce deterioration of important ecosystems. It can be seen as a significant contribution to global conservation efforts (IUCN WCPA 2011), and is therefore an integral part of the Aichi biodiversity targets created by The Convention on Biological Diversity (CBD). With 20 targets representing ambitious goals for conservation and safeguarding of global biodiversity, the eleventh target is dedicated protected areas: "By 2020, at least 17 per cent of terrestrial and inland water areas and 10 per cent of coastal and marine areas … are conserved." Highlighting areas with special significance for ecosystem services and biodiversity (CBD Secretariat 2012)

According to The Protected Planet Report of 2018, the global status of protected terrestrial and marine areas today is 15% and 7% respectively (UNEP-WCMC & NGS 2018). However, biodiversity continues to decline despite global targets being met (Hill et al. 2015). The International Union for Conservation of Nature (IUCN) identifies the cause of this discrepancy with two different factors: The actual extent of which the protected areas deliver biodiversity outcomes, and the level of biodiversity present within the protected areas (IUCN WCPA 2011).

The quality of enforcement and management of protected areas are of substantial importance for the future of the wildlife within (Holmern et al. 2007a; Oberosler et al. 2020), and legal protection of species have little effect towards mitigating hunting, in the absence of enforcement (Holmern et al. 2007a). Recent studies have found connections with staffing and budget levels of protected areas, and species conservation outcomes within its borders (UNEP-WCMC & NGS 2018; Oberosler et al. 2020).

Additionally, according to PAME (Global Database on Protected Area Management Effectiveness), only 21% of countries meet the management effectiveness targets. Most of the areas assessed are in Western Africa, with some areas in South America and Asia (UNEP-WCMC & NGS 2018). A mapping study shows that 32,8% of global protected land is under intense human pressure from agriculture, grazing of livestock, light pollution and roads (Jones et al. 2018). Not accounting for the pressure exerted through bushmeat extraction, proposed to be one of the most widespread threats in tropical forests (Oberosler et al. 2020), and accredited to the threatened population status of 301 terrestrial mammal species globally (Ripple et al. 2016).

One of the major challenges of conservation is the balance between the needs of local communities and the protection of nature (Nyhus 2016). Especially in areas where economies are dependent on local resource extraction and agricultural activities (Pandey et al. 2016), as often is the case in low-income countries (Allendorf & Yang 2013; Ripple et al. 2016). These dependencies might also be historic as part of beliefs systems and cultural values (Pandey et al. 2016). In communities surrounding protected areas, poverty tends to increase such illegal activities of extraction and poaching, causing over-exploitation of resources (Bel 2011).

The human disturbance and encroachment of nature brings wildlife and people closer together, introducing human-wildlife conflicts (Hariohay & Røskaft 2015; Hariohay et al. 2017; Torres et al. 2018). As wildlife are indifferent to borders of natural habitats, protected areas or human property, they can generate plenty of harm to human wellbeing. Conflicts with human interests are bound to occur and are deemed to be inevitable where humans and animals share the same habitat (Bel 2011). Incidents of animal disturbance can vary in severity from assault, with associated livestock or human casualties, to raiding of agricultural crops, property damage, spread of disease and simple nuisance (Holmern 2003; Treves et al.

2006; Linnell et al. 2011; Nyhus 2016). Opportunity cost associated with time spent guarding crops or livestock and psychosocial wellbeing, also comes into play (Hariohay & Røskaft 2015; Nyhus 2016).

These are incidents that can lead to persecution and retaliation against conflict species (Holmern et al. 2007b; Liu et al. 2011; Ankur et al. 2017), deliberate destruction of animal habitat (Treves et al. 2006), and decline in local support of conservation efforts (Songorwa 1999; Gadd 2005; Okello 2005; Kideghesho et al. 2007; Hariohay et al. 2018). Cooperation from, and the attitudes of, local communities are crucial for protected areas to deliver successful biodiversity outcomes (Stankey & Shindler 2006; Pandey et al. 2016; Hariohay et al. 2018).

People tend to maintain positive perceptions towards wildlife and conservation schemes as long as their needs for livelihood are met (Gillingham & Lee 1999; Allendorf et al. 2007) and benefits received from the area outweigh the costs (Holmern 2003; Kideghesho et al. 2007). Naturally, when wildlife inflicts costs, attitudes among people worsen. As experiencing crop raiding decrease tolerance of wildlife (Songorwa 1999; Gadd 2005; Linkie et al. 2007; Hariohay et al. 2018), along with livestock depredation (Hariohay et al. 2018).

Stricter regulation to combat human disturbance of local wildlife or failure to address the needs of local communities, can even further complicate the issue. Creating a conflict between different stakeholders (Madden 2004; Pandey et al. 2016) or even a conflict on a political level (Treves et al. 2006). Conflicts in conservation are often made worse by underlying social friction between groups of people (Madden & McQuinn 2014; Nyhus 2016), and violation of wildlife protective restrictions can be politically motivated or simply an expression of resistance to conservation (Madden 2004; Baynham-Herd et al. 2018; Skogen & Krange 2020).

A mismatch between perceived wildlife induced damage and actual damage might occur, as farmers could overestimate the effects of crop raiding events (Gillingham & Lee 2003). Smaller to medium sized animals (Mfunda & Røskaft 2011) and birds might be the more common perpetrators, but less provocative (Nyhus 2016), shifting blame towards larger mammals. However, even if a problem is only perceived to exist, it is still of serious concern to conservation (Sonam W et al. 2006).

Varying socioeconomic factors of education, livestock ownership, distance to the PA, wealth, ethnicity, occupation age and gender has been found to be important in explaining differences of attitudes towards conservation (Gadd 2005; Allendorf et al. 2006; Kideghesho et al. 2007; Tomićević et al. 2010; Zaffar Rais et al. 2015; Hariohay et al. 2018). Gender is important as men and women often interact differently with the environment and associated conflicts (Nyhus 2016). In a society with stringent gender-roles, the restricted access and illegality of some activities related to the PA, affects the two differently (Allendorf et al. 2006). Studies have found men to be more positive towards PA's than women, likely due to the beforementioned division of tasks in the household (Mehta & Heinen 2001).

Geographic location might also be an important factor, as the frequency of conflict events can vary greatly with region (Nyhus 2016). Often conflicts are concentrated at the borders of the forests between protected area and human agricultural land and development (Linkie et al. 2007), with households closer to the PA at higher risk (Røskaft et al. 2013; Ankur et al. 2017; Hariohay et al. 2017).

This is the essence of human-wildlife conflicts which the IUCN, recognize as an immense challenge all over the world (IUCN SSC HWCTF). With socio-economic and ecological factors that create or worsen conflicts, impoverishing human communities as well as diminishing local biodiversity (WWF 2008). There is a need to mitigate these conflicts, on behalf of all parties involved (Upma Manral et al. 2016; Torres et al. 2018), and for conservation efforts to be successful (Madden 2004). Interdisciplinary approaches are needed to alleviate the stress of these conflicts, and for communities and wildlife to move towards coexistence (IUCN SSC HWCTF).

Human-wildlife conflicts are important aspects of the capability of protected areas to deliver biodiversity outcomes, a capability that is of a major talking point in Asia (IUCN WCPA 2011) home to almost 60% of global human population (UN DESA 2019). One third of the worlds recognized biodiversity hotspots are located in this densely populated continent (IUCN CEM 2017), and the southern part sub-region is considered by the IUCN to be the zone of greatest conservation need, globally. Forests of South Asia have the most biologically diverse ecosystems, but the region faces increasing challenges of human degradation of nature

(Hasnat et al. 2019), and the IUCN highlight the importance of integrated management in countries within the sub-region (IUCN CEM 2017).

One of the countries in the IUCN priority sub-region, is Myanmar, "With an extraordinarily rich natural heritage and global conservation value, Myanmar is a strategic country in terms of biodiversity conservation" (IUCN). Myanmar was one of the fastest growing economies of South-East Asia, with 7.5% growth between 2012 - 2016, a growth which was expected to continue for several years (NUPI 2018). After the COVID pandemic and the coup of 2021, the growth and future of the country becomes harder to predict. Ecosystem services and biodiversity is incremental for livelihoods and economic growth of the country, with 36% of GDP and two-thirds of employment tied to the agricultural sector (CBD Secretariat 2015). The major threats to the country's nature, have been identified by the CBD to be tied to forest degradation, depletion and encroachment, general habitat destruction, and direct resource extraction such as bushmeat hunting, overfishing and animal trade (CBD Secretariat 2015). There is reason for concern, as societal conflicts and political instability has been proven to have negative effects on conservation (Amano et al. 2017), and shown to increase bushmeat consumption and poaching (Plumptre et al. 1997).

There are a total of 51 protected areas in the country, covering 6.35% and 0.48% of terrestrial and marine territory, receptively. Far from fulfilling the 11th Aichi Target of protected area coverage. Five of which have had management effectiveness evaluations (UNEP-WCMC & IUCN 2021b). Two of the areas not evaluated for management effectiveness is Shwesettaw Wildlife Sanctuary (SWS) and Chattin Wildlife Sanctuary (CWS), both serving as habitat for the endangered and endemic Eld's deer (*Rucervus eldii*).

A survey performed in CWS identified Eld's deer as a prominent problem animal, with 33% of surveyed locals claiming the animal to be damaging to their agricultural activities. Additionally, 42% of the respondents confirmed to have been eating Eld's deer meat. There were geographical differences to both the experience of crop raiding and meat consumption, whereas both events increased with closer proximity to the PA borders. Crop raiding also seemed to be worse in the southern regions (Thant et al. 2017). The population in CWS, previously considered to be the world's largest population, has declined over the past years, believed to be due to a combination of habitat loss and hunting (Gray et al. 2015).

The Eld's deer population in SWS, however, has increased steadily over the same period. Now consisting of more than 1500 individuals, regarded the world's largest population of the species. The increase is believed to be caused by the establishment of a no-access military area, where the animal receives protection from human disturbance (McShea 2018; Diana et al. 2019). A camera trapping survey performed by NINA (Norwegian Institute of Nature Research), confirmed the existence of Eld's deer within SWS, as well as identifying two other ungulate species; Northern Red Muntjac (*Muntiacus vaginalis*) and Wild boar (*Sus scrofa*). Larger ungulates are believed to have gone extinct in the area (NINA 2014)

There are no known studies on the interactions between local communities and Muntjac in SWS. The animal is a sought-after bushmeat in many Asian communities, and it is hunted over most of its geographic range. Both legally and illegally, often with use of snares. It is one of the most desired bushmeats in many Asian communities. Areas of heavy hunting pressure have had the animal population reduced, making them locally rare in some regions, but evidence suggest they are more resistant to human pressure than many other ungulate species (Timmins 2016). They do not seem to be heavily involved in crop raiding activities with few incidences in Sumatra (Linkie et al. 2007) and Chattin Wildlife Sanctuary (Thant et al. 2017).

The third ungulate in SWS, Wild boar, was not accused of crop raiding by Burmese locals in Chattin Wildlife Sanctuary(Thant et al. 2017). However, many researchers have studied the crop raiding behaviour of Wild boar all over the world and it is well established that the animal causes significant losses (Sonam W et al. 2006; Linkie et al. 2007; Li et al. 2013; Thurfjell et al. 2013; Pandey et al. 2016; Ankur et al. 2017; Khan & Ilyas 2018; Liu et al. 2019). The animal causes damage by trampling, wallowing, rooting and eating of agricultural crops (Li et al. 2013). It strives along the edges of its habitat, bringing it closer to humans, increasing its damaging potential in fragmented landscapes (Pandey et al. 2016) as shorter distance between Wild boar habitat and agricultural land increases the risk of crop raiding (Liu et al. 2019).

## Hypothesis:

There is an ongoing human-wildlife conflict between the local population in SWS and the interests of the PA, possibly threatening the endangered Eld's deer. Crop raiding and bushmeat consumption are amongst the drivers of the conflict, which varies between geographic regions surrounding the PA and influences human perceptions of the three study animals. There are also demographic differences in the perception of animals and the experience of or involvement in conflict.

## Predictions:

P1: Wild Boar is a species who to a larger extent than Eld's deer and Muntjac, disturb the local inhabitants (crop raiding) (a). Locals living further away from the PA borders experience less crop raiding (b).

P2. Consumption of Wild boar meat is more common amongst locals than consumption of Eld's deer and Muntjac (bushmeat) (a). Locals living further away from the PA borders are less involved in bushmeat consumption (b).

P3. Locals have more positive perceptions of Eld's deer than Wild boar and Muntjac (a). Human perceptions of different animals are negatively influenced by conflict level and the experience of crop raiding from a given animal negatively influence the perception of said animal (b).

# Materials and methods

## Study site:

The protected area, Shwesettaw Wildlife Sanctuary (SWS), is situated in the dry zone of central Myanmar, covering 464.09 $km^2$ (UNEP-WCMC & IUCN 2021a) and characterized by mostly forested low hills and ravines. The eastern part of the PA is flat and covered by dry deciduous forest with a grass covered understory. The Western part is hilly, dominated by mixed deciduous forest and an understory of bamboo (Diana et al. 2019).

An asphalt road bisects the western and eastern side of the PA, around the transition between the two forest types. The area span over four townships Minbu, Pwint Phyu, Ngapeh and Setote-Taya, all in the Magwe region, with a restricted access military area on the eastern side of the PA (Figure 1). A total of 42 villages surrounds the area with an approximate 26 000 residents, and a yearly religious festival with hundreds of thousand visitors visit the area every year, extracting construction material of bamboo and wood for one-time-use structures (Diana et al. 2019; NEA 2019).

Although cultivation of land and resource extraction is not formally permitted, there is massive human pressure on the PA. Land within the military area, formerly part of the PA, has been converted to cotton plantations, the northern and eastern border has been converted to agricultural land for rice crops, while farmland-forest mosaics span the southern and western areas. Informal tracks, passable by foot, cart and motorcycle, cover the entire PA, and there are major human disturbances and threats to the area. There is direct extraction of provisioning services such as fuelwood, building materials, non-timber forest products, collection of fuelwood and illegal hunting, often with the use of snares (Diana et al. 2019).

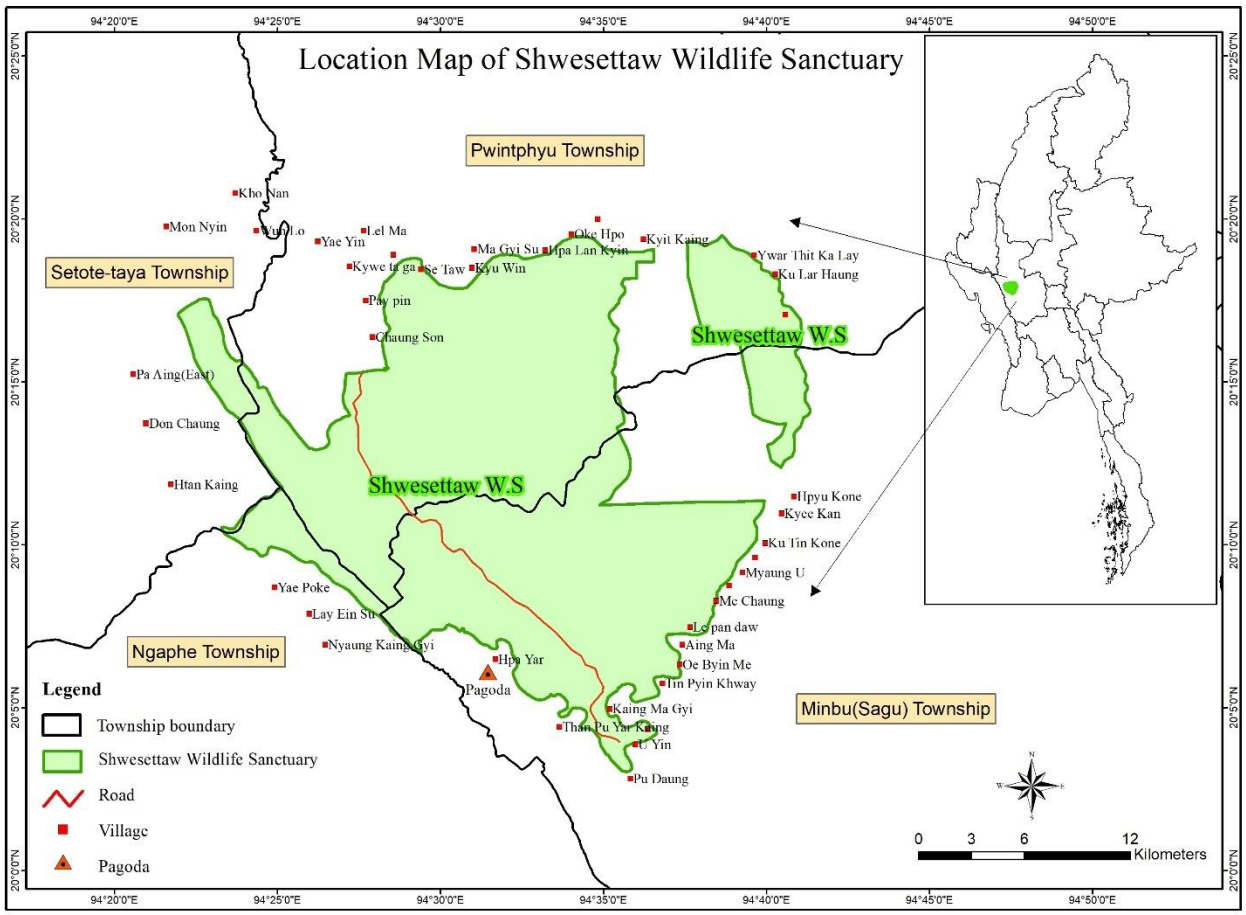



*Figure 1: Map of Shwesettaw Wildlife Sanctuary (Planning and Statistics Division).*

## Design:

Of the total 42 villages in the area, 10 was randomly chosen as study sites. To secure a somewhat equal spread of villages surrounding the entire SWS, villages were divided in six groups based on geographic location. From which villages were randomly pulled. Due to the differing number of villages within the six groups, an unequal number were pulled from each of them. This resulted in one village from each of Ngapeh and Setote-Taya townships and four from Minbu and Pwintbyu. In each village, 25 households were later surveyed for a total of 250 respondents.

## Data collection:

Due to the global Covid19 pandemic, with the associated risk assessments and travel restrictions, I was prevented from travelling to Myanmar. Data collection therefore had to be performed by a hired local research assistant, Aung Khant Phyoe. Great care to training and detailed instructions was given in advance of the data collection to assure its quality and accuracy. The research assistant performed the survey during November and December of 2020, supervised by fellow master student Hsu Yee Kyaw and PhD candidate Thazin Htay. The choice of households to be surveyed could not be done in advance and therefore had to be done on-site. The head of each village was consulted prior to conducting the survey, permission had to be granted and households that could not be included due to safety reasons or simple availability, had to be avoided. The research assistant entered each household that were to be surveyed and conducted the questionnaire as face-to-face interviews. Through the entire process, the assistant strived to conduct the interviews equally across all households and villages, with great attention to matters of behaviour and clothing. The assistant had no affiliation with the local forest department.

## Questionnaire:

The questionnaire was constructed using an online tool called SurveyAnyplace, which allows for online and offline survey and data storage. A total of 43 questions relating to each of the three study animals, demographics and land use, were prepared (Appendix 11). Most of the questionnaire was designed using the principles of a Likert scale, while some had other formats. Either binary or open-ended. Response options varied between set parameters reflecting size or distance, to demographic groupings and frequency.

For each of the species Eld's deer, Muntjac and Wild boar, a printed picture was prepared in advance, and later shown to each respondent. They were told to name the species on the picture as a test of their knowledge or familiarity with the animal. After they had responded, they were told the correct name of the species, and the questionnaire could continue. They were then asked about observations of the animals around Shwesettaw Wildlife Sanctuary, their perception of each of them, bushmeat consumption habits and the perceived disturbance received by the three study species. The knowledge test of animal familiarity was used in a brief inspection of respondent reliability.

Using a feature of the survey program called question logic, specific answers by respondents would assume selected topics and questions irrelevant for the rest of the interview. This mechanism ensured that respondents who reported that they did not own any farmland or livestock, would not be asked further questions about disturbance of agriculture or pasture. This was also applied to respondents who answered that they did not eat meat from wild animals and were consequently not asked about further meat consumption habit.

While performing the interviews, the research assistant wrote down all answers on physical paper, a hard copy, which was later entered into a digital format using a Huawei tablet and the survey tool SurveyAnyplace. When Wi-Fi was available, the collected data was uploaded and could be accessed online. The initial methodology was to enter data directly into the tablets as the interviews were performed. This however, had to be changed as the pilot test, done in advance of the data collection, identified some issues with this approach. Some changes were also made to the response options of frequency and units of measurements used in the questionnaire, as a consequence of the pilot test.

## Analysis of data:

Due to the use of a Likert scale design in the survey, individual respondents had as many as five different options of response to certain questions. Having that many response options not only complicate the statistical models but also requires a large enough sample to be usable in statistical models. Several response options were therefore grouped together into either binary option (farmland ownership; yes, no) or fewer categories (perception; good, neutral, bad). Some of the questions were originally based on frequency. That format, however, turned out to be confusing to the respondents and was unnecessarily detailed, spreading the responses to thin. These questions were ultimately recoded into binary options (E.g.: crop raiding and meat consumption).

IBM SPSS was used to organize the data and group variables together, along with descriptive statistics of frequencies and chi square test of significance between a selection of categorical variables. The Chi-square tests of significance were done as an exploratory analysis in order to get more insight into the data and to identify potential predictors that needed extra attention. The tests for significant relationships were done in isolation, not taking into account the global environment of other variables or any random effects. Additionally, the large number of tests that were run on the same variables made them vulnerable to type I errors as no Bonferroni adjustments were made to the significance level. The exploratory descriptive analysis was therefore not considered in the discussion of results.

The rest of the analysis was performed using RStudio. To answer the hypothesis of this research, the most important predictors, and their effect size, on the response variables had to be identified. Due to the nature of the data, non-normally distributed, nominal and with binary response variables (crop raiding and meat consumption), binomial generalize linear mixed models (GLMM) with the logit link function, was fitted. Cumulative link mixed model (CLMM) was used for the analysis of perceptions, where the response variables were ordinal, ranging from 1-3, negative, neutral, positive.

Village was treated as a random factor for all the models due to the stratified random sampling of the study sites, and the disparities between villages that was detected during the exploratory stages of the data analysis.

The selection of the best models or best combination of predictors for the GLMM and CLMM, was done using AIC. The AIC was used to identify which of the model candidates that best explained the data through likelihood and least complexity. With a $\Delta AIC < 2$ between two models, the best candidate was selected based on the probabilities of the model being the best fit, using Akaike weight (Fabozzi 2014). Alternative model candidates within $\Delta AIC < 2$ of the chosen models were catalogued (Table 9-15, Appendix).

To test for association between the categorical predictor variables, prior to the analysis, a Cramer's V matrix was used. A moderate association being between 0.20 and 0.40, while a relatively strong association is represented by values between 0.40 and 0.60 (Kotrlik et al. 2011). For this study, the threshold for excluding a predictor variable due to collinearity, was set at 0.500 V (Table 8, Appendix). This was done due to the potential of multicollinearity to increase standard errors and impact the statistical significance of correlated predictors (Allen 1997). An additional test of the collinearity, VIF, was done after performing the final GLMM models, looking at inflation of the variance due to the lack of independence between predictors (O'Brien 2007). With values above 10 indicating multicollinearity and values above 2.5 suggesting caution (Senaviratna 2019). R-squared was used to measure the variance explained by the predictor variables for the GLMM models (Table 16, Appendix).
The models were interpreted using odds ratio (OR) as a measure for the strength of association, effect size, calculated by exponentiating the estimates and confidence intervals. The latter was substituted by p-values with a significance level set at $\alpha = 0.05$. The reference categories for the predictors, of which the parameters of the given predictor were compared to, are catalogued in (Table 7, Appendix), with an OR of 1.00. The OR represented either likelihood increasing or likelihood decreasing relationships of the predictor parameters. The increasing predictors were written as multiplications of the reference, while the likelihood decreasing was written as percentages. This was done solely to make the interpretation of the results more intuitive.

# Results

## Animal crop-raiding

Descriptive

Only respondents with farmland ownership were considered eligible for questions regarding crop raiding. The results in this section are therefore limited to represent 78% of the total respondents surveyed (N = 194). The descriptive results are based on two different methods of questioning, open-ended and animal specific. Only the open-ended is used in analysis.

Farmland owners were asked the open-ended question: "What animal is most disturbing to your agricultural activities?" and were allowed to answer several animals. The results gave a level of disturbance for each of the three ungulates, as well as several animals spread over different taxon. The reported disturbance was especially low for Eld's deer and Muntjac with 2% and 7% respectively. Wild boar was the most frequently reported single species with 33%, while groups of smaller pest animals of rodents, birds and insects were the second most reported (Table 1). 93% of farmland owners reported crop raiding from at least one animal, with the majority naming two different species. When asked about the severity of damage from these animals, 30% of farmland owners perceived it as serious. There were differences in crop raiding reporting between villages (Figure 2).

*Table 1: Reported crop raiding amongst farmland owners:*

| | Open-ended | | Animal specific | |
|---|---|---|---|---|
| Animals | Frequency | Percentage | Frequency | Percentage |
| ED | 3 | 2% | 32 | 17% |
| MJ | 14 | 7% | 78 | 40% |
| WB | 64 | 33% | 92 | 49% |
| Monkey | 19 | 10% | | |
| Bird | 26 | 13% | | |
| Rodents | 36 | 19% | | |
| Insect | 37 | 19% | | |
| Other* | 34 | 18% | | |

*Other: Squirrel, mole, rabbit, porcupine.

*Open-ended & animal specific: N = 194.

A second question about animal disturbance of agricultural land was asked, "To what extent does this animal disturb your agriculture activities?", this time animal specific for the three ungulates: Eld's deer, Muntjac and Wild boar. Of farmland owners, 17% claimed that Eld's deer was involved in crop raiding and 40% claimed Muntjac. The degree of disturbance for these to animals was almost exclusively described as moderate. Comparatively, 49% of the local farmland owners considered wild boar to be a problem for their agricultural activities (Table 1), whereas about half of these described the degree of disturbance as serious. 60% of farmland owners reported crop raiding from at least one of the three animals.

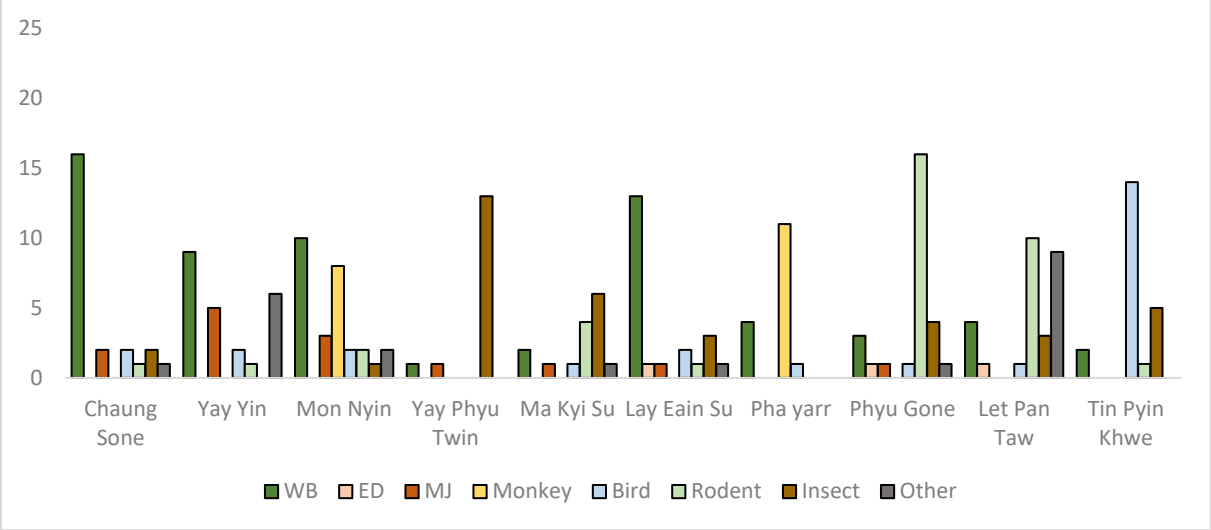



*Figure 2: Reported crop raiding animals in each village, open-ended questioning method. N = 194, each respondent was allowed to answer several animals.*

Categorical relationships

The extent to which farmland owners reported crop raiding for each of the study animals with the open-ended questioning method, varied with several socio-economic and geographic factors. Crop raiding by Wild boar varied with the area where villages were situated ($\chi^2$ = 34.656, df = 3, $p < 0.001$) and with reported observations of the same animal ($\chi^2$ = 6.776, df = 1, p = 0.009).

Analysis

Perceived WB crop raiding, open-ended questioning method, was significant with the predictor parameters; observation of animal (β = 0.87, SE: 0.38, p = 0.02), villages situated on the eastern side of SWS (β = - 2.03, SE: 0.77, p = 0.009), and villages situated on the southern side of SWS (β = - 1.61, SE: 0.61, p = 0.009). Observation of the animal increased the likelihood of reporting crop raiding by 2.39 times the odds of no observation, residency in eastern villages decreased the odds of reporting crop raiding by 87% compared to the reference parameter, and residency in southern villages decreased the odds of reporting crop raiding by 80% compared to the reference parameter (Figure 3). The model explained 31 % of the variation in perceived WB crop raiding (Table 16, Appendix) and all predictors had variance inflation factor (GVIF) < 2 (Table 17, Appendix).


*Figure 3: GLMM, WB crop raiding. The x-axis and highlighted numbers depict the odds-ratio (OR) with predictors sorted by increasing score on the y-axis. Positive relationships in blue, and negative relationships in red. Asterisk ***, **, *; depict sign.*

## Human disturbance, bushmeat consumption

Descriptive:

All respondents were asked about their bushmeat consumption habits, measured with the general question “Do you eat meat from wild animals”, and answered with either a “yes” or a “no”. Furthermore, the respondents who answered “yes” were asked the same question again, this time animal specific, and a third open-ended question where the respondents were asked to name all kinds of bushmeat they had been eating. In both the animal specific and the open-ended, 21% and 56% of respondents claimed to have been eating Eld’s deer and Muntjac meat, respectively. 61% claimed to have been eating Wild boar meat (Table 2). 74% of the 249 respondents claimed to have been eating any form of bushmeat, of which the frequency was mostly once a year or rarer. There were differences in bushmeat consumption habits between villages (Figure 4).

*Table 2: Open-ended and animal specific bushmeat consumption*

| | Open-ended | | Animal specific | |
|---|---|---|---|---|
| Animals | Frequency | Percentage | Frequency | Percentage |
| ED | 52 | 21% | 51 | 21% |
| MJ | 140 | 56% | 139 | 56% |
| WB | 152 | 61% | 152 | 61% |
| Gaur | 4 | 2% | | |
| Sambar | 5 | 2% | | |
| Other* | 25 | 14% | | |

*Other: Rabbit, wild bird, lizards, wild cat. N = 249

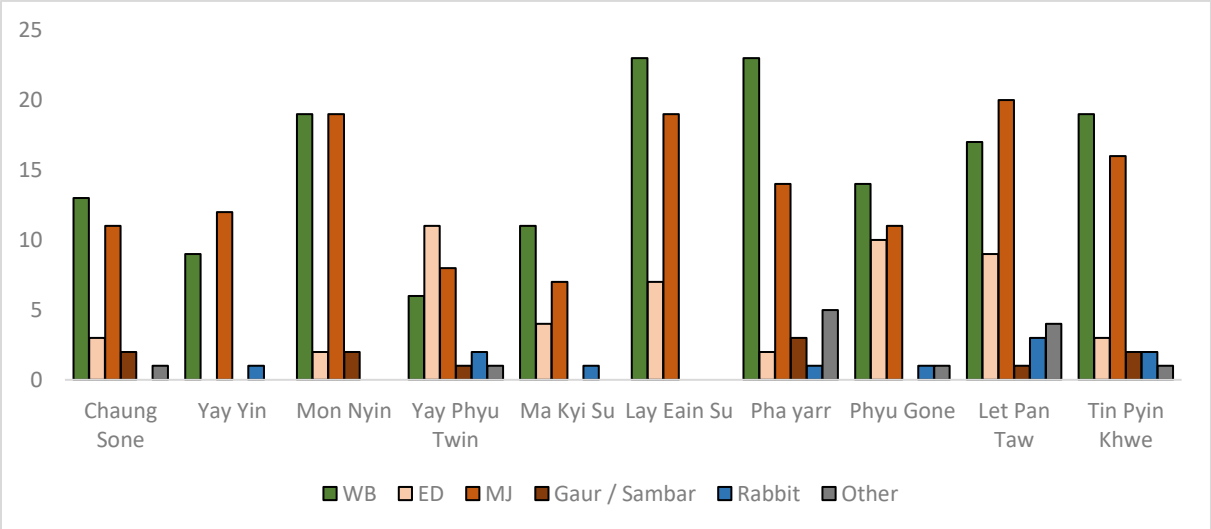



*Figure 4: Reported Bushmeat consumption in each village, open-ended questioning method. N = 249, each respondent was allowed to answer several animals. Other: Bird, lizard, monkey wild cat.*

The reported bushmeat consumption of all three study animals varied with several socio-economic factors. Consumption of meat from all three study animals varied significantly with the area where villages were situated (ED: $\chi^2 = 18.670$, df = 3, $p < 0.001$; MJ: $\chi^2 = 28.812$, df = 3, p = 0.014; WB: $\chi^2 = 39.321$, df = 3, $p < 0.001$), and with gender (ED: $\chi^2 = 6.665$, df = 1, p = 0.010; MJ: $\chi^2 = 4.659$, df = 1, p = 0.031; WB: $\chi^2 = 13.511$, df = 1, $p < 0.001$). Consumption of Eld's deer and Muntjac also varied significantly with age (ED: $\chi^2 = 9.613$, df = 2, p = 0.008; MJ: $\chi^2 = 10.335$ df = 2, p = 0.006), while Wild boar consumption varied significantly with education (WB: $\chi^2 = 6.278$, df = 2, p = 0.043). Muntjac and Wild boar varied significantly with farmland ownership (MJ: $\chi^2 = 8.909$, df = 1, p = 0.003; WB: $\chi^2 = 10.973$, df = 1, p = 0.001), and consumption of all three study animals varied significantly with observation of the same animal (ED: $\chi^2 = 42.323$, df = 1, $p < 0.001$; MJ: $\chi^2 = 10.212$, df = 1, p = 0.001; WB: $\chi^2 = 18.349$, df = 1, $p < 0.001$).

Analysis

ED meat consumption was statistically significant with the predictor variables; observation of ED ($\beta = 2.83$, SD: 0.64, $p < 0.001$), age group elder ($\beta = 1.81$, SD: 0.65, p = 0.005), eastern village location ($\beta = 1.67$, SD: 0.60, p = 0.005) and western village location ($\beta = 1.30$, SD: 0.0.66, p = 0.049).

Observation of the animal increased the likelihood of consuming ED by 16.97 times the odds of no observation and belonging to the elder age group (60+) increased the likelihood of consuming ED by 6.10 times the odds of the reference age group (18-35). Residency in eastern villages increased the likelihood by 5.31 times the odds of the reference village location (north) and residency in western villages increased the likelihood by 3.65 the odds of the reference (Figure 5a). The model explained 51% of the variation in ED meat consumption (Table 16, Appendix) and all predictors had variance inflation factor (GVIF) < 2 (Table 18, Appendix).

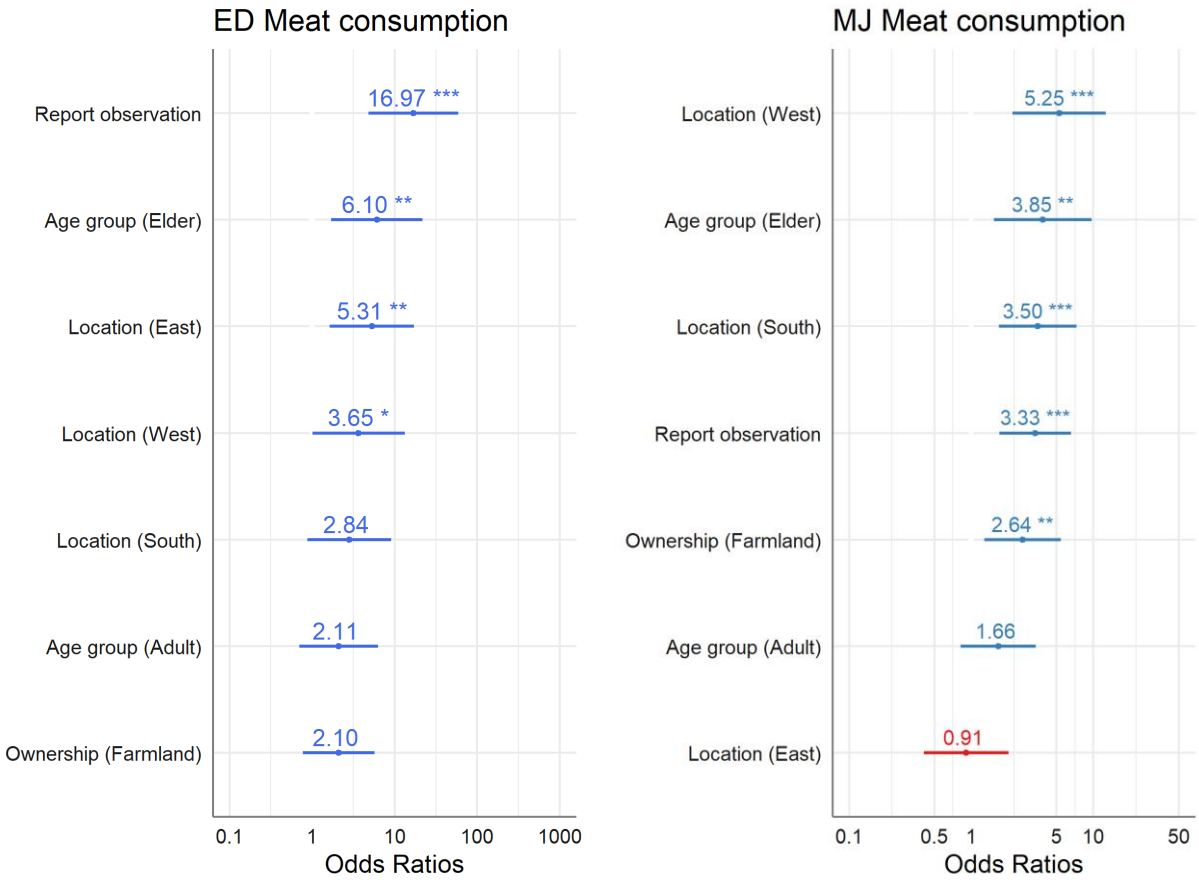



*Figure 5, a & b: GLMM, ED (a) & MJ (b) meat consumption. The x-axis and highlighted numbers depict the odds-ratio (OR) with predictors sorted by increasing score on the y-axis. Positive relationships in blue, and negative relationships in red. Asterisk ***, **, *; depict significance codes of 0.001, 0.01, 0.05, respectively*

MJ meat consumption was statistically significant with the predictor variables; western village location ($\beta = 1.66$, SD: 0.45, $p < 0.001$), age group elder ($\beta = 1.35$, SD: 0.47, $p = 0.004$), southern village location ($\beta = 1.25$, SD: 0.37, $p < 0.001$), observation of MJ ($\beta = 1.20$, SD: 0.34, $p < 0.001$) and farmland ownership ($\beta = 0.97$, SD: 0.37, $p = 0.008$).

Residency in western villages increased the likelihood of consumption by 5.25 times the odds of the reference village (north), and residency in southern villages increased the likelihood by 3.50 the odds of the reference. Belonging to the elder age group (60+) increased the likelihood of consuming MJ by 3.85 times the odds of the reference age group (18-35). Observation of the animal increased the likelihood of MJ consumption by 3.33 times the odds of no observation and farmland ownership increased the likelihood by 2.64 times the odds of those without farmland (Figure 5b). The model explained 30% of the variation in MJ meat consumption (Table 16, Appendix).) and all predictors had variance inflation factor (GVIF) < 2 (Table 19, Appendix).

WB meat consumption was statistically significant with the predictor parameters; western village location ($\beta = 2.48$, SD: 0.64, $p < 0.001$), southern village location ($\beta = 1.56$, SD: 0.51, $p = 0.002$), farmland ownership ($\beta = 1.46$, SD: 0.0.43, $p < 0.001$), observation of WB ($\beta = 0.96$, SD: 0.36, $p = 0.007$), livestock ownership ($\beta = -0.79$, SD: 0.35, $p = 0.021$) and gender female ($\beta = -0.84$, SD: 0.34, $p = 0.015$).

Western village location increased the likelihood of consuming WB meat by 11.95 times the odds of the reference parameter (northern village location), while the southern location increased the likelihood by 4.67 times the odds of the reference. Farmland ownership increased the likelihood by 4.30 times the odds of those without farmland, and observation of the animal increased the likelihood of consuming WB by 2.62 times the odds of no observation. Livestock ownership and gender were negative relationships, decreasing the likelihood of consuming WB by 55% and 57% respectively, compared with the reference parameters of no livestock ownership and male (Figure 6). The model explained 41% of the variation in WB meat consumption (Table 16, Appendix) and all predictors had variance inflation factor (GVIF) < 2 (Table 20, Appendix).

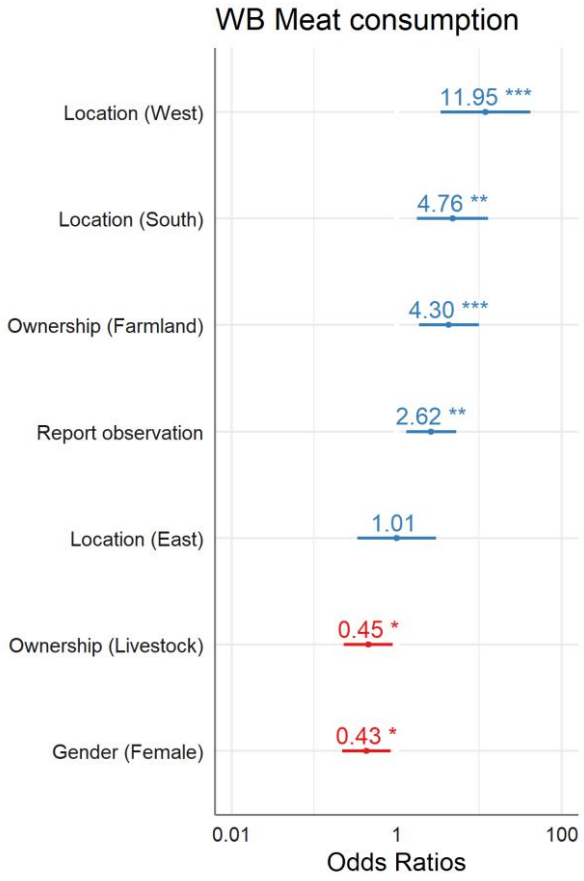



*Figure 6: GLMM, WB meat consumption. The x-axis and highlighted numbers depict the odds-ratio (OR) with predictors sorted by increasing score on the y-axis. Positive relationships in blue, and negative relationships in red. Asterisk ***, **, *; depict significance codes of 0.001, 0.01, 0.05, respectively.*

## Perception

Descriptive:

All the respondents (N = 249) were asked about their perception of Eld's deer, Muntjac and Wild boar, measured with the question: "What do you think of a large population of this animal, living inside SWS". Response options were on a Likert scale from very good to very bad, which were later recoded into positive, neutral, negative. Perceptions of Eld's deer and Muntjac were similar, only 6.9% and 10.4% had negative perceptions of the two animals, respectively. Comparatively, Wild boar stood out as 43% of the respondents thought a large population of this animal in SWS would be negative (Table 3). Respondents were also asked how they perceived their relationship with the PA-staff, as well as how they perceived the staff's capability and trustworthiness. Most respondents were either neutral or positive, with few incidences of negative perceptions towards the PA-staff (Table 4).

*Table 3: Human perceptions of animals*

| Study animal | Positive | Neutral | Negative |
|---|---|---|---|
| ED | 65% | 28% | 7% |
| MJ | 61% | 29% | 10% |
| WB | 29% | 28% | 43% |

*Table 4: Human perceptions of PA-staff*

| Parameter | Positive | Neutral | Negative |
|---|---|---|---|
| Capability | 40% | 55% | 5% |
| Trust | 47% | 48% | 4% |
| Relationship | 37% | 61% | 2% |

Human perception towards Muntjac and Wild boar varied significantly with farmland ownership (MJ: $\chi^2 = 8.599$, df = 2, p = 0.014; WB: $\chi^2 = 17.932$, df = 2, p < 0.001), and human perception of Muntjac varied significantly with the proximity of village location to the borders of the PA ($\chi^2 = 7.025$, df = 2, p = 0.030). The human perceptions of all three study animals varied with gender (ED: $\chi^2 = 7.098$, df = 2, p < 0.029; MJ: $\chi^2 = 6.238$, df = 2, p < 0.044; WB: $\chi^2 = 15.577$, df = 2, p < 0.001), and the human perceptions of Eld's deer and Wild boar also varied with observation of the same animal (ED: $\chi^2 = 7.483$, df = 2, p = 0.024; WB: $\chi^2 = 7.971$, df = 2, p = 0.019). Wild boar was the only animal in which human perceptions significantly varied with the experience of crop raiding ($\chi^2 = 9.474$, df = 2, p = 0.009).

Analysis

Human perception of ED was statistically significant with the predictor parameter; gender female (β = - 0.67, SD: 0.28, p = 0.016) and human perception of MJ was statistically significant with the predictor parameter; gender female (β = - 0.63, SD: 0.27, p = 0.021). Female decreased the odds of having either neutral or good perception of ED with 49% and MJ with 47%, compared with the gender male (Figure 7, a & b).

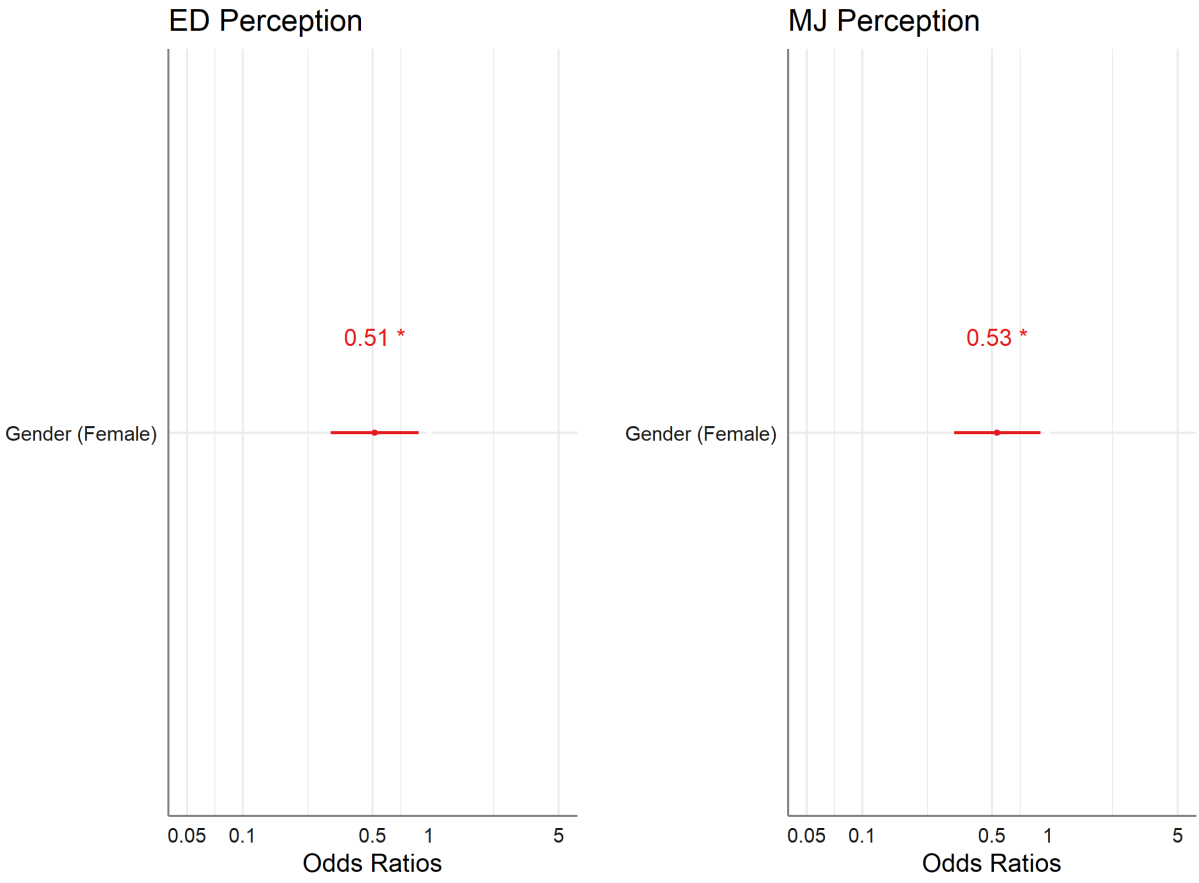



*Figure 7, a & b: CLMM, ED (a) & MJ (b) perception. The x-axis and highlighted numbers depict the odds-ratio (OR). Positive relationships in blue, and negative relationships in red. Asterisk ***, **, *; depict significance codes of 0.001, 0.01, 0.05, respectively*

Human perception of WB was statistically significant with the predictor parameters; secondary education level (β = 0.87, SD: 0.39, p = 0.025), reported observation of WB (β = 0.54, SD: 0.32, p = 0.049), gender female (β = - 0.78, SD: 0.27, p = 0.004) and experience of WB crop raiding (β = - 1.17, SD: 0.32, p < 0.001). Having an education level of secondary or higher increased the likelihood of being either neutral or positive towards WB by 2.39 times those of no formal education and reporting observation of WB increased the same likelihood by 1.71 times of those who had not observed the animal. The experience of WB crop raiding decreased the odds of having either neutral or positive perception of WB with 69% of those who did not experience crop raiding and being of gender female decreased the same odds by 54% (figure 8).

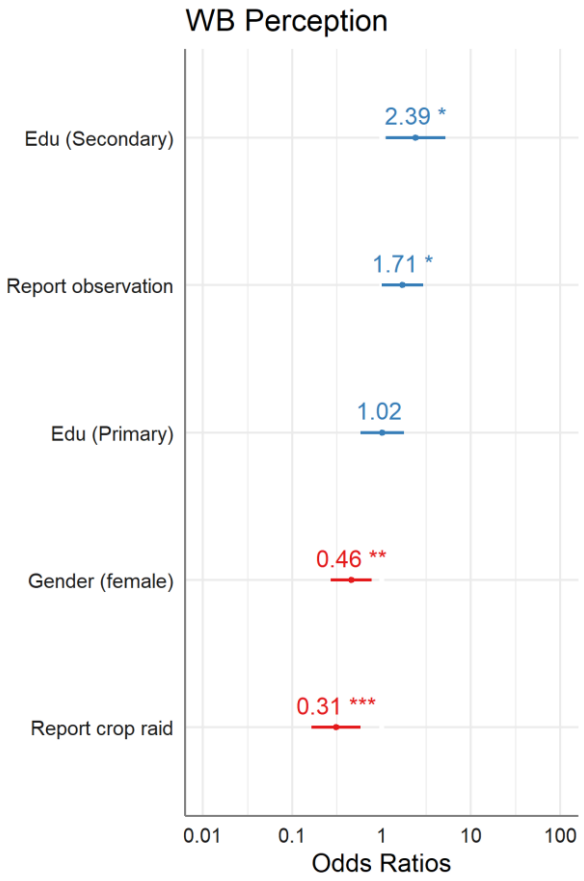



*Figure 8: CLMM, WB perception. The x-axis and highlighted numbers depict the odds-ratio (OR). Positive relationships in blue, and negative relationships in red. Asterisk ***, **, *; depict significance codes of 0.001, 0.01, 0.05, respectively.*

## Additional descriptive results

Observation of animals

All respondents were asked if they had seen any of the three study animals (N=249) and the reported observations of the animals varied with several socio-economic factors. Observation of all three animals differed significantly with gender (ED: $\chi^2 = 16.840$, df = 1, $p < 0.001$; MJ: $\chi^2 = 34.548$, df = 1, $p < 0.001$; WB: $\chi^2 = 34.692$, df = 1, $p < 0.001$). Observation of Eld's deer and Wild boar differed significantly with the area where villages were situated (ED: $\chi^2 = 32.475$, df = 3, $p < 0.001$; WB: $\chi^2 = 14.220$, df = 3, $p = 0.003$; Muntjac and Wild boar observation with age (MJ: $\chi^2 = 16.083$, df = 2, $p < 0.001$; WB: $\chi^2 = 9.421$, df = 2, $p = 0.009$), while Muntjac observation also differed significantly with farmland ownership ($\chi^2 = 4.562$, df = 1, $p = 0.033$).

*Table 5: Animal observations by geographic region*

| Animals | North | East | South | West |
|---|---|---|---|---|
| ED | 39% | 86% | 57% | 38% |
| MJ | 76% | 66% | 71% | 80% |
| WB | 64% | 34% | 65% | 58% |

Additionally, respondents had good knowledge of the tree ungulate species in SWS. When shown pictures of each animal 99%, 80% and 89%, of the respondents correctly named ED, MJ and WB, respectively. None of the respondents reported any livestock depredation or livestock disturbance originating from either of these species, nor from any other animals in SWS. A few mentions were made of damage caused by snake.

# Discussion

## Crop raiding

Focusing on the results of the open-ended question (Appendix 11), the perpetrators of crop raiding were a diverse set of animals ranging from mammals to insects and birds. The problem of agricultural disturbance was undoubtably present as 93% of the farmland owners reported crop raiding from at least one animal, 30% of which were considered to have negative consequences. Wild boar was the most reported problem animal, as it was reported to be a crop raider by a third (33%) of the farmland owners, while Eld's deer and Muntjac were barely mentioned (2% and 7% respectively).

At an earlier stage of the questionnaire, respondents were asked about animal specific crop raiding (Appendix 11), and 60% of farmland owners reported crop raiding from at least one of the three ungulate species. This method of questioning also describes agricultural disturbance as being present in SWS, although to a lesser degree totally and solely attributed to the three ungulate species. Wild boar was the most reported problem animal, reported by about half of the respondents (49%), Muntjac a close second (40%) and Eld's deer comparatively quite low (17%).

Interestingly, the different line of questioning resulted in completely different frequencies of crop raiding, as farmland owners accused the three study animals far more when asked about them individually, than when they were given more freedom in their response later in the questionnaire.

Of the ungulates, Wild boar was the animal with the smallest difference between the two methods of questioning, with an increase from open-ended too animal specific of 43%. While respondent reporting of Eld's deer crop raiding increased with almost 1000% for animal specific questioning. There is literature describing locals overestimating animal induced damage to crops (Gillingham & Lee 2003) which could be a plausible explanation for the discrepancy in crop raiding between the two methods. However, a second explanation lies in the design and framing of the questionnaire itself. The animal specific method of measuring crop raiding, "To what extent does this animal disturb your agriculture activities?", could be

considered a leading question. Leading questions can create false opinions (Williams 2003) and direct respondents toward a certain answer (Choi & Pak 2005; Iarossi 2006).

In hindsight, the animal specific question seems of poor design, introducing a bias and possibly influencing respondents to report crop raiding. A biased question will produce low quality and unreliable information (Gideon 2012). The results from the animal specific questioning will therefore be disregarded and going forward the open-ended question of crop raiding will be considered the best measure. All statistical methods are based on results from the open-ended method of questioning.

There is ample support in literature of wild boar inflicting damage to crops (Sonam W et al. 2006; Linkie et al. 2007; Li et al. 2013; Thurfjell et al. 2013; Pandey et al. 2016; Ankur et al. 2017; Khan & Ilyas 2018; Liu et al. 2019). For wild boar to be the most reported crop raiding animal in SWS is not unexpected based on these studies. However, the animal was not reported as a crop raiding animal by locals in CWS. Conversely, Eld's deer was found to be the most common perpetrator in CWS. Reported by 33% of respondents, along with a few incidences caused by Muntjac (Thant et al. 2017). The results of my study in SWS thereby contradict those found by Thant (2017) in CWS with regards to both Wild boar and Eld's deer crop raiding. The results for Muntjac are however quite similar between the two areas.

The results of this study describe Wild boar as the most problematic species with regards to local agricultural activities, being the most reported crop raiding animal. This provides support for the prediction (P1), "Wild Boar is a species who to a larger extent than Eld's deer and Muntjac, disturb the local inhabitants". As well as some support for the hypothesis of a human wildlife conflict existing in SWS, with 93% of surveyed farmland owners in the region reporting an issue with at least on animal.

# Bushmeat consumption

Almost three-quarters of the respondents (74%) claimed to have been eating bushmeat, however, the frequency of bushmeat consumption was found to be mostly once a year or rarer. Most of the bushmeat came from ungulates along with a small number of lizards, birds and rabbits. Eld's deer meat was proclaimed to be eaten by 21% of the respondents, least of the three study animals. Muntjac second most with 56% and Wild boar at 61%. As with crop raiding, respondents were asked about bushmeat consumption in two ways, both open-ended and animal specific. For this measure however, the reported ungulate meat consumption coincided between the two methods of questioning.

Interestingly, four respondents claimed to have been eating Gaur, and five of them mentioned Sambar. These two species of large ungulates are extant in several countries in South-East Asia including Myanmar (Timmins et al. 2015; Duckworth et al. 2016) but they are believed to have gone extinct in SWS (NINA 2014). Whether the source of this meat originated from SWS or another area is unclear, as no further questions were asked. It is also a possibility that the respondents have wrongly named the animals, and that the meat instead originated from other smaller ungulates, for instance Eld's deer or Muntjac.

The bushmeat consumption in SWS is consistent with the described level of human disturbance in the area, with illegal hunting and extensive use of snares (Diana et al. 2019; NEA 2019)). The impoverished conditions in Myanmar - with the people's dependency on direct use of nature for their livelihoods, along with the described tendency of poverty to increase illegal activities and poaching (Bel 2011) - provides support for the findings of this study. The rare frequency of bushmeat consumption might suggest an opportunistic approach to hunting. In the questionnaire notes, many of the respondents claimed that meat had to be bought from hunters in other villages, however some also claimed that they were able to get hold of bushmeat with skilful dogs or if they were to come across the animals by accident.

A Sumatran study found that farmers and commercial hunters used snares to capture deer species for subsistence needs and personal consumption, while Wild boar were caught as pest-control and to be sold to predetermined retailers (Luskin et al. 2014). Wild boar is shown in this study of SWS to be a conflict species, with regards to disturbance of agricultural activities, and it seems likely that pest mitigation is part of the motivation behind hunting of this animal. Which ultimately also might increase Wild boar bushmeat consumption.

The hunting methods and appeal of Muntjac meat in many Asian communities (Timmins 2016), correspond to the described use of snares in the area and the extent of consumption of Muntjac meat. The Eld's deer consumption is lower than for the other two ungulate species in SWS, and also lower than in CWS, where 42% of respondents were found to be eating Eld's deer meat (Thant et al. 2017). The lessened conflict surrounding the animal with low reporting of Eld's deer crop raiding in SWS, compared to CWS, might be one of the reasons for the somewhat lower meat consumption. It might also be due to a higher support for conservation among the local communities, better awareness of the animals threatened status, or a matter of law enforcement or protection within the PA.

The results of this study describe Wild boar as the most common bushmeats in SWS, although, consumption of Muntjac meat is only a couple percentage less. This provides support for the prediction (P2), "Consumption of Wild boar meat is more common amongst locals than consumption of Eld's deer and Muntjac". These results do provide some support for the hypothesis of a human wildlife conflict existing in SWS, with 74% of the respondents reporting bushmeat consumption of any kind.

## Perception

Around a third of respondents had positive perceptions of Eld's deer (65%) and Muntjac (61%). The remaining respondents were mostly neutral, while only a few had negative perceptions of the two animals (7% and 10% respectively). Respondent perceptions of Wild boar, however, were quite different. With most respondents having negative perceptions of the animal (43%) and the remaining percentages about equally distributed between neutral (28%) and positive (29%). As a sidenote, there were few incidences of negative perceptions towards the PA-staff, with most respondents being either neutral or positive.

The predominantly positive respondent perceptions of Eld's deer and Muntjac is another indication that these two species exert little disturbance on human activities in SWS. As incidences such as crop raiding has been shown to decrease tolerance of wildlife (Songorwa 1999; Gadd 2005; Linkie et al. 2007; Zaffar Rais et al. 2015; Hariohay et al. 2018). This literature also supports the respondents' negative perceptions of Wild boar, as the animal has been found in this study to be the most common crop raider in SWS.

Interestingly, Eld's deer was found to be a problem animal in CWS, nevertheless, people were generally positive towards conservation of the animal (Thant et al. 2017). Being a problem animal might therefore not necessarily be a cause for negative human perceptions. However, in this study in SWS, respondent perception of Wild boar differed significantly with the experience of crop raiding, decreasing the odds of having either neutral or positive perceptions of the animal with 69%.

This study has not properly explored the importance of bushmeat as a source of dietary protein for local people in and around SWS, but the frequency of bushmeat consumption was found to be rare. Indicating little importance for the local people's diet. Access to bushmeat has been shown to have a positive influence on human perceptions (Gillingham & Lee 1999), however this was not the case in SWS. The potentially small dietary importance of bushmeat consumption in the area, might explain the absence of this as a predictor of perception. With three quarters of respondents claiming to have eaten bushmeat it is however evident that bushmeat consumption is quite normal in the area.

The respondents mostly neutral and positive perceptions of the PA-staff, along with their positive perceptions of Eld's deer (one of the primary conservation targets of SWS) indicates that there is little conflict between the local communities and the conservation targets of the PA. An indication that is strengthened by the absence of livestock depredation by wildlife, briefly explored by this survey. Although some of the animals within SWS create dissatisfaction, the general attitude towards the area seems to be positive. It is well documented that people tend to have positive perceptions of conservation and wildlife when benefits received from the area outweigh the costs (Holmern 2003; Kideghesho et al. 2007) and needs for livelihoods are met (Gillingham & Lee 1999; Allendorf et al. 2007). The access and use of resources within SWS might therefore be a good thing with regards to human perceptions and in mitigating conflict. Promoting cooperation and support for the PAs existence, which in turn is crucial for PAs to deliver successful biodiversity outcomes (Stankey & Shindler 2006; Pandey et al. 2016; Hariohay et al. 2018). The access and resource use might however also pose great threat to the health and longevity of biodiversity within SWS.

The results of this study describe mostly positive, with some neutral, human perceptions of Eld's deer and Muntjac. Eld's deer was the animal that respondents had the most positive perceptions of, with Muntjac a close second. While the majority had negative perceptions of Wild boar. This provides support for the prediction (P3); "locals have more positive perceptions of Eld's deer than Wild boar and Muntjac". The results also provide support for the prediction (P3a); "the experience of crop raiding from a given animal negatively influence the perception of said animal", and prediction (P3b) "perception of different animals varies in relation to conflict level". There is also support for the hypothesis of crop raiding as a driver of conflict in SWS, which influences respondent's Wild boar perception.

# Predictors

## Geographic location (part 1)

Wild boar crop raiding and consumption of Eld's deer, Muntjac and Wild boar meat differed significantly between areas where villages were situated. However, the human perceptions of Eld's deer, Muntjac and Wild boar did not.

Respondents with residency on the southern areas of SWS were 80% less likely to have experienced crop raiding from Wild boar while those with residency on the eastern side were 87% less likely. The western areas of the PA were not significantly different from the northern side, and respondents in those two regions of SWS were experiencing the most crop raiding from Wild boar. The villages that reported most disturbance from this animal were Chaung Sone, Yay Yin, Mon Nyin and Lay Eain Su, all situated on the western and northern sides of SWS. Ma Kyi Su, the only village with a low number of reported crop raiding amongst the western and northern villages, were also the most eastern positioned.

Respondents with residency on the western areas of SWS were 3.65, 5,25 and 11.95 times more likely to have eaten Eld's deer, Muntjac and Wild boar meat, respectively, than respondents in the northern villages. Additionally, Eld's deer meat consumption was 5.31 times more likely to have happened amongst respondents in the eastern villages. While Muntjac and Wild boar meat consumption was 3.50 and 4.76 times, respectively, more likely to have happened amongst respondents in the southern villages. Also here compared with northern villages, where the least ungulate meat consumption took place. Along with southern villages for Eld's deer meat and eastern villages for Muntjac and Wild boar meat.

The villages that were most involved in Eld's dear meat consumption were Yay Phyu Twin, Phyu Gone, both situated on the eastern side of the PA, and Let Pan Taw, the most eastern of villages in the southern group. The last village of a considerable Eld's deer meat consumption, more than 20% of respondents, was Lay Eain Su on the western side of SWS. Muntjac and Wild boar meat consumption mostly followed the same pattern and occurred in all the villages. Most involved were respondents in Mon Nyin and Lay Eain Su, both on the western side of SWS, and Pha Yarr, Let Pan Taw, and Tin Pyin Khwe, all three on the southern side of SWS.

The regional differences in villages surrounding PA's are supported by similar findings elsewhere, as conflict incidences between animals and humans can vary between geographic regions (Nyhus 2016; Thant et al. 2017).

The preferred habitats of the study animals might be an explanation for the regional differences in crop raiding and bushmeat consumption. Eld's deer has been shown to have a strong preference towards the eastern side of SWS and the military cotton plantations, where it receives protection from human disturbance due to the restricted access (Diana et al. 2019). The establishment of the military area is believed to be the cause of the Eld's deer population increase in SWS (McShea 2018; Diana et al. 2019). This eastern habitat importance for the Eld's deer in SWS supports the findings of this study, with the respondents of eastern villages being most likely to have eaten Eld's deer meat, and 86% of respondents in that area of SWS reporting observations of the animal (Table 5). The increased likelihood of eating Eld's deer meat amongst respondents in the western villages, is however more difficult to explain.

There is no known literature on Muntjac or Wild boar habitat and preferred areas within SWS, other than the unpublished data from a NINA camera trap survey. Performed in the dry season, Muntjac footage were captured across the entire PA, except for in the eastern positioned military area where no cameras were installed (NINA 2014). Not providing any supportive evidence for the increased Muntjac meat consumption on the western and southern side of SWS. The camera trap footages of Wild boar however seem to follow a north to south line, bisecting SWS at the approximate middle of the PA. Whereas almost all Wild boar footages were captured on the western side (NINA 2014). This gives support for the lower experience of Wild boar crop raiding amongst the eastern villages, as well as the increased Wild boar meat consumption in western and southern villages. The decrease in crop raiding amongst the southern villages is however more difficult to explain.

Human activities and their livelihood might be another explanation for the regional differences. Where there are less agricultural land or cultivation of less palatable crops for certain animals, crop raiding and animal interference might be less of a problem, and communities that are dependent on resource extraction from the PA and bushmeat as a protein source, will likely inflict more disturbance on local wildlife. From my results, the western communities in SWS seems to be more active in bushmeat consumption, for all three ungulates.

The results of this study describe regional differences in the experience of crop raiding and bushmeat consumption between villages surrounding the PA. Providing support for the hypothesis of varying conflict level between geographic regions of SWS.

## Geographic location (part 2)

Neither crop raiding, consumption of bushmeat nor perception of any of the study animals, varied with village proximity to PA borders.

There is ample evidence in literature of human-wildlife conflicts intensifying at the borders between PA's and local communities (Linkie et al. 2007; Røskaft et al. 2013; Ankur et al. 2017; Hariohay et al. 2017). Which was also found to be the case for meat consumption and crop raiding in CWS (Thant et al. 2017), and specifically for Wild boar in other countries (Pandey et al. 2016; Liu et al. 2019). The lack of these findings in SWS, provides grounds for questioning the methodology of this survey.

When villages were chosen as survey targets prior to the data collection, the different areas surrounding SWS were considered and divided in groups, of which villages were randomly pulled. For proximity to PA, however, no such considerations were made. As a consequence of this, only three villages had a location that was distant from the PA (Table 6, Appendix). These three villages were positioned at the northern, western and eastern side of SWS, with no comparisons within the same group, and with no representation of the southern side. To be able to thoroughly investigate the effect of village proximity to PA borders, the methodology would have to be better designed for that purpose.

The results of this study indicate no effect of village proximity to PA borders. Thus, providing no support for prediction (P1b); “Locals living further away from the PA borders experience less crop raiding”, nor prediction (P2c); “Locals living further away from the PA borders are less involved in bushmeat consumption”. However, due to the weak methodology used in measuring proximity in this survey, there is not enough evidence to give a solid conclusion.

## Socio-economic effects on bushmeat consumption

Respondent consumption of Eld’s deer meat differed significantly with Age, while respondent consumption of Muntjac meat did so for age and farmland ownership. Respondent consumption of wild boar meat differed significantly with farmland ownership, livestock ownership and gender. Respondents in the elder age group (60+) were 6.10 and 3.85 times more likely to have eaten Eld’s deer and Muntjac meat, respectively, than those in the youngest age group (18-35). Additionally, respondents with farmland ownership were 2.64 times more likely to have eaten Muntjac meat, than those who did not own any farmland. Respondents with farmland ownership were also 4.30 times more likely to have eaten Wild boar meat. Livestock owners were 55% less likely to have eaten Wild boar meat than those without livestock, and respondents of gender female were 57% less likely to have eaten Wild boar meat than men.

The likelihood increasing effect of age group elder on consumption of Eld’s deer and Muntjac meat, might be due to generational differences. Economic development might have made bushmeat less important as a protein source and increased protection of animals in SWS, establishment of non-access military area within the borders of the PA, and potentially declines in animal populations over time - bushmeat consumption might have decreased over recent years. The elder age group belong to a completely different generation with their reporting of bushmeat consumption potentially being influenced by past trends.

The level of conflict between farmland owners and Wild boar in SWS provides support for the likelihood increasing effect of farmland ownership on respondent consumption of Wild boar meat. The perception of the animal is more negative amongst this group of respondents and so is potentially the frequency of hunting activities, motivated by protection of crops and retaliation for damages. Possibly increasing the availability of Wild boar meat amongst farmland owners. The likelihood increasing effect of farmland ownership on respondent consumption of Muntjac meat is however more difficult to explain. There was no statistically

significant effect of farmland ownership on Eld's deer meat consumption, potentially caused by the comparative rarity in consumption of meat from this animal.

The likelihood decreasing effect of gender female on consumption of Wild boar meat is extensively supported by literature, hunting activities being mostly performed by men (Loibooki et al. 2002). With hunting of Wild boar in SWS being potentially motivated by pest control and for sale to predetermined retailers, individuals not part of the hunt might be less prone to consumption of the meat.

The secured livelihood and potentially higher personal wealth, of livestock owners, might explain the likelihood decreasing effect of livestock ownership on respondent consumption of Wild boar meat. As their ownership of domesticated animals provide both a source of income and dietary protein, they might be less dependent on direct extraction of resources from the PA. In a survey performed in Serengeti National Park in Tanzania, most individuals arrested for poaching had few livestock and low income (Loibooki et al. 2002). The same was found in Rungwa-Kizigo-Muhesi Game Reserve, where conservation crimes were typically committed by young males with no livestock or land ownership (Hariohay et al. 2019). Wealthier individuals in rural areas have been shown to consume less bushmeat (Brashares et al. 2011) and people with means of generating income has been shown to be less involved in illegal hunting for bushmeat (Loibooki et al. 2002).

The literature provide support for the decreasing effect of livestock ownership on bushmeat consumption. It is however interesting that, in this study, this effect is only seen with regards to Wild boar and not for Eld's deer and Muntjac meat consumption. There are potential explanations for this disparity: Wild boar meat could be a less attractive source of protein for the wealthier respondents, conflict with the animal might be absent, and time spent doing animal husbandry might reduce the opportunity to engage in hunting activities of Wild boar. The animal is known to be nocturnal in areas of conflict with humans (Keuling & Leus 2019), potentially complicating hunting of the animal. There are also suggestions in literature that wealth is not the main driver of illegal hunting, but rather the opportunity and time available to devote to such activities (Knapp 2007).

The results of this study describe age, livestock ownership, farmland ownership and gender differences in the consumption of bushmeat. Providing support for the hypothesis of demographic differences in the experience of or involvement in conflict.

## Socio-economic effects on perception

Respondent perception of all three ungulates differed significantly with gender, while respondent perception of Wild boar also differed significantly with education. Respondents with higher level of education were 2.39 times more likely, than those of no formal education, to have either neutral or positive perceptions of Wild boar. Respondents of gender female were 49%, 47% and 54% less likely than men, to have neutral or positive perceptions of Eld's deer, Muntjac and Wild boar respectively.

People of higher educational levels have been shown in literature to have more positive perceptions towards conflict animals than less educated individuals (Røskaft et al. 2007; Tomićević et al. 2010), while also showing higher appreciation for received benefits (Mbise et al. 2021), supporting the findings of this study. The fact that education has a significant effect only for Wild boar, might be caused by the described crop raiding behaviour associated with the animal. While respondents' perceptions towards Eld's deer and Muntjac are less challenged by conflict, and there is less need for higher education in order to understand the benefits of the animals' existence.

There is ample support in literature of gender as an important variable in explaining perceptions and attitudes. Men having more positive perceptions of wildlife and conservation than females (Mehta & Heinen 2001; Tomićević et al. 2010; Zaffar Rais et al. 2015), supporting the findings of this study. The reasons for this might be attributed to stringent gender-roles, with restrictions of access and protection of resources affecting the traditional responsibilities of the two genders differently (Allendorf et al. 2006). The patriarchal social system in Myanmar, with women having a strong dependency on natural resources in their daily life (Aye 2018), might explain the findings of this study. It is argued that women are generally more negatively affected by poor communities and housing, than men, but also that they are more directly affected by the state of the environment (Aye 2018).

Considering that model selection based on Akaike weight excluded all other predictors, the importance of gender in explaining respondent perception is unquestionable. With Eld's deer and Muntjac being little involved in conflict, on occasion providing a source of protein in human diet and posing no threat in terms of livestock depredation or assault on people, - the negative relationship of gender female on respondent perceptions of these two animals is difficult to explain. With little conflict in the area and few identified reasons for respondents having negative perceptions of Eld's deer and Muntjac, this finding might indicate that there is a tendency for women in SWS to have more negative perceptions toward all facets of conservation and wildlife.

The negative relationship of gender female on perceptions of Wild boar is however more understandable. With the animal proven to be involved in crop raiding in the area, causing losses and concern to individual households. In the questionnaire notes, a few respondents mentioned being afraid of the animal and described Wild boar as a potentially dangerous animal. Higher levels of fear have been shown to be associated with negative attitudes, with gender important in explaining the variation (Røskaft et al. 2003).

The results of this study describe gender differences in the perception of animals. Providing support for the hypothesis of demographic differences in the perception of the animals.

# Conclusion

To conclude, the farmland owners in local communities surrounding SWS are experiencing a degree of crop raiding, with Wild boar being the most common perpetrator and the two other ungulates little involved. In some villages, the most common problem animals are monkeys, birds, insects and rodents. Bushmeat consumption is normal in the communities surrounding SWS, but quite rare in frequency. The most consumed bushmeat is Wild boar, with Muntjac as a close second and fewer incidences of Eld's deer meat consumption. The parameters of age, livestock ownership, farmland ownership and gender affect people's involvement in bushmeat consumption.

The problem of crop raiding and involvement in bushmeat consumption varies with geographic location of villages, with differences in conflict level between regions of SWS. Wild boar being a more severe problem animal in northern and western villages, while locals in western villages are generally more involved in bushmeat consumption than other regions of SWS, along with eastern areas for Eld's deer meat and southern areas for Muntjac and Wild boar meat. There are no differences between villages located far away and villages located close to the PA, in crop raiding nor involvement in bushmeat consumption.

Attitudes towards aspects of the PA are rarely negative, with mostly neutral and positive perceptions towards the PA-staff and mostly positive perceptions towards Eld's deer and Muntjac. Human perceptions of Wild boar however are mostly negative. As attitudes towards animals varied in relation to conflict, with experience of crop raiding from Wild boar negatively influencing perceptions of the animal. Human perception of all three ungulates varies with gender, as females have more negative perceptions.

There is partially an ongoing human-wildlife conflict between the local population in SWS and the interests of the PA, with the Eld's deer population potentially threatened by bushmeat consumption. Although the frequency of consumption is quite low, the threatened status of the animal and the approximated population size of 1500 individuals, might warrant some concern. The conflict between humans and Eld's deer can be classified as a one-way conflict, as there are little incidences of Eld's deer crop raiding. This also happens to be the case for Muntjac, while there is a two-sided human-wildlife conflict between the local communities and Wild boar.

# Appendix

## Village information

*Table 6, Appendix: Village information*

| Village | Nr. | Location | Distance | Households | Surveyed | Percentage |
|---|---|---|---|---|---|---|
| Chaung Sone | 1 | North | Adjacent | 160 | 25 | 16% |
| Yay Yin | 2 | North | Distant | 67 | 25 | 37% |
| Mon Nyin | 3 | West | Adjacent | 167 | 25 | 15% |
| Yay Phyu Twin | 4 | East | Adjacent | 280 | 25 | 9% |
| Ma Kyi Su | 5 | North | Adjacent | 150 | 24* | 16% |
| Lay Eain Su | 6 | West | Distant | * | 25 | - |
| Pha Yarr | 7 | South | Adjacent | >250 | 25 | < 10% |
| Phyu Gone | 8 | East | Distant | 170 | 25 | 15% |
| Let Pan Taw | 9 | South | Adjacent | 276 | 25 | 9% |
| Tin Pyin Khwe | 10 | South | Adjacent | 110 | 25 | 23% |
| Total | | | | >1630 | 249* | < 15% |

* Respondent nr 112 of village 5 has been removed from the dataset as the information given in the survey was related to another village and experiences 15 years back in time. Total number of households in village 6 is unknown.

## Predictors and reference parameters

*Table 7, Appendix: Predictors and reference parameters*

| Predictor | Abbreviation | Parameters | Reference (OR=1.00) |
|---|---|---|---|
| Cardinal direction | Crd | East, south, west | North |
| Proximity to PA | GPS | Distant | Adjacent |
| Gender | Gnd | Female | Male |
| Age | Age | Adult, elder | Young adult |
| Education | Job | Primary, above primary | No formal education |
| Occupation | Edc | Farmer | Non-farmer |
| Farmland ownership | FrO | Own farmland | No ownership |
| Livestock ownership | LvO | Own livestock | No ownership |
| Observation of animal | WbO/EdO/MjO | Observation | No observation |
| Crop raid | WbD/EdD/MjD | Yes | No |
| Bushmeat consumption | WbE/EdE/MjE | Yes | No |

# Correlation matrix

*Table 8, Appendix: Correlation matrix*

| | Crd | GPS | Age | Gnd | Job | Edc | FrO | LvO | WbO | EdO | MjO | WbD | WbE | EdE | MjE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Crd** | NA | 0.455 | 0.154 | 0.018 | 0.143 | 0.199 | 0.082 | 0.058 | 0.239 | 0.362 | 0.109 | 0.383 | 0.397 | 0.279 | 0.322 |
| **GPS** | 0.455 | NA | 0.145 | 0.027 | 0.119 | 0.163 | 0.139 | 0.100 | 0.022 | 0.004 | 0.083 | 0.158 | 0.004 | 0.036 | 0.038 |
| **Age** | 0.154 | 0.145 | NA | 0.157 | 0.130 | 0.280 | 0.156 | 0.128 | 0.195 | 0.140 | 0.254 | 0.197 | 0.014 | 0.196 | 0.204 |
| **Gnd** | 0.018 | 0.027 | 0.157 | NA | 0.018 | 0.137 | 0.053 | 0.034 | 0.373 | 0.261 | 0.372 | 0.079 | 0.233 | 0.164 | 0.137 |
| **Job** | 0.143 | 0.119 | 0.130 | 0.018 | NA | 0.177 | 0.501 | 0.321 | 0.086 | 0.110 | 0.081 | 0.528 | 0.076 | 0.120 | 0.060 |
| **Edc** | 0.199 | 0.163 | 0.280 | 0.137 | 0.177 | NA | 0.132 | 0.103 | 0.058 | 0.123 | 0.074 | 0.136 | 0.102 | 0.159 | 0.040 |
| **FrO** | 0.082 | 0.139 | 0.156 | 0.053 | 0.501 | 0.132 | NA | 0.275 | 0.066 | 0.107 | 0.135 | 1.000 | 0.210 | 0.102 | 0.189 |
| **LvO** | 0.058 | 0.100 | 0.128 | 0.034 | 0.321 | 0.103 | 0.275 | NA | 0.064 | 0.074 | 0.016 | 0.279 | 0.097 | 0.004 | 0.011 |
| **WbO** | 0.239 | 0.022 | 0.195 | 0.373 | 0.086 | 0.058 | 0.066 | 0.064 | NA | 0.210 | 0.425 | 0.177 | 0.271 | 0.139 | 0.241 |
| **EdO** | 0.362 | 0.004 | 0.140 | 0.261 | 0.110 | 0.123 | 0.107 | 0.074 | 0.210 | NA | 0.227 | 0.115 | 0.157 | 0.413 | 0.203 |
| **MjO** | 0.109 | 0.083 | 0.254 | 0.372 | 0.081 | 0.074 | 0.135 | 0.016 | 0.425 | 0.227 | NA | 0.152 | 0.202 | 0.173 | 0.281 |
| **WbD** | 0.383 | 0.158 | 0.197 | 0.079 | 0.528 | 0.136 | 1.000 | 0.279 | 0.177 | 0.115 | 0.152 | NA | 0.215 | 0.119 | 0.198 |
| **WbE** | 0.397 | 0.004 | 0.014 | 0.233 | 0.076 | 0.102 | 0.210 | 0.097 | 0.271 | 0.157 | 0.202 | 0.215 | NA | 0.181 | 0.517 |
| **EdE** | 0.274 | 0.036 | 0.196 | 0.164 | 0.120 | 0.159 | 0.102 | 0.004 | 0.139 | 0.413 | 0.173 | 0.119 | 0.181 | NA | 0.351 |
| **MjE** | 0.322 | 0.038 | 0.204 | 0.137 | 0.060 | 0.040 | 0.189 | 0.011 | 0.241 | 0.203 | 0.281 | 0.198 | 0.517 | 0.351 | NA |

*Cramer's V > 0.3: Yellow

*Cramer's V > 0.5: Red

## Model selection, AIC tables

*Table 9, Appendix: AIC, crop raid WB*

| Nr. | Model, WB crop raid (open-ended) | Df. | logLik | AICc | ΔAIC | Weight |
|---|---|---|---|---|---|---|
| 34 | Int, Crd, WbO | 6 | - 100.865 | 214.2 | 0.00 | 0.525 |

*Table 10, Appendix: AIC, bushmeat consumption ED*

| Nr. | Model, bushmeat consumption ED | Df. | logLik | AICc | ΔAIC | Weight |
|---|---|---|---|---|---|---|
| 140 | Int, Crd, WbO, FrO, Age | 9 | - 89.997 | 198.8 | 0.00 | 0.134 |
| 132 | Int, Crd, WbO, Age | 8 | - 91.137 | 198.9 | 0.12 | 0.126 |
| 139 | Int, WbO, FrO, Age | 6 | - 93.758 | 199.9 | 1.11 | 0.077 |
| 136 | Int, Crd, WbO, Edc, Age | 10 | - 89.633 | 200.2 | 1.44 | 0.065 |
| 131 | Int, WbO, Age | 5 | - 95.023 | 200.3 | 1.54 | 0.062 |
| 135 | Int, WbO, Edc, Age | 7 | - 92.963 | 200.4 | 1.64 | 0.059 |
| 148 | Int, Crd, WbO, Gnd, Age | 9 | - 90.845 | 200.4 | 1.70 | 0.057 |
| 196 | Int, Crd, WbO, LvO, Age | 9 | - 90.881 | 200.5 | 1.77 | 0.055 |
| 156 | Int, Crd, WbO, FrO, Gnd, Age | 10 | - 89.822 | 200.6 | 1.82 | 0.054 |
| 172 | Int, Crd, WbO, FrO, Gps, Age | 10 | - 89.22 | 200.6 | 1.82 | 0.054 |

*Table 11, Appendix: AIC, bushmeat consumption MJ*

| Nr. | Model, bushmeat consumption MJ | Df. | logLik | AICc | ΔAIC | Weight |
|---|---|---|---|---|---|---|
| 198 | Int, Crd, FrO, MjO, Age | 9 | - 139.973 | 298.7 | 0.00 | 0.442 |
| 230 | Int, Crd, FrO, LvO, MjO, Age | 10 | - 139.685 | 300.3 | 1.60 | 0.199 |
| 214 | Int, Crd, FrO, Gps, MjO, Age | 10 | - 139.760 | 300.4 | 1.75 | 0.184 |
| 206 | Int, Crd, FrO, Gnd, MjO, Age | 10 | - 139.813 | 300.6 | 1.85 | 0.175 |

*Table 12, Appendix: AIC, bushmeat consumption WB*

| Nr. | Model, bushmeat consumption WB | Df. | logLik | AICc | ΔAIC | Weight |
|---|---|---|---|---|---|---|
| 174 | Int, Crd, FrO, Gnd, LvO, WbO | 9 | - 125.401 | 269.6 | 0.00 | 0.625 |

*Table 13, Appendix: Perception ED*

| Nr. | Model, ED perception | Df. | logLik | AICc | ΔAIC | Weight |
|---|---|---|---|---|---|---|
| 17 | Int, Gnd | 4 | - 196.169 | 400.5 | 0.00 | 0.358 |
| 273 | Int, Gnd, Job | 5 | - 195.937 | 402.1 | 1.62 | 0.137 |
| 19 | Int, EdE, Gnd | 5 | - 196.040 | 402.3 | 1.83 | 0.144 |
| 81 | Int, Gnd, Lvo | 5 | - 196.084 | 402.4 | 1.91 | 0.137 |
| 21 | Int, EdO, Gnd | 5 | - 196.107 | 402.5 | 1.96 | 0.134 |
| 49 | Int, Gnd, Gps | 5 | - 196.111 | 402.5 | 1.97 | 0.134 |

*Table 14, Appendix: Perception MJ*

| Nr. | Model, MJ perception | Df. | logLik | AICc | ΔAIC | Weight |
|---|---|---|---|---|---|---|
| 5 | Int, Gnd, | 4 | - 210.753 | 429.7 | 0.00 | 0.310 |
| 21 | Int, Gnd, Lvo | 5 | - 210.518 | 431.3 | 1.61 | 0.138 |

*Table 15, Appendix: Perception WB*

| Nr. | Model, WB perception | Df. | logLik | AICc | ΔAIC | Weight |
|---|---|---|---|---|---|---|
| 327 | Int, Edc, Gnd, WbD, WbO | 9 | - 241.129 | 501.0 | 0.00 | 0.298 |
| 455 | Int, Edc, Gnd, WbD, WbE, WbO | 10 | - 240.757 | 502.4 | 1.43 | 0.146 |
| 71 | Int, Edc, Gnd, WbD, | 8 | - 243.023 | 502.7 | 1.63 | 0.132 |
| 325 | Int, Gnd, WbD, WbO | 7 | - 244.179 | 502.8 | 1.81 | 0.121 |
| 335 | Int, Edc, Gnd, Gps, WbD, WbO | 10 | - 241.028 | 503.0 | 1.97 | 0.111 |

## Model selection, Rsquared & Gvif

*Table 16, Appendix: Rsquared models*

| Model | | R2m | R2c |
|---|---|---|---|
| WB Crop raid | Theoretical | 0.267 | 0.318 |
| | Delta | 0.212 | 0.253 |
| ED Bushmeat consumption | Theoretical | 0.519 | 0.519 |
| | Delta | 0.363 | 0.363 |
| MJ Bushmeat consumption | Theoretical | 0.297 | 0.297 |
| | Delta | 0.256 | 0.256 |
| WB Bushmeat consumption | Theoretical | 0.392 | 0.418 |
| | Delta | 0.338 | 0.360 |

*Table 17, Appendix: GVIF, crop raid WB*

| WB crop raid | GVIF | Df | GVIF^(1/(2*Df)) |
|---|---|---|---|
| Crd | 1.018 | 3 | 1.003 |
| WbO | 1.018 | 1 | 1.009 |

*Table 18, Appendix: GVIF, Bushmeat consumption ED*

| ED bushmeat consumption | GVIF | Df | GVIF^(1/(2*Df)) |
|---|---|---|---|
| Crd | 1.133 | 3 | 1.021 |
| Age | 1.116 | 2 | 1.028 |
| FrO | 1.041 | 1 | 1.020 |
| EdO | 1.056 | 1 | 1.028 |

*Table 19, Appendix: GVIF, Bushmeat consumption MJ*

| ED bushmeat consumption | GVIF | Df | GVIF^(1/(2*Df)) |
|---|---|---|---|
| Age | 1.133 | 2 | 1.032 |
| Crd | 1.070 | 3 | 1.011 |
| FrO | 1.058 | 1 | 1.029 |
| MjO | 1.080 | 1 | 1.039 |

*Table 20, Appendix: GVIF, Bushmeat consumption WB*

| WB bushmeat consumption | GVIF | Df | GVIF^(1/(2*Df)) |
|---|---|---|---|
| Crd | 1.102 | 3 | 1.016 |
| WbO | 1.199 | 1 | 1.095 |
| FrO | 1.152 | 1 | 1.073 |
| FlO | 1.126 | 1 | 1.061 |
| Gnd | 1.160 | 1 | 1.077 |

# References


Allen MP. 1997. Understanding Regression Analysis. Springer US : Imprint: Springer, New York, NY.

Allendorf T, Swe KK, Oo T, Htut Y, Aung M, Allendorf K, Hayek LA, Leimgruber P, Wemmer C. 2006. Community attitudes toward three protected areas in Upper Myanmar (Burma). Environmental Conservation **33**:344-352.

Allendorf TD, Smith JLD, Anderson DH. 2007. Residents' perceptions of Royal Bardia National Park, Nepal. Landscape and urban planning **82**:33-40.

Allendorf TD, Yang J. 2013. The role of ecosystem services in park–people relationships: The case of Gaoligongshan Nature Reserve in southwest China. Biological Conservation **167**:187-193.

Amano T, Székely T, Sandel B, Nagy S, Mundkur T, Langendoen T, Blanco D, Soykan CU, Sutherland WJ. 2017. Successful conservation of global waterbird populations depends on effective governance. Nature **553**:199-202.

Ankur K, Harendra Singh B, Ashish D, Advait E. 2017. Patterns of crop rading by wild ungulates and elephants in Ramnagar Forest Division, Uttarakhand. Human-wildlife interactions **11**.

Aye TT. 2018. The Role of Rural Women in Environmental Management in Myanmar: A Case Study of Ngaputaw Township. Open Science Journal (OSJ) **Vol 3**.

Baynham-Herd Z, Redpath S, Bunnefeld N, Molony T, Keane A. 2018. Conservation conflicts: Behavioural threats, frames, and intervention recommendations. Biological conservation **222**:180-188.

Bel SL. 2011. Human Wildlife Conflicts in Southern Africa : Riding The Whirl Wind in Mozambique and in Zimbabwe. IntechOpen.

Brashares JS, Golden CD, Weinbaum KZ, Barrett CB, Okello GV. 2011. Economic and geographic drivers of wildlife consumption in rural Africa. Proc Natl Acad Sci U S A **108**:13931-13936.

CBD Secretariat. 2012. TARGET 11 - Technical Rationale extended, Available from https://www.cbd.int/sp/targets/rationale/target-11/#footnote37 (accessed 29th of February 2020).

CBD Secretariat. 2015. National Biodiversity Strategy and Action Plan, Myanmar.

Choi BCK, Pak AWP. 2005. A catalog of biases in questionnaires. Prev Chronic Dis **2**:A13-A13.

Diana EB, Erlend BN, Richard B, Robert BOh, Thin Thin Y, Tun O, Myint A, John DCL. 2019. Integrating data from different survey types for population monitoring of an endangered species: the case of the Eld's deer. Scientific Reports **9**:1-14.

Duckworth JW, Sankar K, Williams, , A.C. SK, N. & Timmins RJ. 2016. Bos gaurus, The IUCN Red List of Threatened Species, Available from https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2891A46363646.en (accessed 14th of May 2021).

Fabozzi JFF, M. Sergio; Rachev, Teodosii; Arshanapalli, Bala. 2014. The Basics of Financial Econometrics: Tools, Concepts, and Asset Management Applications.399-403.

Gadd ME. 2005. Conservation outside of parks: attitudes of local people in Laikipia, Kenya. Environmental Conservation **32**:50-63.

Gideon L. 2012. Handbook of Survey Methodology for the Social Sciences. Springer New York : Imprint: Springer, New York, NY.

Gillingham S, Lee PC. 1999. The impact of wildlife-related benefits on the conservation attitudes of local people around the Selous Game Reserve, Tanzania. Environmental Conservation **26**:218-228.

Gillingham S, Lee PC. 2003. People and protected areas: a study of local perceptions of wildlife crop-damage conflict in an area bordering the Selous Game Reserve, Tanzania. Applied Business and Technology **37**:316-325.

Gray TNE, Brook SM, McShea WJ, Mahood S, Ranjitsingh MK, Miyunt A, Hussain SA, Timmins R. 2015. Rucervus eldii. The IUCN Red List of Threatened Species, Available from https://www.iucnredlist.org/species/4265/22166803.

Hariohay KM, Fyumagwa RD, Kideghesho JR, Røskaft E. 2017. Assessing crop and livestock losses along the Rungwa-Katavi Wildlife Corridor, South-Western Tanzania.

Hariohay KM, Fyumagwa RD, Kideghesho JR, Røskaft E. 2018. Awareness and attitudes of local people toward wildlife conservation in the Rungwa Game Reserve in Central Tanzania. Human dimensions of wildlife **23**:503-514.

Hariohay KM, Ranke PS, Fyumagwa RD, Kideghesho JR, Røskaft E. 2019. Drivers of conservation crimes in the Rungwa-Kizigo-Muhesi Game Reserves, Central Tanzania. Global ecology and conservation **17**:e00522.

Hariohay KM, Røskaft E. 2015. Wildlife Induced Damage to Crops and Livestock Loss and how they Affect Human Attitudes in the Kwakuchinja Wildlife Corridor in Northern Tanzania. Environment and natural resources research **5**:72-72.

Hasnat GNT, Kabir MA, Hossain MA. 2019. Major Environmental Issues and Problems of South Asia, Particularly Bangladesh. Pages 109-148. Cham: Springer International Publishing, Cham.

Hill R, Miller C, Newell B, Dunlop M, Gordon IJ. 2015. Why biodiversity declines as protected areas increase: the effect of the power of governance regimes on sustainable landscapes. Sustainability science **10**:357-369.

Holmern T 2003. Human-wildlife conflicts and hunting in the Western Serengeti, Tanzania. Norwegian Institute for Nature Research, Trondheim.

Holmern T, Muya J, Røskaft E. 2007a. Local law enforcement and illegal bushmeat hunting outside the Serengeti National Park, Tanzania. Environmental Conservation **34**:55-63.

Holmern T, Nyahongo J, Røskaft E. 2007b. Livestock loss caused by predators outside the Serengeti National Park, Tanzania. Biological conservation **135**:518-526.

Iarossi G 2006. Power of Survey Design: A User's Guide for Managing Surveys, Interpreting Results, and Influencing Respondents. Herndon: World Bank Publications, Herndon.

IPBES. 2019. Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.

IUCN. Region Asia, Myanmar, Available from https://www.iucn.org/regions/asia/countries/myanmar (accessed 01st of March.

IUCN CEM. 2017. South Asia, Available from https://www.iucn.org/commissions/commission-ecosystem-management/regions/south-asia.

IUCN SSC HWCTF. Human-Wildlife Conflict, Available from https://www.hwctf.org/about (accessed 20th of February 2020).

IUCN WCPA. 2011. Protected Areas in East Asia : evaluating and strengthening implementation of the CBD Programme of Work on Protected Areas and the East Asian Regional Action Plan.

Jones KR, Venter O, Fuller RA, Allan JR, Maxwell SL, Negret PJ, Watson JEM, Jones KR. 2018. One-third of global protected land is under intense human pressure. Science (New York, N.Y.) **360**:788-791.

Keuling O, Leus K. 2019. Sus scrofa. The IUCN Red List of Threatened Species Available from https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T41775A44141833.en (accessed 6th of May 2021).

Khan S, Ilyas O. 2018. Status distribution and feeding habit of Wild Boar Sus scrofa (Mammalia: Artiodactyla: Suidae) in Pench Tiger Reserve, Madhya Pradesh, India. Journal of threatened taxa **10**:12459-12463.

Kideghesho JR, Kideghesho JR, Røskaft E, Røskaft E, Kaltenborn BP, Kaltenborn BP. 2007. Factors influencing conservation attitudes of local people in Western Serengeti, Tanzania. Biodiversity and conservation **16**:2213-2230.

Knapp EJ. 2007. Who Poaches? Household Economies of Illegal Hunters in Western Serengeti, Tanzania. Human dimensions of wildlife **12**:195-196.

Kotrlik J, Williams H, Jabor K. 2011. Reporting and Interpreting Effect Size in Quantitative Agricultural Education Research. Journal of agricultural education **52**:132-142.
Li L, et al. 2013. Factors influencing wild boar damage in Taohongling National Nature Reserve in China: a model approach. European journal of wildlife research **59**:179-184.
Linkie M, Dinata Y, Nofrianto A, Leader-Williams N. 2007. Patterns and perceptions of wildlife crop raiding in and around Kerinci Seblat National Park, Sumatra. Animal conservation **10**:127-135.
Linnell JDC, Thomassen J, Jones K 2011. Wildlife-Human interactions : from conflict to coexistence in sustainable landscapes : a cooperative research project between India and Norway. Norsk institutt for naturforskning, Trondheim.
Liu F, McShea WJ, Garshelis DL, Zhu X, Wang D, Shao L. 2011. Human-wildlife conflicts influence attitudes but not necessarily behaviors: Factors driving the poaching of bears in China. Biological conservation **144**:538-547.
Liu Q, Yan K, Lu Y-f, Li M, Yan Y-y. 2019. Conflict between wild boars (Sus scrofa) and farmers: distribution, impacts, and suggestions for management of wild boars in the Three Gorges Reservoir Area. Journal of mountain science **16**:2404-2416.
Loibooki M, Hofer H, Campbell KLI, East ML. 2002. Bushmeat hunting by communities adjacent to the Serengeti National Park, Tanzania: the importance of livestock ownership and alternative sources of protein and income. Environmental Conservation **29**:391-398.
Luskin MS, Christina ED, Kelley LC, Potts MD. 2014. Modern Hunting Practices and Wild Meat Trade in the Oil Palm Plantation-Dominated Landscapes of Sumatra, Indonesia. Human ecology : an interdisciplinary journal **42**:35-45.
Madden F. 2004. Creating Coexistence between Humans and Wildlife: Global Perspectives on Local Efforts to Address Human-Wildlife Conflict. Human dimensions of wildlife **9**:247-257.
Madden F, McQuinn B. 2014. Conservation's blind spot: The case for conflict transformation in wildlife conservation. Biological conservation **178**:97-106.
Mascia MB, Pailler S, Krithivasan R, Roshchanka V, Burns D, Mlotha MJ, Murray DR, Peng N. 2014. Protected area downgrading, downsizing, and degazettement (PADDD) in Africa, Asia, and Latin America and the Caribbean, 1900–2010. Biological conservation **169**:355-361.
Mbise FP, Ranke PS, Røskaft E. 2021. Community spatial distance and educational determinants of how local people appreciate conservation benefits around Tarangire and Saadani National Parks, Tanzania. Global ecology and conservation **28**:e01641.
McShea WA, Myint & Songer, Mel & Connette, Grant. 2018. The Challenges of Protecting an Endangered Species in the Developing World: A Case History of Eld's Deer Conservation in Myanmar. Case Studies in the Environment. 2. 10.1525/cse.2017.000760.
Mehta JN, Heinen JT. 2001. Does Community-Based Conservation Shape Favorable Attitudes Among Locals? An Empirical Study from Nepal. Environmental Management **28**:165-177.
Mfunda IM, Røskaft E. 2011. Wildlife or crop production: the dilemma of conservation and human livelihoods in Serengeti, Tanzania. International journal of biodiversity science, ecosystems services & management **7**:39-49.
Mora C, Sale P. 2011. Ongoing global biodiversity loss and the need to move beyond protected areas: a review of the technical and practical shortcomings of protected areas on land and sea. Marine Ecology Progress Series **434**:251-266.
NEA. 2019. Conservation of biodiversity in Myanmar -including strengthened management of wetlands and protected areas
NINA. 2014. Results from camera trapping in Shwesettaw WS.
NUPI. 2018. Myanmar: A Political Economy Analysis.
Nyhus PJ. 2016. Human–Wildlife Conflict and Coexistence. Annual Review of Environment and Resources **41**:143-171.
O'Brien RM. 2007. A Caution Regarding Rules of Thumb for Variance Inflation Factors. Quality & quantity **41**:673-690.

Oberosler V, Tenan S, Zipkin EF, Rovero F. 2020. Poor management in protected areas is associated with lowered tropical mammal diversity. Animal conservation **23**:171-181.
Okello MM. 2005. Land Use Changes and Human-Wildlife Conflicts in the Amboseli Area, Kenya. Human dimensions of wildlife **10**:19-28.
Pandey P, Pandey P, Shaner P-JL, Shaner P-JL, Sharma HP, Sharma HP. 2016. The wild boar as a driver of human-wildlife conflict in the protected park lands of Nepal. European journal of wildlife research **62**:103-108.
Planning and Statistics Division. Map of Shwesettaw Wildlife Sanctuary. Forest Department, Myanmar.
Plumptre AJ, Bizumuremyi JB, Uwimana F, Ndaruhebeye JD. 1997. The effects of the Rwandan civil war on poaching of ungulates in the Parc National des Volcans. Oryx **31**:265-273.
Ripple WJ, et al. 2016. Bushmeat hunting and extinction risk to the world's mammals. Royal Society Open Science **3**:160498-160498.
Røskaft E, Bjerke T, Kaltenborn B, Linnell JDC, Andersen R. 2003. Patterns of self-reported fear towards large carnivores among the Norwegian public. Evolution and human behavior **24**:184-198.
Røskaft E, Handel B, Bjerke T, Kaltenborn BP. 2007. Human Attitudes Towards Large Carnivores in Norway. Wildlife biology **13**:172-185.
Røskaft E, Mwakatobe A, Nyahongo J. 2013. Livestock Depredation by Carnivores in the Serengeti Ecosystem, Tanzania. Environment and natural resources research **3**:46-46.
Senaviratna NAMR. 2019. Diagnosing Multicollinearity of Logistic Regression Model. Asian Journal of Probability and Statistics:Page 1-9.
Skogen K, Krange O. 2020. The Political Dimensions of Illegal Wolf Hunting: Anti-Elitism, Lack of Trust in Institutions and Acceptance of Illegal Wolf Killing among Norwegian Hunters. Sociologia ruralis **60**:551-573.
Sonam W W, Paul D C, James P L. 2006. Farmer Perceptions of Crop Damage by Wildlife in Jigme Singye Wangchuck National Park, Bhutan. Wildlife Society bulletin **34**:359-365.
Songorwa AN. 1999. Community-Based Wildlife Management (CWM) in Tanzania: Are the Communities Interested? World development **27**:2061-2079.
Stankey G, H. , Shindler B. 2006. Formation of Social Acceptability Judgments and Their Implications for Management of Rare and Little-Known Species. Conservation Biology **20**:28-37.
Thant ZM, Røskaft E, Linnell J. 2017. Costs and benefits associated with natural resource exploitation in Chatthin Wildlife Sanctuary in Myanmar, and its impact on thamin (Rucervus eldii thamin) conservation. NTNU.
Thurfjell H, Göran S, Göran E. 2013. Effects of hunting on wild boar Sus scrofa behaviour. Wildlife Biology **19**:87-93.
Timmins R, Kawanishi K, Giman B, Lynam, A.,, Chan B, Steinmetz R, Sagar Baral H, Samba Kumar N. 2015. Rusa unicolor. The IUCN Red List of Threatened Species, Available from https://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T41790A22156247.en (accessed 14th of May 2021).
Timmins RJ, Steinmetz, R., Samba Kumar, N., Anwarul Islam, Md., Sagar Baral, H.. 2016. Muntiacus vaginalis. The IUCN Red List of Threatened Species Available from https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T136551A22165292.en (accessed 7th of June 2021).
Tomićević J, Shannon MA, Milovanović M. 2010. Socio-economic impacts on the attitudes towards conservation of natural resources: Case study from Serbia. Forest policy and economics **12**:157-162.
Torres DF, Oliveira ES, Alves RRN. 2018. Chapter 22 - Understanding Human–Wildlife Conflicts and Their Implications. Pages 421-445. Elsevier Inc.
Treves A, Wallace RB, Naughton-Treves L, Morales A. 2006. Co-Managing Human-Wildlife Conflicts: A Review. Human dimensions of wildlife **11**:383-396.
UN DESA. 2019. World Population Prospects 2019: Highlights.

UN SDG Blog. 2019. UN Report: Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating', Available from https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/ (accessed 29th February 2020).

UNEP-WCMC, IUCN. 2021a. Protected Planet: The World Database on Protected Areas (WDPA) and World Database on Other Effective Area-based Conservation Measures (WD-OECM), Available from www.protectedplanet.net (accessed 15th of May 2021).

UNEP-WCMC, IUCN. 2021b. Protected Planet: The World Database on Protected Areas (WDPA) and World Database on Other Effective Area-based Conservation Measures (WD-OECM), Myanmar, Available from https://www.protectedplanet.net/country/MMR (accessed 12th of March 2020).

UNEP-WCMC I, NGS. 2018. Protected Planet Report.

Upma Manral, SHRUTI SENGUPTA, SYED AINUL HUSSAIN, SAKSHI RANA, BADOLA R. 2016. Human Wildlife Conflict in India: A review of economic implication of loss and preventive measures, Wildlife Institute of India. Indian Forester:928-940.

Williams M 2003. Making sense of social research. Sage, London.

WWF. 2008. Common Ground - Reducing human wildlife conflict.

Zaffar Rais M, Athar N, Bilal H, Gopi Govindan V. 2015. Attitudes of Local People Toward Wildlife Conservation: A Case Study From the Kashmir Valley. Mountain Research and Development **35**:392-400.

# Questionnaire

Appendix 11: Questionnaire:

**1. Questionnaire info**

Date

Questionnaire number

Village number

Household number

**2. Age**

Age

**3. House information**

Gender (Male / Female)

Size of household

Highest level of education (None / Monastery / Primary / Secondary / Above secondary)

**4. Religious beliefs**

1. Buddhsim

2. Christianity

3. Islam

4. Hinduism

Additional Text

/ open text box.

**5. Occupation (the main source of income)**

1. Farmer

2. Salary based

3. Business person

4. Shop vendor

Additional Text

/ Open text box

**6. Land ownership and size (1 acre ~ 4 000m2)**

1. Less than 1 acre

2. 1-5 acre

3. More than 5 acre

4. More than 10 acre

5. Own no land

**7. Location of farmland for crops (miles)**

1. Within the PA

2. Less than 2 miles from PA

3. 2 - 5 miles from PA

4. More than 5 miles from PA

5. Have no farmland

**8. Where do you pasture your livestock? (miles)**

1. Within the PA

2. Less than 2 miles from PA

3. 2 - 5 miles from PA

4. More than 5 miles from PA

5. Have no livestock in need of pasture grounds

**9. Name this animal (WB)**

(open text box) Picture of Wild boar

**10. Seen this animal inside PA (WB)**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**11. Seen this animal outside of PA (WB)**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**12. To what extent does this animal (WB) disturb your household livestock?**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**13. To what extent does this animal (WB) disturb your agriculture activities?**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**14. (WB) What do you think of a large population of this animal, living inside SWS?**

1. Very good

2. Good

3. Neutral

4. Bad

5. Very bad

**15. Name this animal (ED)**

(open text box) Picture of Eld's deer

**16. Seen this animal inside PA (ED)**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**17. Seen this animal outside of PA (ED)**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**18. To what extent does this animal (ED) disturb your household livestock?**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**19. To what extent does this animal (ED) disturb your agriculture activities?**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**20. (ED) What do you think of a large population of this animal, living inside SWS?**

1 Very good

2 Good

3 Neutral

4 Bad

5 Very bad

**21. Name this animal (MJ)**

(open text box) Picture of Muntjac

**22. Seen this animal inside PA (MJ)**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**23. Seen this animal outside of PA (MJ)**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**24. To what extent does this animal (MJ) disturb your household livestock?**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**25. To what extent does this animal (MJ) disturb your agriculture activities?**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**26. (MJ) What do you think of a large population of this animal, living inside SWS?**

1. Very good

2. Good

3. Neutral

4. Bad

5. Very bad

**27. What animal is most disturbing to your household livestock?**

(open ended, open text box)

**28. To what extent does this animal disturb your household livestock? (follow up on animal mentioned in the question above)**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**29. What animal is most disturbing to your Agriculture activities?**

(open ended, open text box)

**30. To what extent does this animal disturb your agriculture activities? (follow up on animal mentioned in the question above)**

1. Not at all

2. Very little

3. Some extent

4. Bad

5. Very bad

**31. How is your relationship with the PA-staff**

1. Very bad

2. Bad

3. Neutral

4. Good

5. Very good

**32. How is your trust towards the PA-staff?**

1. Very bad

2. Bad

3. Neutral

4. Good

5. Very good

**33. What is the capability of the PA-staff?**

1. Very bad

2. Bad

3. Neutral

4. Good

5. Very good

**34. Do you eat meat from wild animals**

1. Yes

2. No

**35. Which wild animals do you eat? (open-ended)**

(open text box, open ended)

**36. How often do you eat that/these animal(s)?**

1. Never

2. Yearly

3. Seasonal

4. Monthly

5. Weekly

6. Daily

**37. Is that meat accessible?**

1. Never

2. Rarely

3. Sometimes

4. Often

5. Always

**38. How often do you eat Wild Boar?**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**39. Is Wild Boar meat accessible?**

1. Never

2. Rarely

3. Sometimes

4. Often

5. Always

**40. How often do you eat Thamin?**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**41. Is Thamin meat accessible?**

1. Never

2. Rarely

3. Sometimes

4. Often

5. Always

**42. How often do you eat Muntjac?**

1. Never

2. Several years ago

3. Yearly

4. Seasonal

5. Monthly

6. Weekly

7. Daily

**43. Is Muntjac meat accessible?**

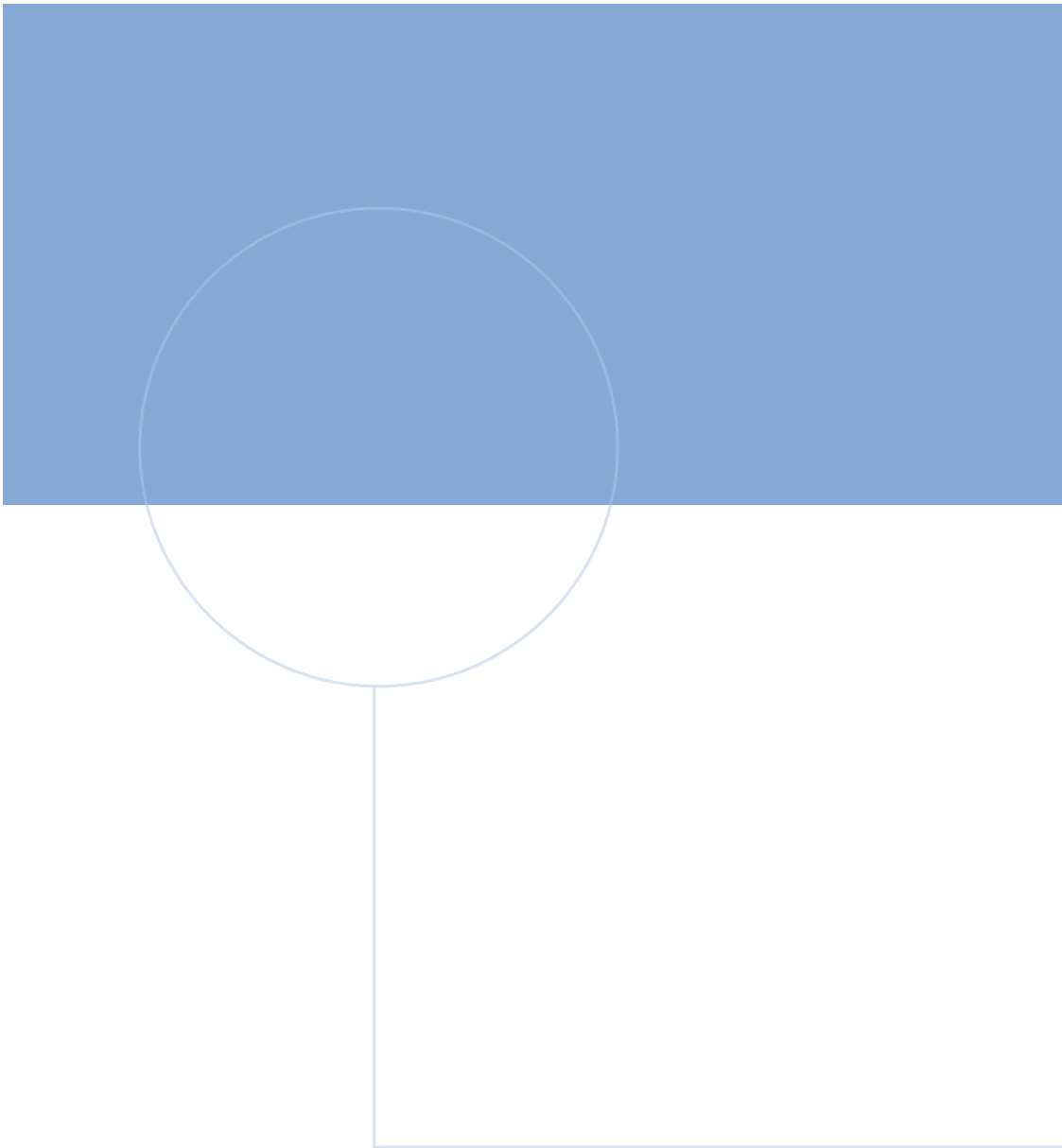
1. Never

2. Rarely

3. Sometimes

4. Often

5. Always



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