Demystifying the link between Rural Urban Migration and Human Wildlife Conflict: A case of Gangzur and Kengkhar, Eastern Bhutan

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ROYAL GOVERNMENT OF BHUTAN

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Citation:

Wangdi, S., Norbu, N., Wangdi, N., Yoezer, D., Choden, K., Wangchuk, J., (2018). Demystifying the link between Rural Urban Migration and Human Wildlife Conflict: A case of Gangzur and Kengkhar, Eastern Bhutan. UWICER Press, Lamai Goempa, Bumthang.

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Executive Summary

The conflicts between wildlife and human are not a new phenomenon in Bhutanese farming communities and remain to be one of the most challenging issues for the Royal Government of Bhutan. In the recent past, the policymakers and public commonly viewed that the human-wildlife conflict was the main driving force in perpetuating rural-urban migration in Bhutan. The migration is the by-product of various causes and conditions from both the rural communities and urban cities. Thus, the human-wildlife conflict as the primary cause of rural-urban migration remains to be ambiguous and largely speculative. We examined the farmers' perception of human-wildlife conflict as the primary driving factor of rural-urban migration and its associated implications.

We used a semi-structured questionnaire for collecting both quantitative and qualitative data from 526 households of 11 chiwogs (sub-blocks) randomly selected from Gangzur gewog(block), Lhuntse, and Kengkhar gewog, Mongar district in Bhutan.

The results revealed that agricultural farming is the major source of livelihood for the people of both the gewogs. All the households suffered agriculture crop loss to one or more wild animals, while the wildlife predation on livestock was relatively low. In terms of monetary value, the average loss incurred per household per year seems to be significant. The communities of our study area fall under the Wangchuck Centennial National Parks makes the HWC more complex due to their conservation efforts. Farmers need to adopt alternative farming practices and income-generating activities, while the government should improve rural amenities and services with the intervention of agricultural crop diversification to minimize the conflict.

At the higher challenge level, the farmers are more concerned with water scarcity, inadequate markets to sell agricultural products and shortage of land than of wildlife depredation on their crops and livestock. Even though the number of houses left unoccupied in rural villages is significant, the loss of crops in the last one year in relationship to unoccupied houses is insignificant. The migration from rural to own dzongkhag town is slightly higher than migration to Thimphu- the capital city. From this perspective, it's reasonable to conclude that the human-wildlife conflict is one of the main challenges for rural communities but not the primary driving force for rural-urban migration. However, our study covered the perceptions of rural farmers, the urban dwellers (migrated individuals) will have different insights to understand this complex HWC dynamics. Balanced socio-economic development, urbanizing the rural areas and reforming the education system will have tremendous potential in reducing the current trend of rural-urban migration.

Introduction

The Himalayan Kingdom of Bhutan possesses extraordinarily rich biodiversity with 72% of land under forest cover and identified as one of the world's global biodiversity hotspots (1,2). The land area is just about 38,394 km^2 with a population of over seven hundred thousand people (3) one of the least-populated country in South Asia (4). Subsistence agriculture farming is one of the mainstays of livelihoods. About 70% of Bhutan's population depends on crops and livestock for their living (5). The interaction between wildlife and human dates back to human prehistory (6,7) and wild animals' predation on crops and livestock were documented around 10,000 years ago (8). The interaction between wildlife and humans is believed to be increasing from the perspective of human-wildlife conflict (HWC) around the globe (9–11). The potential for conflicts arises whenever the wildlife species poses a threat to human interests. Conflicts between people and wild animals have been one of the most challenging issues for both wildlife conservation and socio-economic development, particularly for developing countries with rich biodiversity (12). The increasing trends of conflicts urgently call for improved strategies and policies to promote the co-existence of wildlife and people (13). Bhutan is no exception, owing to the gradual growth of the human population on one hand, and the rapid increase of wildlife leads to competition for shared and limited forest resources. These results in various types of conflicts, such as crop-raiding, livestock predation, human death and retaliatory killing of wildlife (5,14–16). The human-wildlife conflict has been emerging to be recognized as a significant issue for Bhutan although co-existing with extraordinarily rich biodiverse habitats.

In the past, HWC was a natural phenomenon and considered as an agricultural problem in rural communities (17). Today, the conflict is a global challenge that may create an adverse impact on both human and wildlife (18). In Bhutan, HWC is one of the most critical threats faced both by the farmers in rural villages (1,5,19) and the Government, due to various underlying causes. Around 51% of the country's total land area is under protected areas (20) and the Constitution of Bhutan mandates to maintain a minimum of 60% of the country's land under forest cover at all times. A strong wildlife conservation policy that provides primacy for wildlife such as the restriction of poaching and killing endangered species even though the animal may have predated livestock and or raided crops. While other species such as wild pigs (Sus scrofa), macaques (Macaca mulatta), and sambars (Cervus unicolor) may be killed or trapped or poisoned to defend against damage to crops and properties only within the private registered land(21). However, Bhutan's conservation policy is uniquely designed which allows farmers to live within the protected areas and biological corridor. As a result, the

majority of the rural population lives in proximity to forest areas and poses a great challenge to ensure a balance between wildlife conservation and rural livelihood improvement.

In recent years, agriculture crop damage and livestock predation by wild animals have been rampant in rural communities of

Bhutan (1,22). The wildlife encroachment was commonly viewed as one of the longstanding impediments to alleviate poverty and improve the livelihoods of rural society. The policymakers and public hypothesized that the human-wildlife conflict was the primary push factor for rural-urban migration in Bhutan. Certainly, these conflicts may be one of the causes in perpetuating rural-urban migration (23) testified by the hordes of young productive citizens abandoning their rural farmlands (24) and the number of unoccupied houses (referred as Gung-tong) increasing annually. However, studies have revealed that with the boost of economic development and improved living standards, the reliance on agriculture farming tends to decrease continuously (25,26). The rise of population growth rate, increase in demand for natural resources and improved livelihood are attributed to low tolerance for wildlife depredation on crops and livestock.

Currently, the perception of the severity of conflicts has been heightened and escalated to the national concern without establishing the magnitude of its implications on rural-urban migration. Rural-urban migration is a common pressing social issue particularly in developing countries (27–30), and rural poverty is one of the potential push factors for rural-urban migration across the globe. Rural-urban migration is not only instigated by human-wildlife conflicts but also prompted by socio-economic factors, social, political, cultural, environmental, health, education, and market factors (31,32). Bhutan is no exception, however, HWCs as the major driving force behind rural-urban migration seems to be ambiguous and remain largely speculative. This study was aimed to elucidate and explore the farmers' perception of human-wildlife conflict as the primary cause of rural-urban migration and its associated implications. Qualitative and quantitative descriptive analysis was carried out and are presented succinctly in this paper.

Methods

1. Overview of the study area

The study was conducted in two gewogs, the Gangzur in Lhuntse and Kengkhar in Mongar district in eastern Bhutan (Fig 1). Agriculture and livestock farming is the main source of livelihood for the people of these gewogs. Despite continuous support from the government, people in these gewogs still face great challenges for their livelihood. Gangzur gewog has the highest poverty rate (46.76%) among eight blocks (NSB, 2007). Kengkhar gewog faces an acute shortage of both drinking and irrigation water supply. Wildlife predation on crops and livestock is another dimension of problems for both the gewogs exposing these communities to poverty and thus vulnerable to rural-urban migration.

Furthermore, the geographical landscape of both the gewogs are characterized by rugged mountains, steep terrains and deeply incised valleys posing extreme difficulty to improve socio-economic developments and hindering rural livelihood enhancement. Geographically the gewogs are situated along the Kurichu watershed, and Gangzur gewog falls within the buffer of the Wangchuck Centennial National Park- the largest national park spanning over 4919 km2 in the kingdom. The gewogs are well connected with farm roads, electricity, telecommunication networks, education, and basic health amenities. Gangzur gewog has an area of 536 km2 and consists of 452 households with a total population of 5067 people located within an altitude range of 1200 – 2800 masl(33). Broad-leaved forest is the dominant forest type in the area which exists along with other forest types such as fir, mixed conifer, chirpine, blue pine, and shrubs. Kengkhar is one of the remotest gewogs under Mongar dzongkhag covering an area of 100 Km2 and consists of 437 households with a total population of 3886(34). It is located within an altitude range of 860 - 2400 masl and vegetation cover ranges from Chirpine forest to cool and warm broadleaved forests.

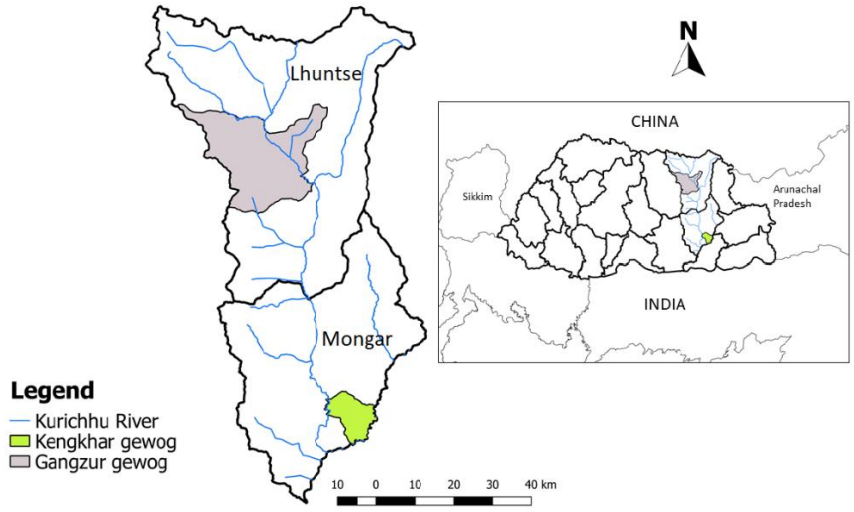

Fig 1: Map of Bhutan showing the study area location.

2. Data collection

A semi-structured questionnaire was used to collect data from the households in the study areas. Before we embarked on data collection, the pre-consultation meeting was held with the head of family members from each household to seek to explain the purpose of study and also to seek their consent. During the meeting, we randomly sampling selected either the head of household or family member present for the meeting for an in-depth questionnaire survey. Through this simple random selection of the respondents the study covered about 70% of the total households from both the gewogs. Selected interviewees were conducted a face-to-face interview the next day.

We carried out the fieldwork from March to April 2016. 20 survey enumerators and 5 research assistants were hired for the data collection. The recent graduates who could fluently speak the local dialects (Sharshop and Kurtoeb) were selected as enumerators. Sharshop is the native language of Kengkhar, while Kurtoeb is the local spoken language of Gangzur. Enumerators and research assistants were trained and familiarized with the objectives of the study and questionnaire. Interview rehearsal was conducted with interviewees for pre-testing the questionnaire to ensure high-quality data. A total of 526 respondents were interviewed from 56 villages. Microsoft Access was used for data compilation and data were analyzed using Microsoft Excel (Office 2016).

3. Ethics statement

The study was approved by the Ugyen Wangchuck Institute for Conservation and Environmental research clearance committee. All the respondents were consented during the pre-consultation meeting held with the head and family members from each household before the interview. The respondents were also informed about the objectives of the study before consenting and were offered guarantees on the confidentiality of their responses and personal data.

Results and Discussions

Attributes of respondents

A total of 526 respondents, almost equal number of genders (50.6% female and 49.4% male) participated in the interview (Table 1). The majority of respondents (80.6%) were uneducated, and few (15.6%) of them had attended below secondary education including literacy and primary education, while a few interviewees attended tertiary and monastic education. Most of the respondents were farmers (92.8%), and business entrepreneurs, dependents (including children and adults), civil servants, lay priests, private employees, herder, and students, remained less than 3%. Most of the respondents were from the age group of Gen X (36.5%) and Baby boomers (35.6%), while the Millennials and silent generation consisted of 13.9% and 12.9% respectively. The average household size in Gangzur was 4.1 persons/HH whereas Kengkhar had 3.8 persons/HH. The national average household size of Bhutan is 3.9 (NSB, 2018) which declined from 4.6 in 2005.

Table 1: Distribution of respondents by gender, education, occupation and age

Category	Gangzur	Kengkhar	Total (%)
Gender			
Female	158	108	266(50.6)
Male	96	164	260(49.4)
Education			
Monastic Education	5	7	12(2.3)
Uneducated	217	207	424(80.6)
>Secondary Education	28	54	82(15.6)
Tertiary Education	4	4	8(1.5)
Occupation			
Dependent	4	1	5(1.0)
Businessman	8	5	13(2.5)
Farmer	236	252	488(92.8)

Civil servant	2	4	6(1.1)
Gomchen/lay priest	3	7	10(1.9)
Private employee	0	2	2(0.4)
Herder	1	0	1(0.2)
Students	0	1	1(0.2)
Age			
Teenage (>17)	1	1	2(0.4)
Millennials (18-34)	26	47	73(13.9)
Gen X (35-50)	99	93	192(36.5)
Baby Boomers (51-69)	87	100	187(35.6)
Silent generation (70-87)	40	28	68(12.9)
< 88 years	1	3	4(0.8)

These data revealed that very young and older population are shouldering the responsibility of the households and agricultural farming is still the major source of employment for unskilled and illiterate citizens of Bhutan. Lack of basic literacy skills and schooling may hinder the socio-economic developments and poverty alleviation in the community. However, the majority of the respondents were economically active for the labour force participation to ensure sustainable developments. Entire five chiwogs from the Gangzur and six chiwogs from Kengkhar were included for the study. In Gangzur, Somshing chiwog had the highest number of respondents (82 respondents) and the lowest was from Nimshong chiwog with 30 respondents (Fig 2). In Kenkhar, the highest number of households interviewed was from Nanari with 57 respondents, followed by Shingchongri (56) and Murung (51) on contrary to the 30 households from Udaree. An average of 11.9% of the total household was unoccupied in the study area, while the unoccupied houses Kengkhar were almost double (15.2%) than that of Gangzur (8%). Nye (15.5%) and Nanari (24.4%) were the highest unoccupied house chiwogs, whereas the Shawa (3.7%) and Udaree (7.3%) were the lowest unoccupied house chiwogs in Gangzur and Kengkhar respectively.

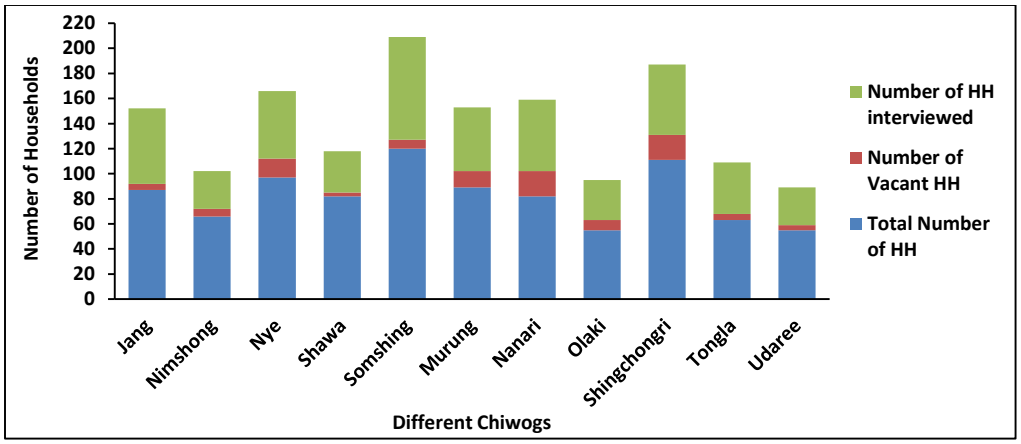

Fig 2: Distribution of sample by chiwogs, unoccupied houses and the total number of households interviewed.

Rural population decline is reported as one of the potential contributing factors that lead to Unoccupied housing. Over the last twelve years (2005-2017), the Bhutanese population residing in rural areas was decreased from 69.1% to 62.2% (35,36), although the decline depends on diverse critical factors such as modern socio-economic development, education, and employment. The high proportion of unoccupied house is a serious cause of concern to both the government and farmers due to unforeseen rippling effects on economic developments. Most of the unoccupied houses might have occupied part of cultivated agriculture land, which now remains fallow. This not only wastes the land resources but also affects local food security (37). More importantly, this may challenge Bhutan's vision of food self- sufficiency and lead to disruption of social dynamism. A successful national development process pervades the stable and sustainable social livelihood structures (38). In general, the unoccupied house indicates the high rate of housing and demographic changes in rural areas. Bhutanese society has been built upon strong socio-religious and cultural values such as volunteerism through the provision of free labour by every household towards securing community livelihoods (39). The unoccupied houses may result in labour shortage in the community and lead to a gradual disappearance of these values from the modern Bhutanese society (40). Given the nature of unoccupied housing phenomenon as the by-product of interwoven factors and conditions, it would be extremely difficult to determine the specific root causes, even though we know that rural out-migration is happening in Bhutan.

Socio-economic characteristics of the respondents' family members

Almost half (49%) of the respondents' family members of Kengkhar and 45.3% of Gangzur gewog are farmers, followed by 20.8 % studying youths and under 10 % civil servants (Fig.3). The majority of the households' main source of income was agriculture (70.4% and 77.7% respectively for Kengkhar and Gangzur) followed by contract labour (13.5%) in Gangzur and 7.8% handicrafts in Kengkhar (Fig 4). Surprisingly, there were few households (7.5%) who were lay monks and their livelihood directly depended on the performance of rituals in the communities. Under 3.7% of households were dependent on business and remittance from civil servants. A significant number of households (91.9%) in Gangzur and Kengkhar (94.4%) reared livestock(41) which generated an average monthly income of Nu.489.3 and Nu.337.2, while a few households (8.1%) and (5.6%) own no livestock respectively. An average landholding in Gangzur is 2.6 acres/household and 2.8 acres/household in Kengkhar, while 2.3% and 1.5% of respondents' households of Gangzur and Kengkhar respectively reported having no land for farming and has led to poverty.

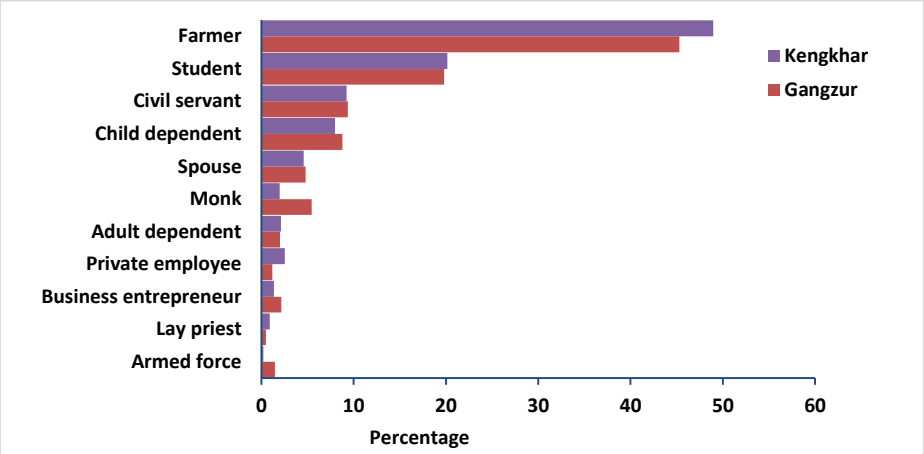

Fig 3: Occupation of respondents' family members

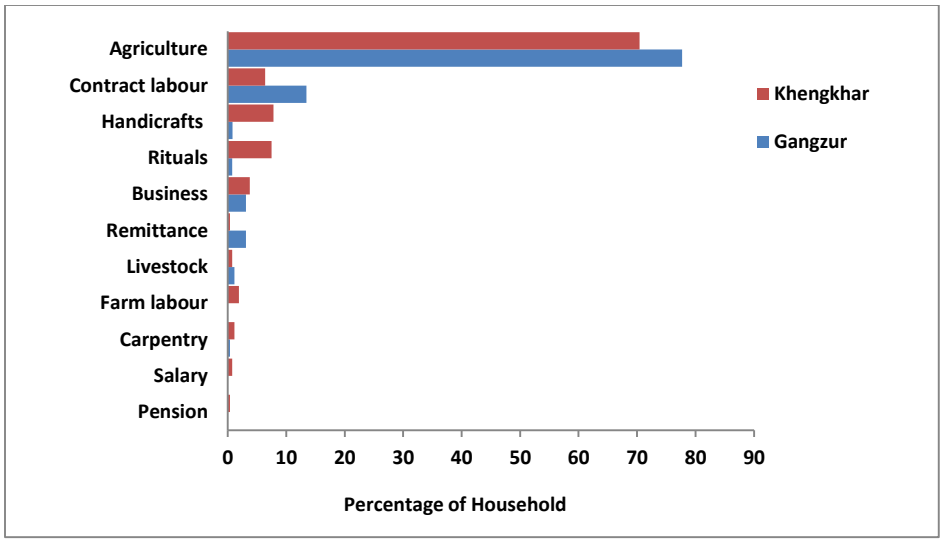

Fig 4: Primary source of income for the households

Farming as the main occupation of the majority of respondents and their family members' and agriculture as the primary source of income indicated that agriculture farming is the mainstay of livelihood for the rural people. Agricultural farming plays a critical role in building a strong economy for society and the nation. The recent development of rural out-migration will have a direct effect on agriculture production and rural land-use patterns (27,42). However, in developing countries, out-migration can be one of the important strategies for rural households to diversify and improve their livelihoods (43). Similarly, the socio-economic income generated from handicraft entrepreneurs, businesses and remittances received may potentially increase the rural household incomes and enhance agricultural farming practices. It's commonly viewed that those households engaging in these business opportunities and receiving remittances are well to do and generally have a higher level of income for their living (42,44,45). Development and investment in agriculture are the best means to fight rural poverty and also a viable solution to encourage young entrepreneurs-leading to achieve food security and national economic growth (46,47). Young and rural people's dismissive attitude towards agriculture farming may lead to a pervasive and entrenched challenge for the nation that requires a long-term strategic intervention.

Agricultural farming has been the largest source of rural employment (62.7%)(35) for low-skilled and illiterate people, while it has significant potential to employ the educated youth including school dropouts to pursue livelihoods in agriculture. We need to maximize the investment ensuring agriculture employment is more appealing for young people to consider working in the agriculture

sector(48). Currently, some parts of rural community farmers still struggle to earn enough for feeding their own families and meeting the cost of educating their children. About 6.2% of Bhutanese households faced inadequacy of food during the last one year particularly in rural areas(35). The government must enhance livelihood options for farmers to attract more young people's involvement with agriculture. The government and policymakers need to focus on the development of the agriculture sector as the potential long-term employment sector while tackling the current unemployment issues. We need to encourage and empower young people in agriculture for sustainable farming with technological support and knowledge through priority investment and rural development. Education policies should be realigned with the current needs and trends in agriculture employment opportunities. Stimulate our parents and school-going children to think that receiving an education is the way into agriculture farming rather than considering farming as the last option for their livelihoods.

The intensity of wildlife depredation on crops and livestock

All of the 526 interviewed households stated that they suffered crop losses to one or more wildlife species (Table 2). About 43.2% of respondents reported that wild boars were responsible for the highest crop loss (27,904 kg) that corresponds to the total economic value of Nu. 15,62,624/- (USD 22,979.76) (1USD = 68 Ngultrums) lost annually. On average, each household incurred loss of $ USD 85.4 per year. The National workforce wage rate is Nu.215 ($ USD 3.16) per day, which is Nu.6450 ($ USD 94.85) per month. In terms of monetary value, a household loses almost a month's income annually which is significant to farmers of low income. Among the animals; macaques, barking deer and porcupines caused the greatest damage on the crops, while sambar, birds, squirrels, rats, and bears caused the least. Among the wildlife, wild boars caused the maximum damage to maize, paddy, potato, wheat, and millets. Maize, paddy, potatoes, wheat and chilies were the most affected food crops due to wildlife depredation, which are the important staple food for the farmers.

Table 2: Wildlife Crop depredation, crop preferences and economic value of crops damaged in a year (Household's Responses)

Species	Respondents (%)	Wildlife counted (Number)[A]	Crops loss (Kg)[B]	Average price (Nu.)[C]	Total economic Value(USD)	Crop preferences of wildlife
Wild Boar	227(43.2)	214	27904	56	1562624(22979.7)	Maize, Paddy, Potato, Wheat, Millet
Macaque	124(23.6)	134	12998	58	753884(11086.5)	Maize, Paddy, Potato, Wheat, Millet, Chilli
Barking deer	85(16.2)	31	5907	46	271722(3995.9)	Maize, Paddy, Potato, Chilli, Cabbage
Porcupine	50(9.5)	107	6814	46	313444(4609.5)	Maize, Paddy, Potato
Sambar	14(2.7)	90	792	46	36432(535.7)	Maize, Paddy, Potato
Birds	11(2.1)	7	265	57	15105(222.2)	Maize, Paddy
Squirrel	6(1.1)	6	220	59	12980 (190.9)	Maize
Rats	5(1.0)	9	452	60	27120(398.9)	Maize, Paddy, Chilli
Bear	4(0.8)	15	1250	49	61250 (900.7)	Maize, Wheat
Total	**526**	**613**	**56602**		**3054561(44920.0)**	

A. A number of wild animals counted during the crop-raiding.

B. Amount of crops lost to wildlife in a year in kilograms.

C. Average current market price of crops and vegetables (Maize Nu.59 ($ 0.868)/kg; Paddy Nu.55($0.810)/kg; Wheat Nu.38 ($0.559)/kg; Millet Nu.104($1.530)/kg; Potato Nu.24($0.352)/kg; Chilli Nu.66($0.970)/kg; Cabbage Nu.26($0.382)/kg. Source: Bhutan

RNR Statistic (2016)

Understanding the farmers' perceptions regarding the wildlife crop depredation is critical to ascertain the intensity of rural living difficulties caused by wildlife. The study revealed that farmers experienced constant conflicts with wildlife and almost every household suffered crop loss to one or more wild animals annually. Given the nature of rural community settlements that fall under Wangchuck Centennial National Park within the heart of forests, surrounded by diverse wildlife habitats, an average economic loss incurred in terms of monetary value per household annually tends to be relatively high. Since the majority of rural people are subsistence farmers, arguably such loss can be an enormous amount in comparison to their low-income source and be potentially devastating which

may have a huge implication for their daily livelihoods (49). However, the loss of different crops to various wild animals in varying quantities at different seasons potentially makes the farmer feel less damage to their crops. The actual impact of wildlife destruction on crop yield may also depend on the stage of plant development (50). For instance, damage during the critical reproductive stage may result in total loss of the yield. The quantity of crop loss incurred was purely based on the landowner's perception and the actual field data may offer a different perspective. The farmers may overlook the minor damages, underestimate the number of damaged fields and overestimate the damages by wildlife (51). However, irrespective of the quantity damaged and the amount of economic value lost, whether real or perceived, wild animals' predation on crops is a serious concern for the farmers (52). This will not only impede alleviating rural poverty but also portray farming as an unpleasant livelihood option for the young future farmers of Bhutan.

The prevalence of crop-raiding by wildlife indicates human-wildlife conflict acts as one of the main push factors for rural out-migration. Farmers with their livelihood at stake may be more vulnerable to these conflicts and increasingly develop a low tolerance level for crop depredation. With varied reasons, the human-wildlife interaction will continue to occur and rural communities will perceive it as the enduring threat to their livelihoods in the foreseeable future. Practical actions along with rural development flagship programs and strong socio-economic development policy interventions are required to minimize the conflicts. The government's interventions should focus on increasing the general level of wildlife crop damage tolerance and reduce the impact of crop loss(52) by wild boars and macaques. We should introduce alternative farming practices such as planting crops that are less palatable or appealing to wildlife and growing highly raided crops beyond the buffer of unappealing crops to minimize the main crop depredations (53). Farmers should also be trained on crop diversification and invest in alternative income-generating activities supported by improved rural amenities and financial services. We need to formulate pragmatic solutions and alternative options that can increase the overall income of farmers. For instance, encourage community forests management and community stewardship of natural resources as a reward for bearing the brunt of wildlife conservations.

The majority (74.5%) of households reported they did not lose their livestock to the wildlife predators within the past years and only 25.5 % of respondents lost their livestock to wildlife. Inadequate fodder and low milk productions were some of the common primary challenges for both the gewogs, while the Gangzur gewog communities were faced with insufficient pastureland and Kengkhar gewog with

an occurrence of livestock diseases (Fig 5). These challenges impede rural farmers to generate income from livestock farming. Livestock predation by wildlife seems to be higher in Gangzur gewog than in Kengkhar. Surprisingly, about 5.7% and 4.2% of respondents in Gangzur and Kengkhar respectively thought livestock rearing is not a challenge.

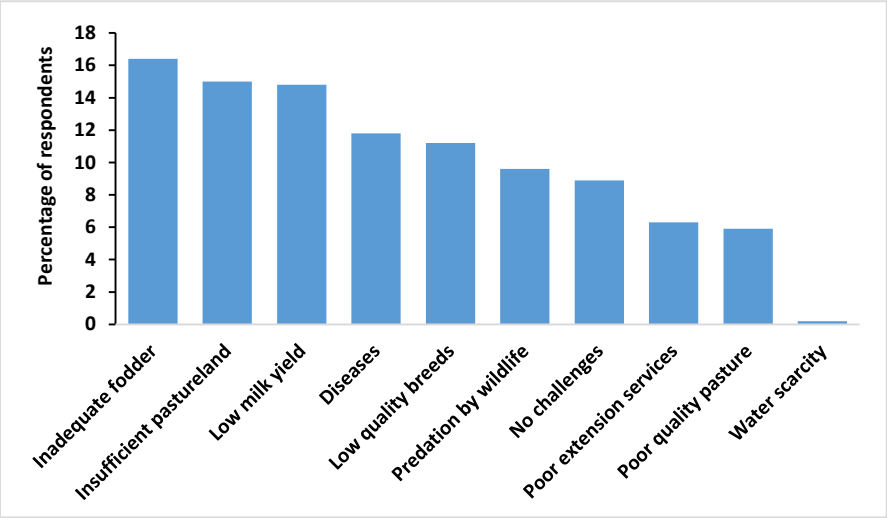

Fig 5: The main challenges for livestock rearing in Gangzur and Kengkhar

Livestock plays an integral part of rural communities' livelihoods, especially in dietary assets and income generation. Wildlife predation on livestock holdings was relatively low compared to the impact of diseases (54–56), insufficient fodder and pastureland -leading to low milk production. The study revealed that rural people are much more concerned with fodder availability, pastureland, and diseases for the livestock than the loss to wildlife predation. Improvement of fodder, pastureland and supply of improved local breeds should be a key area of focus for enhancing rural livelihoods. The findings confirm that wildlife interaction with livestock is not as severe as commonly believed by society (Fig.5). Thus, human-wildlife conflict is certainly not the main challenge for farmers inferring that HWC may not be the primary cause of rural-urban migration. However, our study covered only the rural people's perceptions and the perspectives from migrated individuals may offer valuable insights for a better understanding of the relationship between HWC and rural-urban migration.

Key challenges to secure rural livelihoods.

In the recent past, human-wildlife conflicts regularly featured the headlines and rampant crop raiding and livestock predation was reported in the media (57–63), while the conservationist and scholars studied the issue and published various reports and scientific papers and explored various long-term solutions to address the problem. The state of nation report since 2009 highlighted the wildlife damage on crops and livestock as one of the great challenges for the farmers (64–70). All these discussions and concerns have pushed the long-standing human-wildlife interaction as the root cause of rural farmer's hardship. Thus, in this perspective, the policymakers and society have regarded the human-wildlife interaction as the main cause of increasing unoccupied houses and large swathes of traditionally cultivated lands being left fallow in rural communities. However, the correlation between the number of unoccupied houses and the number of crops damaged by wild animals within the past one year is not significant statistically (Fig 6). The human-wildlife interaction acts as one of the potential rural out-migration push factors that need to be addressed with long-term solutions, but may not be the legitimate primary driving force of the rural-urban migration. The frequent feature of the controversial dilemma between humans and wildlife by media houses and the conservationists seeking funding opportunities seems to have aggravated and overrated the human-wildlife interaction to be regarded by the public and the government as the major cause of rural-urban migration in the country.

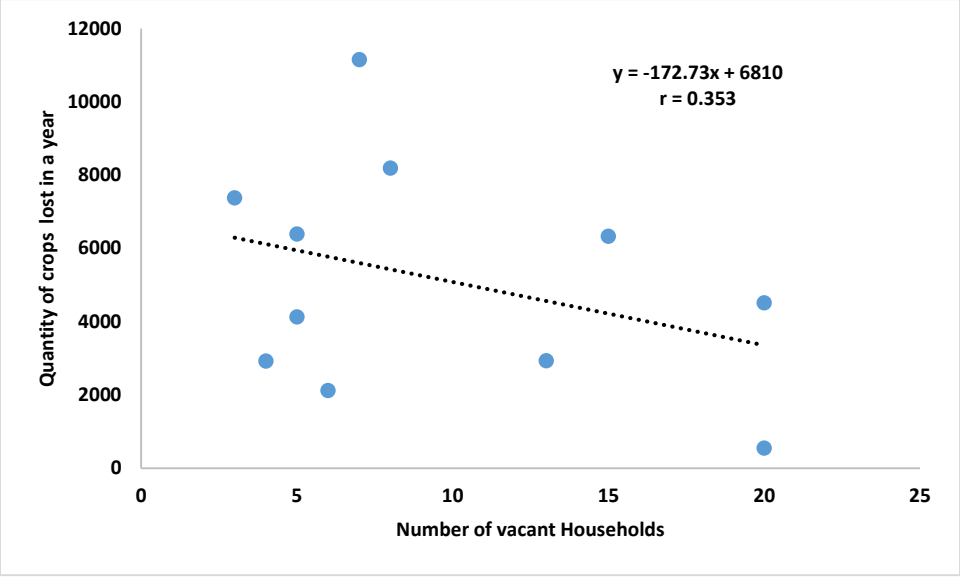

Fig 6: Correlation between the unoccupied houses and quantity (kg) of crops damaged in the Chiwogs

In general, the rural farmers are faced with a host of challenges to secure their livelihood from agricultural and livestock farming. Even though wildlife predation on crops and livestock remains to be one of the rural challenges, water shortage and lack of markets to sell their agricultural and handicraft products and land shortages were some of the main hindrances for the people of both gewogs. Amongst all, water scarcity (Gangzur:25.5% and Kengkhar:47.9%) had severely impacted the people's livelihood (Fig 7). All these challenges directly acted as the major push factors from the rural area. The 2017 population and housing census of Bhutan revealed that the family's movement (17.8%), followed by employment (12.7%) and education (8.3%) were the main reasons for migration.

The rationales for rural-urban migration between our study and the 2017 population and housing census were different but both the study failed to support the HWC as the primary cause of rural-urban migration. The current perception of the human-wildlife conflict as the major cause of rural-urban migration seems to be a one-sided outlook from the society without considering the urban attraction strengths such as employment opportunities, improved education, and health services. Thus, solving the human-wildlife conflicts may not be an absolute panacea in addressing the rural-urban migration.

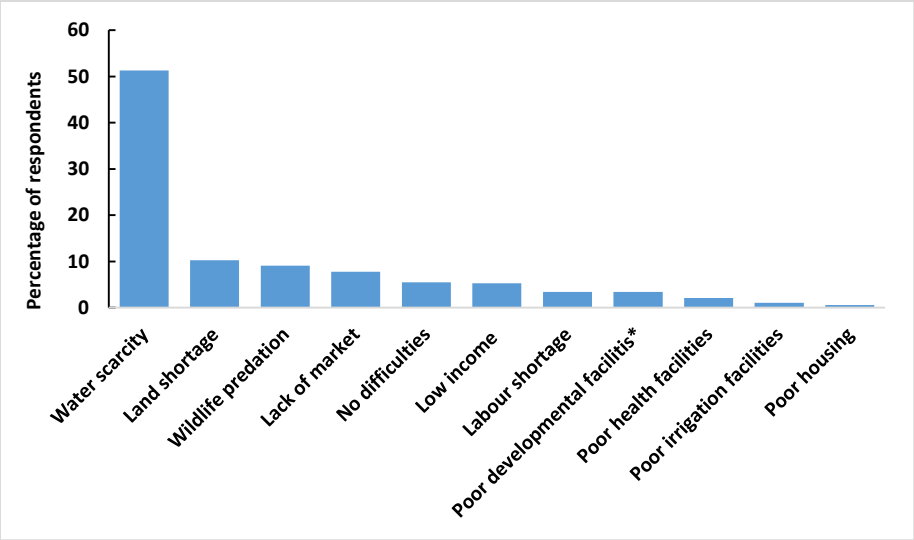

Fig 7: The main difficulties of rural livelihood in Gangzur and Kengkhar

*Road connectivity, Transportation, Education and Electricity

The current scenario of rural-urban migration and its implication

In Gangzur gewog, the majority of the people migrated to own dzongkhag town, while the highest percentage of people from Kengkhar migrated to Thimphu followed by own dzongkhag town. From both gewogs, a significant percentage of people had migrated to Thimphu than of other dzongkhags (Fig.8). Given that Thimphu is the capital city of the country, it received the highest number of net migrants from both the gewogs (23). Overall, the net migration received in Thimphu district is substantial in comparison to other districts within the country, even though the internal migration to own district town seems to be proportionately high.

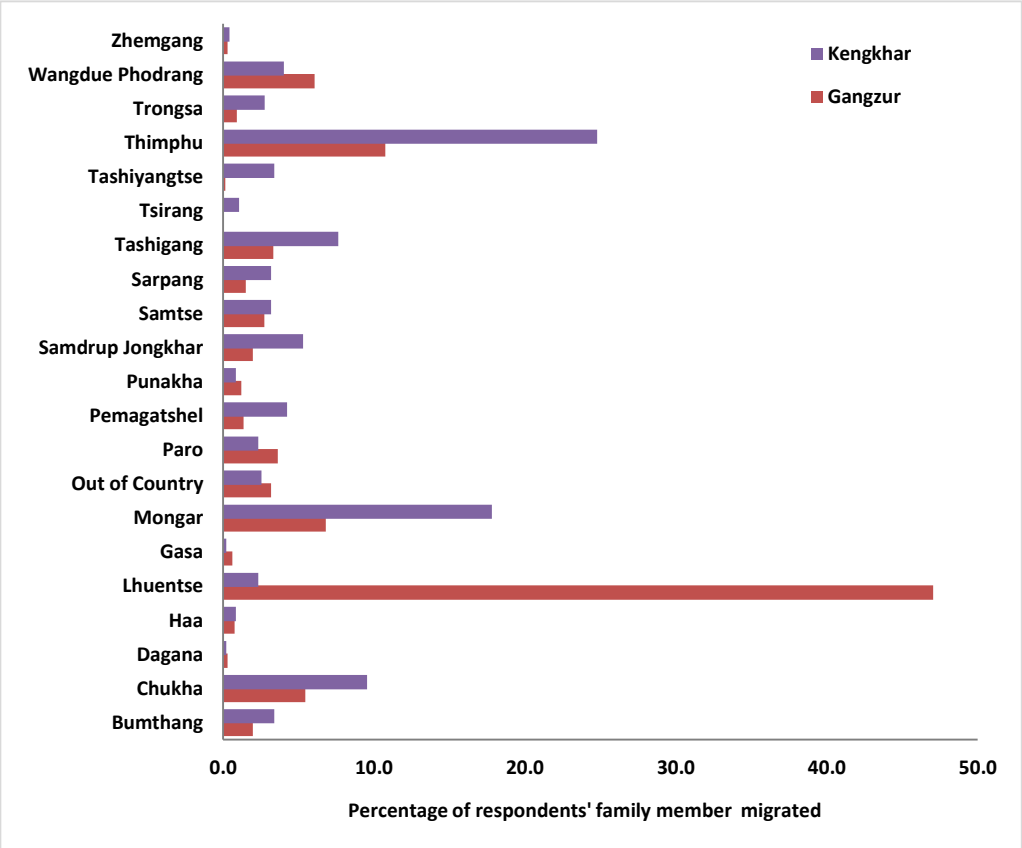

Fig 8: Number of out-migrants from Gangzur and Kengkhar gewogs to different places in the country and abroad.

The study revealed that rural to their own dzongkhag urban town migration is slightly higher than the rural to urban city-Thimphu. However, from both the gewogs migration to Thimphu dzongkhag-urban capital city was the highest than the other dzongkhags. In this perspective, our finding seems to be supported by the 2017 population and housing census report of Bhutan that states rural-urban migration is the highest (44.2%) followed by rural to rural migration (36.6%) as compared to urban-urban and urban-rural migration in the country (35). Since our study was based on the farmer's perception of rural-urban migration, we do not know the actual reasons for their migration.

The data showed that rural-urban migration is substantially significant in both the gewogs, which leads labour force migration from rural to urban which is key to the urbanization process (27). However, with Bhutan's unemployment rate mounted at 2.19 percent particularly prevalent in urban areas, the current trend of rural to urban migration may negatively impact the urbanization. The rural communities and urban centers are closely interdependent (75), the decline of rural poverty with the migration of poor rural people may lead to the emergence of urban poverty. Though an attempt to completely cease the rural-urban mobility is impractical, a balanced development between rural and urban may bring tremendous potential in reducing the current trend of migration. These would reduce the growing disparity between rural and urban living thereby helping to integrate rural farms and the social landscape of cities. For now, more socio-economic developments are required in rural areas to minimize the rural-urban migration, otherwise, whether HWC occurs or not, the rural-urban migration trend may continue to exist.

Conclusion

The purpose of this study was to elucidate an ambiguous common view of the human-wildlife conflict as the primary driving force for rural-urban migration based on the farmer's perception and its associated implications. Agricultural farming is and will continue to be a reliable source of livelihood for unskilled and illiterate citizens of both the gewogs. However, farmers of both gewogs experienced constant interaction with wildlife and suffered crop loss to one or more wild animals yearly. An average monetary value loss incurred per household annually seem to be moderately high in comparison to the national labour force wage rate. Given that both the gewogs are under the jurisdiction of WCNP, the human-wildlife conflicts may continue until the farmers adopt an alternative farming practice that is less palatable to wildlife. This also makes an urgent call for the government to introduce crop diversifications and invest in alternative income-generating activities with improved rural amenities and financial services. Without proper interventions from the

government to resolve this HWC challenges may ultimately become the main catalyst for the rural-urban migration.

The phenomenon of unoccupied houses in rural communities was one of the major challenges for both the government and farmers. This also indicates that population decline and demographic change are happening in rural villages. Without the timely relevant measures and policy interventions to alleviate the unoccupied houses in the rural villages may bring unforeseen rippling effect on economic developments for the country. However, the amount of crops damaged by wild animals within the past one year in relationship to unoccupied houses is insignificant. This seems to suggest that the HWC is one of the potential push factors for rural-migration but not necessarily the main legitimate driving force of the migration.

Rearing livestock is one of the mainstays of rural society for the sustenance and income generation. Human-wildlife conflict due to livestock rearing seems to be minimal, rather the farmers were more concerned about the scarcity of fodder, pastureland and the prevalence of various zoonotic diseases. At the gross challenge level in both the gewogs, the farmers commonly viewed the scarcity of water, unavailability of markets to sell agricultural products and handicrafts and the land shortages were the main impediment to improve their living. From this perspective, it tends to suggests that the HWC is one of the push factors for the rural-urban migration but not as the main driving force of rural-urban migration. However, our study covered only the rural farmers' perceptions, while the perspective from urban dweller (migrated individuals) with further delve into the dynamics of urban attraction strengths such as employment opportunities, improved education, and health services may offer different insights to understand this complex relationship between HWC and the rural-urban migration.

Even though migration from rural to their own dzongkhag town is slightly higher than the rural to urban, the migration from rural to Thimphu- the capital city was the highest than other dzongkhags. Rural-urban migration is substantially significant in both the gewogs. The high migration rate is a serious cause of concern for both farmers and the government providing better amenities in the urban as well as a threat to the village economy thereby impacting the national goal of self-sufficiency. Children's enrollment in education should foster to return for agricultural farming opportunities rather than prompted to urban life. Considering all the push factors from rural communities the balanced socio-economic development, urbanizing the rural areas and reforming the education system will have tremendous potential in reducing the current trend of rural-urban migration.

We recommend undertaking similar studies in the future across other dzongkhags and chiwogs and particularly seeking the views from urban dwellers may offer further insights into the link between HWC and the rural-urban migration in Bhutan. However, we hope our findings will have some

influence in the way human-wildlife conflict is perceived and thereby contribute to a better understanding of its impact on rural-urban migration.

Acknowledgments

We are thankful to the European Union-Global Climate Change Alliance (EU-GCCA) for funding the study. We would like to express our profound gratitude to the officials, communities and participants of Gangzur gewog, Lhuntse and Kengkhar gewog, Mongar for the unconditional support during the field survey. Our deepest appreciation to the UWICER researchers, research assistants and survey enumerators for their hard work and invaluable contribution during the data collection. Finally, we are grateful to the UWICER management for constant support and guidance throughout the study.

References

1.Sangay T, Vernes K. Human-wildlife conflict in the Kingdom of Bhutan: Patterns of livestock predation by large mammalian carnivores. Biol Conserv. 2008;141(5):1272–82. doi: 10.1016/j.biocon.2008.02.027

2.Uddin SN, Taplin R, Yu X. Energy, environment and development in Bhutan. Renew Sustain Energy Rev. 2007;11(9):2083–103.

3.National Statistics Bureau. National Accounts Statistics 2017. Thimphu: National Statistics Bureau; 2017. Available: http://www.nsb.gov.bt/publication/files/pub4pe1310cn.pdf

4.Asian Development Bank. Country Strategy and Program 2006-2010 Bhutan. Thimphu : Asian Development Bank; 2005. Available: https://www.adb.org/sites/default/files/institutional-document/32282/files/csp-bhu-2005.pdf

5.Wildlife Conservation Division. Assessment on Impact of Human-Wildlife Conflict Management Intervention to the local communities. Thimphu : Department of Forests and Parks; 2013.

6.Berger LR, MsGraw WS. Further evidence for eagle predation of, and feeding damage on, the Taung child.South African Journal of Science; 2007; 496-498. Available: http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0038-23532007000600013

7.Lee-Thorp J, Thackeray JF, van der Merwe N. The hunters and the hunted revisited. Journal of Human Evolution. 2000;39(6):565–76. doi: 10.1006/jhev.2000.0436 8.Gordon IJ. What is the Future

for Wild, Large Herbivores in Human-Modified Agricultural Landscapes? Wildlife Biology. 2009;15(1):1–9. doi: 10.2981/06-087

9.Peterson MN, Birckhead JL, Leong K, Peterson MJ, Peterson TR. Rearticulating the myth of human-wildlife conflict. Conservation Letters. 2010;3(2):74–82. doi: 10.1111/j.1755-263X.2010.00099.x

10.White PCL, Ward AI. Interdisciplinary approaches for the management of existing and emerging human-wildlife conflicts. Wildl Research. 2010;37(8):623–9.doi: 10.1071/WR10191

11.Hemson G, Maclennan S, Mills G, Johnson P, Macdonald D. Community, lions, livestock and money: A spatial and social analysis of attitudes to wildlife and the conservation value of tourism in a human-carnivore conflict in Botswana. Biological Conservation. 2009;142(11):2718–25. doi:10.1016/j.biocon.2009.06.024

12.Dowie M. Conservation Refugees: The Hundred-Year Conflict between Global Conservation and Native Peoples. London: MIT Press: 2009. doi: 10.1080/09614520903564298

13.Woodroffe R, Thirgood S, Rabinowitz A. The impact of human-wildlife conflict on natural systems. Longdon: Cambridge University Press.; 2005.doi:10.1017/S0030605306000202

14.Nature Conservation Division. Bhutan National Human -Wildlife Conflicts management strategy. Thimphu: Nature Conservation Division; 2008. 15.Liu F, McShea WJ, Garshelis DL, Zhu X, Wang D, Shao L. Human-wildlife conflicts influence attitudes but not necessarily behaviors: Factors driving the poaching of bears in China. Biol Conserv. 2011;144(1):538–47. doi:10.1016/j.biocon.2010.10.009 16.Lamarque F, Anderson J, Fergusson R, Lagrange M, Osei-Owusu Y, Bakker L. Human-wildlife conflict in Africa: causes, consequences and management strategies. Rome: Food and Agriculture Organization of the United Nations (FAO); 2009. 17.Messmer TA. The emergence of human-wildlife conflict management: Turning challenges into opportunities. International Biodeterioration and Biodegradation. 2000;45(3–4):97–102. doi: 10.1016/S0964-8305(00)00045-7

18.Anand S, Radhakrishna S. Investigating trends in human-wildlife conflict: is conflict escalation real or imagined? Journal of Asia-Pacific Biodiversity. 2017;10:154–61. doi: 10.1016/j.japb.2017.02.003

19.Wang SW, Macdonald DW. Livestock predation by carnivores in Jigme Singye Wangchuck National Park, Bhutan. Biological Conservation. 2006;129(4):558–65. doi: 10.1016/j.biocon.2005.11.024 20.Department of Forests & Park Services. Forest Facts and Figures 2016 [Internet]. Thimphu: Department of Forests and Park Services; 2013. Available: http://www.dofps.gov.bt/wp-content/uploads/2017/07/ForestBookletFinal.pdf

21.Department of Forests & Park Services (DoFPS). Forest and Nature Conservation Rules & Regualtions OF Bhutan, 2017. 4th ed. Thimphu: Department of Forests and Park Services; 2017.

22.NPPC and WWF-Bhutan. Human Wildlife Conflict SAFE Strategy.Nine Gewogs of Bhutan. Thimphu:World Wildlife Fund Bhutan; 2016. Available: http://www.nppc.gov.bt/wp-content/uploads/2017/03/Final-report-HWC-SAFE-system-approach.pdf

23.Gosai M A., Sulewski L. Urban attraction: Bhutanese internal rural–urban migration. Asian Geographer. 2014;31(1):1–16. doi:10.1080/10225706.2013.790830

24.Mountain Eclology Division. Human-Wildlife Conflict in the Mountains of SAARC Region - Compilation of Successful Management Strategies and Practices. Thimphu: SAARC Forestry Centre; 2014. Available: http://www.snowleopardnetwork.org/bibliography/Mishra_Suryawanshi_2014.pdf

25.Ikramullah GS, Rehman NU. Economic and social dimensions of rural-urban migration in Pakistan: Results from a recent survey in the North West Pakistan.International Journal of Business and Social Science. 2011;2(3):96–104. Available:http://www.ijbssnet.com/journals/Vol._2_No._3_[Special_Issue__January_2011]/13.pdf

26.Ellis F. Rural Livelihood Diversity in Developing Countries: Evidence and Policy Implications. Natural Resource Perspectives. 1999;40. Available: https://pdfs.semanticscholar.org/6c8c/1e279da71ed5982580a2585389c9932b2549.pdf 27.Lall S V, Selod H, Shalizi Z. Rural-urban migration in developing countries: A survey of theoretical predications and emperical findings. Washington DC; World Bank; 2006. Available: https://openknowledge.worldbank.org/bitstream/handle/10986/8669/wps3915.pdf?sequence=1&isAllowed=y

28.Jedwab R, Christiaensen L, Gindelsky M. Rural push, urban pull and... urban push? New historical evidence from developing countries. Institute for International Economic Policy: Washington, DC, USA. 2014.Available: https://www.parisschoolofeconomics.eu/IMG/pdf/pse-rues-juin2014-jedwab.pdf

29.Chant S. Households, gender and rural-urban migration: reflections on linkages and considerations for policy. Environment and Urbanization. 1998;10(1):5–21.doi:10.1177/095624789801000117

30.Coast E. Local understandings of, and responses to, HIV: Rural-urban migrants inTanzania. Social Science and Medicine. 2006;63(4):1000–10. doi:10.1016/j.socscimed.2006.03.009

31.Thet KK. Pull and push factors of migration: A case study in the urban Area of Monywa Township, Myanmar. News from the World of Statistics. Institute of Economics in Monywa.2014. Available: http://www.worldofstatistics.org/files/2014/03/March-24-2014.pdf

32.Ajaero CK, Madu IA, Mozie AT. Appraisal of the Factors of Rural-Urban Migration in Southeastern Nigeria. Innovare Journal of Social Sciences. 2013;1(2):1–8.

33.Lhuntse Dzongkhag Administration. Gangzur [Internet]. 2018.[updated Sept 06; cited 2018 Sep 10]. Available: http://www.lhuentse.gov.bt/gewogs/gangzur

34.Mongar Dzongkhag Administration. Khengkhar [Internet]. Mongar Dzongkhag Administration: Royal Government of Bhutan. 2018 [update Sept 14; cited 2018 Sep 14]. Available: http://www.mongar.gov.bt/gewogs/khengkhar

35.National Statistics Bureau of Bhutan. 2017 Population and Housing Census of Bhutan : National Report.Thimphu: National Statistics Bureau of Bhutan; 2018. Available: http://www.nsb.gov.bt/publication/files/PHCB2017_national.pdf

36.Office of the Census Commissioner. Results of Population & Housing Census of Bhutan 2005.Thimphu: Office of the Census Commissioner; 2006. Available: http://www.nsb.gov.bt/publication/files/pub6ri44cs.pdf

37.Tong Y, Niu H, Fan L. Willingness of farmers to transform vacant rural residential land into cultivated land in a major grain-producing area of central China. Sustainability. 2016;8(11):1-15. doi: 10.3390/su8111192

38.Planning Commission. Bhutan 2020: A Vision for Peace, Prosperity and Happiness. Thimphu: Planning Commission; 1999.Available: http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN005249.pdf

39.Choden T. Traditional Forms of Volunteerism in Bhutan.Thimphu: The Centre for Bhutan Studies; 2003. Available:http://www.bhutanstudies.org.bt/publicationFiles/Monograph/monoVolunteerism.pdf

40. Bajgai R. Rural-urban migration: A challenge in preserving socio-cultural practices and values-case of Barpangthang village. In: Proceedings of the 2nd International Seminar on Population and Development;2012 October 5-6; Sherubtse College, Bhutan.

41.Department of Livestock: Livestock Statistics 2016: Thimphu : Department of Livestock; 2016. Available: http://www.moaf.gov.bt/livestock-statistics-2016- available-online/

42.Qin H. Rural-to-Urban Labor Migration, Household Livelihoods, and the Rural Environment in Chongqing Municipality, Southwest China. Human Ecology. 2010;38(5):675–90. doi: 10.1007/s10745-010-9353-z

43.UN Development Program. Human Development Report 2009. Overcoming barriers: Human mobility and development.New York: United Nations Development Programme; 2009.Available: http://hdr.undp.org/sites/default/files/reports/269/hdr_2009_en_complete.pdf

44.Wouterse F, Taylor JE. Migration and Income Diversification:: Evidence from Burkina Faso. World Development. 2008;36(4):625–40. doi: 10.1016/j.worlddev.2007.03.009

45.Airola J. The Use of Remittance Income in Mexico. International Migration Review. 2007;41(4):850–9. doi:10.1111/j.1747-7379.2007.00111.x

46.Ogbeide, Osadebawen; Ele, Idba; Ikheloa E. Young People and Agricultural Employment : Locality and Interest Factors. Mayfair Journal of Agriculture Development in Emerging Economies. 2015;1(1):1–13.

47.Brooks K, Zorya S, Gautam A, Goyal A. Agriculture as a Sector of Opportunity for Young People in Africa. World Bank; 2013. Available: https://openknowledge.worldbank.org/bitstream/handle/10986/15605/WPS6473.pdf;se quence=1

48.Goldsmith PD, Gunjal K, Ndarishikanye B. Rural-urban migration and agricultural productivity: The case of Senegal. Agricultural Economics. 2004;31(1):33–45.doi:10.1016/j.agecon.2003.01.002

49.Sillero-Zubiri C, Switzer D. Crop raiding primates: searching for alternative, humane ways to resolve conflict with farmers in Africa.Oxford: Wildlife Conservation Research Unit; 2001.

50.MacGowan B, Humberg L. Corn and soybean crop depredation by wildlife. Purdue University, Department of Forestry and Natural Resources Publication FNR-265-W; 2006. Available: https://www.extension.purdue.edu/extmedia/FNR/FNR-265-W.pdf

51.Conover R. Perceptions of American Agricultural Producers about Wildlife on Their Farms and Ranches. Wildlife Society Bulletin 1998;26(3):597–604. 52.Wang SW, Curtis PD, Lassoie JP. Farmer Perceptions of Crop Damage by Wildlife in Jigme Singye Wangchuck National Park, Bhutan. Environmental Conservation. 2006;34(2):359–65.doi: 10.1017/S0376892906002931

53.Mc Guinness S, Taylor D. Farmers' Perceptions and Actions to Decrease Crop Raiding by Forest-Dwelling Primates Around a Rwandan Forest Fragment. Human Dimensions of Wildlife. 2014;19(2):179–90. doi: 10.1080/10871209.2014.853330

54.Rosas-Rosas OC, Bender LC, Valdez R. Jaguar and puma predation on cattle calves in northeastern Sonora, Mexico. Rangeland Ecology and Management. 2008;61(5):554–60. doi: 10.2111/08-038.1

55.Amador-Alcalá S, Naranjo EJ, Jiménez-Ferrer G. Wildlife predation on livestock and poultry: Implications for predator conservation in the rainforest of south-east Mexico. Oryx. 2013;47(2):243–50. doi: 10.1017/S0030605311001359

56.Mizutani F, Muthiani E, Kristjanson P, Recke H. Impact and value of wildlife in pastoral livestock production systems in Kenya: possibilities for healthy ecosystem conservation and livestock development for the poor. In: World Parks Congress. 2003.121–32.

57.Editor. The agriculture crisis . Kuensel [Internet]. 2017 Jul 10 [cited 2018 Aug 14]; Available: http://www.kuenselonline.com/the-agriculture-crisis/

58.Dorji Y. A Malady Called Rural-Urban Migration Part II. Kuensel [Internet]. 2015 Jan 24 [cited 2018 Aug 13]; Available: http://www.kuenselonline.com/a-malady-called-rural-urban-migration-part-ii/

59.BBS. Human-wildlife conflict continues in Bartsham. Bhutan Broadcasting Service [Internet]. 2012 Sep 5 [cited 2018 Aug 13]; Available: http://www.bbs.bt/news/?p=17351

60.Editor. Relooking at the rural-urban migration debate. The Bhutanese [Internet]. 2015 Apr 25 [cited 2018 Aug 14]; Available: https://thebhutanese.bt/relooking-at-the-rural-urban-migration-debate/

61.Zangmo T. Declining rural population and its significant impact on LG election. The Bhutanese [Internet]. 2016 Jul 16 [cited 2018 Aug 14]; Available from: https://thebhutanese.bt/declining-rural-population-and-its-significant-impact-on-lg-election/

62.Pem D. Rural-Urban Migration on the rise as rural life loses its charm. The Bhutanese [Internet]. 2016 Dec 3 [cited 2018 Aug 14]; Available: https://thebhutanese.bt/rural-urban-migration-on-the-rise-as-rural-life-loses-its-charm/

63.Wangchen J. Combating Fallow Land in Bhutan - New Bhutan Times - Know Bhutan. Bhutan Times [Internet]. 2018 Apr 25 [cited 2018 Aug 14]; Available: https://www.bhutantimes.com/article/combating-fallow-land-in-bhutan

64.Thinley JY. The Annual Report of the Royal Government of Bhutan. Thimphu: Office of Prime Minister and Cabinet; 2009. Available: http://www.cabinet.gov.bt/annual_report/Annual Report 2009.pdf

65.Thinley JY. The State of the Nation. Thimphu: Office of Prime Minister and Cabinet;; 2011. Available: http://www.cabinet.gov.bt/annual_report/Third anual nation Report.pdf

66.Tobgay T. The State of the Tsa-Wa-Sum. Thimphu : Office of Prime Minister and Cabinet;; 2014. Available: http://www.cabinet.gov.bt/Report/State of the Tsa-Wa-Sum (Final) 2014.pdf

67.Tobgay T. The State of the Tsa-Wa-Sum. Thimphu : Office of Prime Minister and Cabinet; 2015. Available: http://www.cabinet.gov.bt/Report/annual%20report%202015.pdf

68.Tobgay T. The State of the Nation. Thimphu: Office of Prime Minister and Cabinet; 2016 [cited 2018 Aug 15]. Available:http://www.cabinet.gov.bt/Report/annual%20report%202015.pdf

69.Tobgay T. The State of the Nation. Thimphu: Office of Prime Minister and Cabinet;2017. Available: http://www.cabinet.gov.bt/Report/StateofNationReport2017.pdf

70.Tobgay T. State of the Nation [Internet]. Thimphu: Office of Prime Minister and Cabinet; 2018. Available: http://www.cabinet.gov.bt/wp-content/uploads/2018/07/SOTN20182.pdf

71.Gyelmo D. Bhutan struggles with local water shortages[Internet]. thethirdpole.nt.2016. [cited 2018 Aug 16]. Available:https://www.thethirdpole.net/en/2016/04/21/bhutan-struggles-with-local-water shortages/

72.Kusters K, Wangdi N. The costs of adaptation: changes in water availability and farmers' responses in Punakha district, Bhutan. International Journal of Global Warming. 2013;5(4):387. doi: 10.1504/IJGW.2013.057287

73.Hoy A, Katel O, Thapa P, Dendup N, Matschullat J. Climatic changes and their impact on socio-economic sectors in the Bhutan Himalayas: an implementation strategy. Regional Environmental Change. 2016;16(5):1401–15. doi: 10.1007/s10113-015-0868-0

74.Choden, K, Wangchuk, J, Yoezer, D, Wangdi, N, Wangchuk, S and Tenzin K. Climate Change Vulnerability Assessment in Kurichhu Watershed : A case of Gangzur. Bumthang: UWICER Press; 2018.

75.Tandoh-offin P. The evolving rural and urban interdependence : Opportunities and challenges for community economic development. Journal of Geography and Regional Planning. 2010;3(12):339–345.