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The park-people conflict in the Chitwan National Park with reference to the Asiatic one-horned rhinoceros (*Rhinoceros unicornis*)

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Natural Resources Management
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By

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Abstract

The lack of access to forest resources for the rural community residing in the buffer zones of national parks has created conflict between the national parks, the people residing in these areas and wildlife. People residing in the buffer zone of national parks incur losses due to the wildlife, which can impact both crops and human lives. This study focused on the attitudes, acceptance and knowledge level of people living near the park to explore the conflict between them and one of the endangered animals, the '*Rhinoceros unicornis'*. A questionnaire survey was randomly administered to 200 households in 16 Buffer Zone Village Development Committees and two municipalities of the Chitwan National Park. The survey represented two categories of households, those that were >2 Km and those that were <2 Km from the park boundaries. Socio-economic status variables such as tribe, education, occupation, household annual income, landownership and dependencies on the National Park forest and Buffer zone forest were used to interpret the results. The analysis of results showed a prevalence of negative attitudes that stemmed from (1) the distance: people living closer to the national park boundary reported rhino damaged the most crops near the national park; (2) a lack of compensation for crop losses; (3) indigenous people (e.g., *Tharus*) living closer to the National Park who traditionally have higher dependencies on the forest resources and (4) households with low income relying heavily on the forest resources of the National Park. However, the increase in the rhino population in the latest census showed an increased level of awareness among the park people living near the park. These findings were corroborated in this study because people emphasised the conservation of the rhino, which showed a positive attitude towards rhino. Ultimately, the impact of the rhino on human settlements and livelihoods and vice versa is an on-going conflict that needs to be resolved to preserve the existence of the rhino in Nepal's protected areas. The role of the government, the National Park authority, and different International and National government organisations are necessary to enhance the livelihoods of people surrounding the national park and to govern wildlife conservation.

Key Words: Park-People conflict, Conservation, National Park and Buffer Zone, Awareness.

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Ultimately, this research would not have been successful if my family had not given me this opportunity to come here, so my immense thanks goes to all of my family members. I would especially like to thank my father, Dipak Kumar Lamsal, and my husband, Bishowamber Khadka for their invaluable encouragement during my thesis.

List of Abbreviations & Acronyms

BZ	Buffer Zone
BZCF	Buffer Zone Community Forest
BZMC	Buffer Zone Management Committee
BZUC	Buffer Zone User Committee
BZVDCs	Buffer Zone Village Development Committees
CF	Community Forest
CNP	Chitwan National Park
DNPWC	Department of National Park and Wildlife Reserve
GPS	Global Positioning System
ha	Hectare
IUCN	International Union for Conservation of Nature
UNESCO	United Nations Educational, Scientific, and Cultural Organization
Km	Kilometre
KMTNC	King Mahendra Trust for Nature Conservation
m	meter
N/No.	Number
NP	National Park
NTNC	National Trust for Nature Conservation
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
VDC	Village Development Committees
WWF	World Wildlife Fund
PA	Protected Area

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Introduction

Background

According to the World Atlas of Biodiversity, an estimated 1.8 million species have been described to date, and conservative estimates indicate that there are approximately 12.5 million species around the world (Groombridge and Jenkins, 2002). Today's world is facing a global biodiversity loss and the extinction of different species from the earth. In regards to the challenges of conserving existing species, "Protected areas have been the critical tool to conserve biodiversity in the face of the global crisis of species extinction and the loss of the world's natural capacity" (Lopoukhine, 2008). The World Database on Protected Areas (WDPA) has recorded more than 100,000 protected areas (PAs) worldwide, which together comprise approximately 12% of the Earth's land surface, and conservation areas have been expanded more than 10 times over the last three decades. The global human population is increasing at an alarming rate, which will create an increased demand for natural resources. The protected areas are very important, but the growing human population will continue to place pressure on them and will increasingly threaten their resources. In places where there are no social safety nets, humans tend to place an increasing amount of pressure on ecosystem services and natural resources. The resultant additional pressures can damage ecosystem to a degree that increases the probability of conflict (Hassan et al., 2005).

The country Nepal occupies 0.1% of the total land area on Earth, but it is home to 2.7% of the flowering plants, 3.4% of the pteridophytes, and 5.1% of the bryophytes, more than 9.3% of the bird species, approximately 4.5% of the mammals, 1.6% of the reptiles, 1% of the amphibians and 1% of fish species worldwide (HMGN/MFSC, 2002). Therefore, Nepal must be regarded as a biodiversity hotspot. The effective conservation of wildlife in Nepal started with the establishment of the Chitwan National Park (CNP) in 1973. The park is situated in south central Nepal, which extends over 932 km² and is renowned for its variety and abundance of precious rare fauna and flora, and a rich cultural heritage (Mishra and Jeffries, 1991). United Nations Educational, Scientific, and Cultural Organization (UNESCO) declared the CNP a world heritage site in 1984. In 1996, an area of 750 km² surrounding the park was declared a buffer zone to balance biodiversity conservation and human needs through the devolution of

resource use rights to the local communities. The Department of National Parks and Wildlife Conservation (DNPWC) has gradually shifted its management efforts to address pertinent parks and people issues by introducing the concept of Buffer Zone (BZ) around the protected area. A portion of the park revenue is spent on biodiversity conservation and overall community development activities in the buffer zone (DNPWC, 2001). According to the Government of Nepal, 30-50% of the park revenues are spent on community development and natural resources management in buffer zones.

Three of the world's five rhinoceros species are found in Asia, one of which is the one-horned rhinoceros (*Rhinoceros unicornis*). Rhinoceros were once found across the entire northern part of the Indian sub-continent; however, presently they are restricted to Nepal and India and are designated as an endangered species in the IUCN red data book. The rhinos are primarily endangered due to hunting and poaching. In the past, big game hunters hunted them for trophies. Now, the horn is believed to have medicinal power, which has increased the value of the rhino on the international black market (Adhikari, 2002).

The people involved in poaching rhinos (*Rhinoceros unicornis)*, as well as tigers (*Panthera tigris)*, are traders, mediators or middle men and poachers (Adhikari et al., 1999). Usually, middle men are local people who are encouraged to kill the animals because locals are much more familiar with the activities of the park protection units. An analysis of cases filed in the CNP shows that more than 60% of the people involved in poaching live in the buffer zone or local areas. The second reason why rhinos are endangered in Nepal is because people modify the rhino's habitat for cultivation and grazing.

The main reason that conflicts arise between the local people and the park authorities is that government laws restrict access to the park resources in an attempt to halt natural resource utilisation (Sharma and Shaw, 1993). Many people in the surrounding villages of the CNP depend on agricultural activities in addition to rearing livestock. The losses in the yield of crops and livestock depredation are the problems observed in most of the Buffer Zone Village Development Committees (BZVDCs) caused by wild animals. Rhinoceros that live along the park border enter nearby

agricultural fields and raid crops, in addition to threatening human lives, which has created conflict between the local communities inhabiting the buffer zone and park management. It is estimated that rhinos and tigers kill eight to ten people annually, and approximately 50 % of the crops are damaged by wild animals in fields adjoining the buffer zone of CNP (UNESCO-IUCN, 2003). In the core area of the Padampur Panchayat and Madi Valley, three to five people are killed each year by rhinoceros and tigers; in addition, livestock are lost. Wild animals, including rhinoceros, cause crop damage that can reduce the total crop value by 10 % to 100 % (Milton and Binney, 1980). The most serious outcome of conflicts is the loss of life due to wild animals (Gurung et al., 2008; Löe and Röskaft, 2004; Packer et al., 2005). Retaliation to defend livestock and protect agricultural crops threatens the survival of wildlife that comes into conflict with humans (Mishra et al., 2003). The government needs to be more attentive, particularly regarding adequate compensation for human deaths and injuries to local people in the BZ (Martin et al., July 2008-June 2009). Thus, resource use patterns and interactions with wildlife and protected areas may influence the attitudes of people towards conservation (Harcourt et al., 1986; Newmark et al., 1994; Raihan Sarker and Røskaft, 2010). Understanding people's beliefs and attitudes towards protected areas is a key factor to developing successful management plans for long-term conservation of those areas (Allendorf, 2007). Therefore, frequent analyses of people's attitudes towards rhino conservation are essential for rhino sustainability.

Statement of Research Significance

The weak economy and a lack of financial opportunities have forced communities within the BZ to rely on the forest resources as a source of energy and income. This can threaten rhinos in two ways: by habitat fragmentation and by increasing the number of people entering the core area, thereby triggering rhino poaching activities (Lamsal, 2008).

The most notable threats to the CNP's biodiversity are poverty and unemployment. Among the large majority of the people that surround the park, there is a growing human population with no alternative sources of energy and employment opportunities that continues to encroach on park resources (KMTNC, 1996).

In this study, people living within the sixteen Buffer Zone Village Development Committees and two municipalities of the CNP were used as a case study. The main

objective of this study was to understand the attitudes of people living near the park towards rhino conservation with an emphasis on peoples' socioeconomic structures, their activities, and rhino frequency, and damage caused by rhino entering BZVDCs. It was hypothesised that there is a link between the socio-economic structure of the buffer zone community and their attitudes towards the rhino's conservation status.

Literature Review

Due to population growth, much of Nepal's land is degraded forest, which causes resource scarcity. Matthew and Upreti (2005) argued that rapid population growth and environmental degradation are key elements to what has gone wrong in Nepal. Therefore, human population growth must be addressed. Conflicts between people and wildlife in the peripheral region of national parks is a major conservation issue that occurs because of competition for resources (Limbu and Karki, 2006). Nepal and Weber (1995) identified five major causes of conflicts for people living near the park, including illegal transactions of forest products, livestock grazing, illegal hunting and fishing, crop damage, and threats to humans from wild animals in the CNP. To address this societal problem, a protected area-buffer zone management approach was proposed instead of a core focus (conventionalist approach) to maintain the integrity of the protected areas (Hjortsø et al., 2006). Maskey (2005) argued that buffer zone programs have not been able to include all the people in the planned development process, including special target groups. Budhathoki (2004) reported inconsistencies between the programmers and its policies and practices of the planned development process. The study by Bhandari and Uibrig (2009) suggested that the users in the buffer zone receive less benefit from community forestry than the users in the department of forests regimes. Their further analysis showed that poor households (HHs) received fewer benefits than the wealthier HHs in both regimes.

The human–carnivore conflict is a serious management issue that creates obstacles to conservation activities. Allendorf (2007) suggested some conservation strategies that can identify different positive and negative perceptions of people that reflect reality and the complexity of people's lives as key factors for sustainable management of PAs. Nepal and Weber (1995) study revealed that even though the local

people disliked the restrictions on for park resource use, they still had positive attitudes towards wildlife conservation.

The primary reason for the decline in wildlife in the Chitwan Valley was the resettlement of large numbers of hill people in the 1950's (Dinerstein and McCracken, 1990). A study by Yonzon (2000) found that the failure of ecological investigations to understand the complexities of species diversity, especially in mammals in the Chitwan, led to faunal collapse. The three model variations used by Rothely et al. (2004) showed that the rhino populations in the CNP were below the park's capacity and they further emphasised the importance of continued anti-poaching efforts in the CNP. The main reason for the rhino population decline in the CNP was the Nepalese Army's inability to patrol protected areas after they began fighting the Maoists in late 2001. As a result, the number of rhinos in and around the Chitwan National Park declined by 32% over five years (2000-2005) after decades of successful conservation.

Jnawali (1989) reported heavy economic losses in his study area because of agricultural depredation by rhinos within 500 meter (m) of the park. He further added that different human activities, such as the collection of fodder, fuel wood and the illegal grazing of animals and elephants used for tourism, were responsible for crop raiding and human harassment. A study by Poudyal (2005) examined the need for effective policy formulation to reduce poaching while, at the same time, alleviating poverty in the areas surrounding the CNP. As lower caste/ethnicity people who understood the needs of the poorest residing in the vicinity of the park were elected to senior positions on the Buffer Zone Management Committee and Buffer Zone User Committee, the local poor people began to support rhino conservation. At the same time, law and order was improved, and better anti-poaching units were created, which were the main reasons for a decrease in rhino poaching during 2008 and 2009 (Martin, 2010). Neupane (2007) revealed an inequality in biogas distribution between rich and poor HHs. Because poor HHs have neither sufficient cattle herds nor the required capital investment of (US $ 93, a cost that is already subsidized), to install a biogas plant, their only option is to go into the forest. However, no differences were found in fuel wood consumption between HHs with biogas and HHs without biogas.

Objectives of the Study

The objectives of this study are as follows:

1. To test the knowledge, attitudes, acceptance of and behaviour towards rhinos and their conservation issues among the people surrounding the CNP.
2. To test the impact of the rhino presence on the local people's opinion of its conservation status.
3. To test perceptions of the local people towards rhinos in relation to crop damage caused by the rhinos.

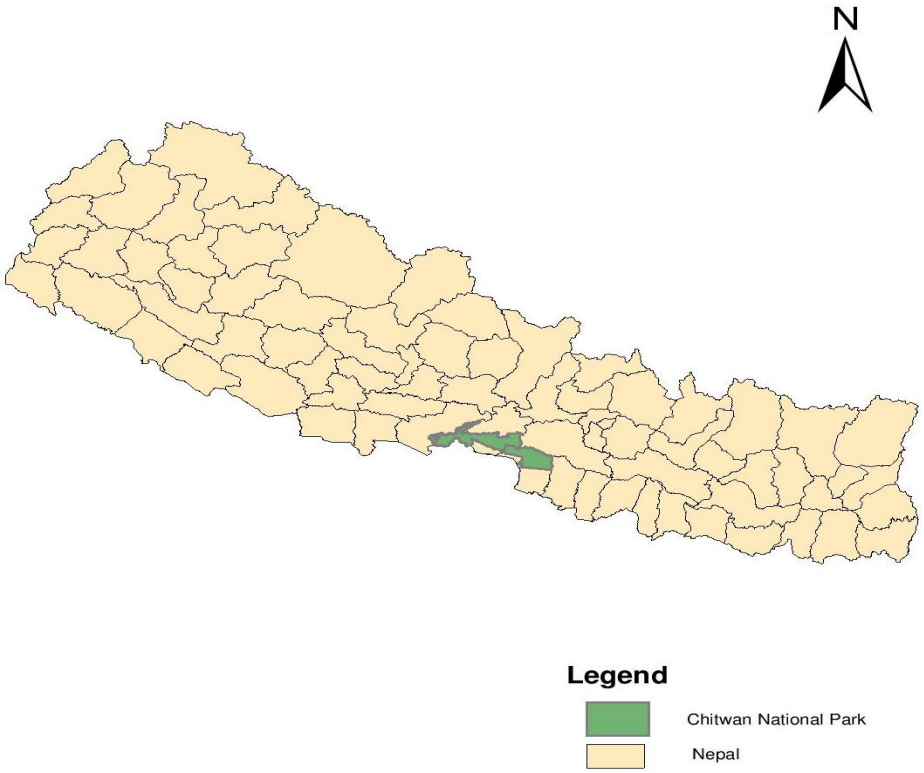
Predictions:

1. Within the BZ, the level of human-rhino conflict is highest in areas with the highest rhino densities.
2. Rhinos enter to BZ villages during the night and early morning.
3. The human-rhino conflict decreases with distance from the NP.
4. Ethnicity, education level, occupation, annual income and landownership affect attitudes towards the conservation of rhinos.

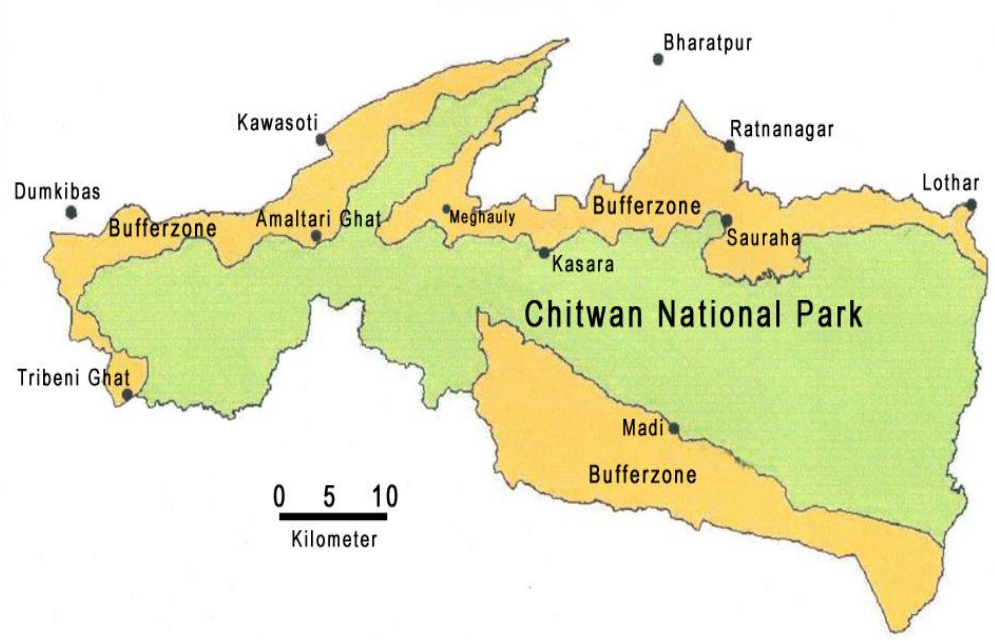
Methodology

Study Area

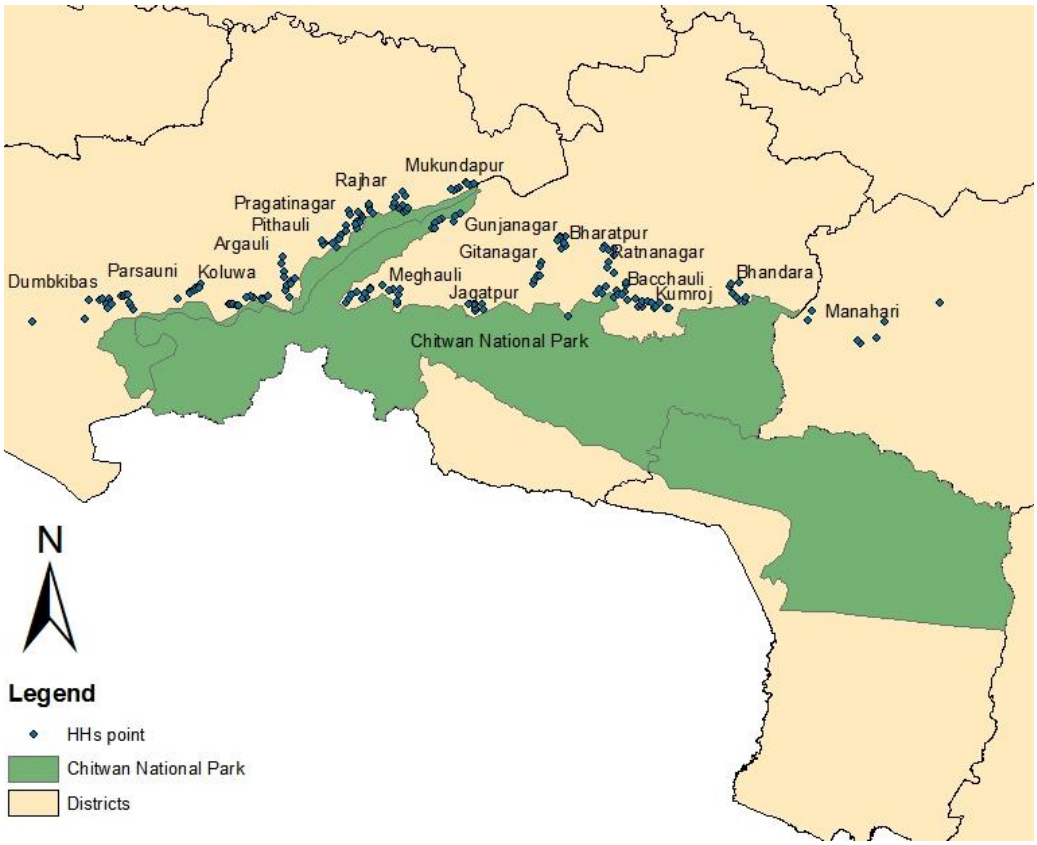
The study covers in total 16 BZVDCs and two municipalities representing three districts (i.e., Chitwan, Makwanpur and Nawalprasi) in the buffer zone of CNP (Map 1, Map 2).



Map 1: Study area- The Chitwan National Park



Map 2: The Buffer Zone around the Chitwan National Park



Map 3: Studied Households locations within the buffer zone of the CNP

Study Species

Rhinoceros unicornis (Photo 1) is listed as an endangered species on the IUCN Red List of Threatened species. The existence of rhinoceros in the CNP is considered the primary tourist attraction, generating a large amount of revenues to the park.

In the Chitwan Valley in Nepal, the rhinoceros population was estimated to be approximately 1000 animals until 1950. The eradication of malaria in the valley opened new settlements for outsiders and people from the mid hills, who were attracted by the highly fertile land.

Photo 1: ***Rhinoceros unicornis***

Because of this, large tracts of forestlands were cleared for settlements and agricultural expansion. These activities not only destroyed animal habitat but increased the illegal killing and poaching of animals, including the rhino. Within 10 years, the rhinoceros population dropped from 1000 to 100. Realising the rapid decline in the rhinoceros population, Nepal's Government declared the remaining prime rhino habitat of approximately 544 km^2 along the Rapti, Narayani and Reu rivers as the Chitwan National Park. Through the successful efforts of the Department of National Parks and Wildlife Conservation (DNPWC), the park was later extended to encompass a total area of 932 km^2. The establishment of the national park increased the rhino population to 270-310 individuals by 1975. From 1976 to 1983, rhino poaching virtually stopped, but in 1984, poaching increased again, as poachers became familiar with the park patrolling system. To address the problem a timely decision was made to form anti-poaching units and to provide rewards to informants to combat and control poaching. The estimated rhino population increased to 466 in 1994. Since 1994, the DNPWC has initiated the Rhino Count at an interval of 5 years in collaboration with the National Trust for Nature Conservation (NTNC) and the World Wildlife Fund (WWF) in Nepal. Because of increased anthropological pressure and external developments, the rhino-monitoring program became one of the major programs of the DNPWC in 1994. The program objectives are to count the number of rhinos to monitor population trends in the CNP, prepare a database of rhinos to describe their distribution in the park and assess the effects of poaching in the CNP. The estimated rhino population increased from 466 to 544 during 1994 to 2000.

An increase in rhino poaching in Nepal during the Maoist insurgency and the social unrest from 2000 to late 2007 reduced the rhino population (Martin et al. 2009). From 2001 to 2005, at least 101 rhinos were poached in and around the CNP (Martin 2006). Rhino poaching dropped in 2007 because of enforcement of the law (Martin et al. 2009). The rhino count conducted in 2008 showed 408 rhinos in the CNP, which increased to 503 rhinos in the latest rhino, count in 2011 (Fig. 1).

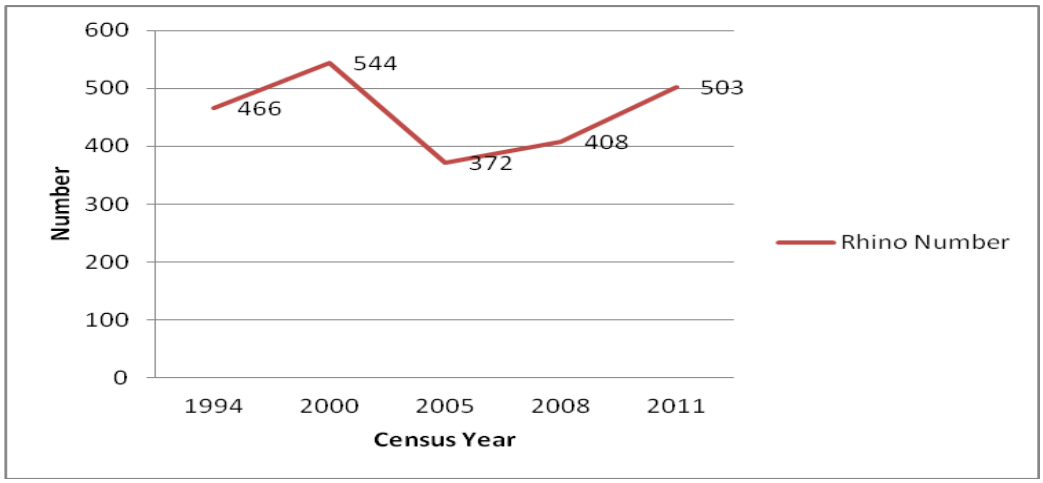


Figure 1: Rhino numbers in the CNP in different census years (source, DNPWC).

Questionnaire Survey

Altogether there are 35 Buffer Zone Village Development Committees (BZVDCs) and two Municipalities of the CNP. Of the BZVDCs, three VDCs are in the Parsa District, one VDC is in the Makawanpur District, 15 VDCs are in the Nawalparasi District and the remaining 16 VDCs including two municipalities are in the Chitwan District. The total number of individuals living in the buffer zone of the CNP was 300,000 in 2010 (IUCN, 2010).

This study examined 16 BZVDCs and two municipalities. Among the 200 HHs surveyed, 109 HHs are in the Chitwan District, 83 HHs are in the Nawalparasi District and eight HHs are in the Makwanpur District. The number of HHs surveyed in each of the BZVDCs and municipalities was selected randomly. Likewise, 39 % of the HHs are located within 2 Km of the park boundary, and the remaining 61 % of the HHs are located farther than 2 Km from the park boundary of the BZ.

In most of the cases, the head of family was interviewed. In the absence of the head of family, the information was collected from the adults present to obtain the real field scenario (on the basis of their experience and maturity). The participants were selected randomly. Face to face interviews were conducted using structured questionnaire. Socio-economic and demographic information, such as ethnicity, education, occupation, household annual income and land ownership which were used for the prediction of conservation attitudes, were obtained through open-ended

questions. The questionnaires that were used to obtain information on the Park-people conflict with one-horned rhinoceros are presented in Annex 1.

Because the people living in the buffer zone are dependent on the agriculture and livestock, this study collected information about their occupation, education, farm size, types of crops farmed, livestock reared, etc. In addition, the dependency of the people on the NP and BZ forest for different purposes and the damages caused by the interference of the wild life, especially the rhino were of major importance.

GPS as a Study Tool

Different HHs in the buffer zone of the CNP was the unit of this survey. The Global Positioning System (GPS) location was recorded for all HHs surveyed to indicate the distance of the HHs from the national park boundaries. My research focused on the park-people conflict, which is governed by the distance of human settlement from the national park boundaries and people's interaction with the park resources.

Data Analysis

Statistical Package for the Social Science (SPSS) windows version 18 was used for the statistical analysis. Variables such as the economic condition of the people living near the park, their daily activities, and crop damage due to wildlife (with special attention to the rhino), the frequency of rhinos entering into the village and people's attitudes towards rhino conservation were tested. People's perceptions about the park and rhino conservation based on their socio-economic condition and their distance from the park boundaries were tested using chi-square tests with a significance level of $p < 0.05$. A regression analysis was used to analyse the dependency of people living near the park on the national park forest and the buffer zone forest according to their economic condition.

Results

Socio-economic Survey

General Characteristics of the Respondents

To avoid gender bias, the survey was based on the availability of the household members during the field study. However, the proportion of male to female respondents represented was still male-biased (60.5% males, 39.5% females). To collect reliable information, the interview was performed with respondents above 18 years of age. This was done to reflect the respondent's insight on the subject matter (Table 1).

The respondents came from more than 10 ethnic groups, which were categorised into five major groups. The majority of the respondents belong to the Brahmin and Chettri (the immigrants from the hilly region of Nepal, 38 %) and the Tharu (the proper indigenous groups of study area 25 %) (Table 1). The majority of the respondents (87.5 %) had lived at their current residence for more than 10 years. Most of the respondents were lifelong residents (i.e. indigenous people, basically Tharus) and did not plan to migrate to another place. Very few (6.2 %) of the respondents were planning to move from their present residence, respondents in this group had lived in the area for less than 5 years (Table 1).

Almost half of the respondents had a primary level education (48.5 %), while 22 % had a secondary level education and very few had a university level education. The remaining were illiterate (Table 1). Twenty-two percent of the respondents were employed and the rest (78 %) were unemployed, but they were all involved in their household activities either directly or indirectly (Table 1).

Agriculture is the main source of food, income, and employment for the majority of the people in Nepal. In this study 97.5 % of the HHs' were dependent on agriculture related occupation, including livestock rearing, while few HHs respondents (2.5 %) were involved in business sectors (Table 1).

Table 1: Demographic and socioeconomic characteristics of the respondents

Category	Indicators	Number (N)	%
Sex	Male	121	60.5
	Female	79	39.5
Age group	18-30 years	32	16.0
	30-50 years	105	52.5
	50-80 years	63	31.5
Residence period	Late settlers (<5years)	11	5.5
	Middle settlers (5-10years)	14	7
	Early settlers (>10years)	175	87.5
Ethnicity	Brahmin/Chettri	76	38
	Indigenous Tharu	50	25
	Mongolian/Newar/Tamang/Magar	43	21.5
	Damai/Kami	16	8
	Bote'Fisherman'/Kumal/Chepang	15	7.5
Education	Illiterate	52	26
	Primary	97	48.5
	Secondary	44	22
	University	7	3.5
Households Occupation	Agriculture/Livestock	101	50.5
	Agriculture	12	6
	Agriculture/Livestock/Government/Others	79	39.5
	Business	5	2.5
	Agriculture/Labour Work	3	1.5
Annual Income (NPR)	<100000	65	32.5
	100000-300000	81	40.5
	>300000	54	27

Household Economy

Farm Size

In my study area, 68 % of the respondents owned less than 0.5 ha of land, while 32 % owned more than 0.5 ha of land. The annual income of respondents in relation to their land ownership is shown in Table 2. There are significant differences in the HHs annual income with different land ownership (χ^2 = 10.61, df = 2, N = 200, $p < 0.005$). The results showed that the majority of the respondents who owned < 0.5 ha land had an

annual income below Nepalese Rupee (NPR) 100,000 while the respondents who owned > 0.5 ha had an annual income between NPR 100,000 – 300,000 or above NPR 300,000 (Table 2).

Table 2: The annual income of HHs based on land ownership

HHs annual income	Landownership of HHs <0.5 ha N (%)	>0.5 ha N (%)	Total N (%)
<100000	53 (39 %)	12 (18.8 %)	65 (32.5 %)
100000-300000	54 (39.7 %)	27 (42.2 %)	81 (40.5 %)
>300000	29 (21.3 %)	25 (39.1 %)	54 (27 %)
Total	136 (100 %)	64 (100 %)	200 (100 %)

By comparing the survey regarding the livestock holdings with the annual income of the HHs, I came to find that HHs with a greater and more diverse number of livestock had a higher annual income.

A comparison between land holdings and livestock holdings showed that households with less land had more livestock (Fig 2).

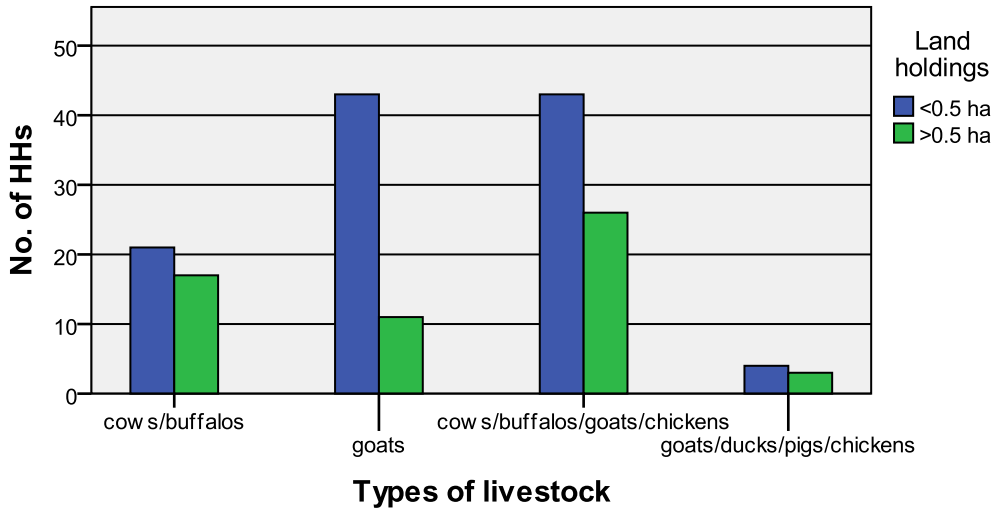


Figure 2: The relationship between land holdings and the livestock holdings

Rhino Occurrence/Crop Damage/Animal Depredation/Hunting and Poaching

Crop raiding was an important issue in the study areas. Almost two-fifths (38.5 %) of respondents reported crop damage by different wild animals from the NP, whereas the remaining respondents reported no damage. Among the reported wild animals causing crop damage, the rhino was reported the most < 2 km from the NP boundary (Table 3).

Table 3: Crop damage by wild animals based on distance from the park boundaries

Respondents response for crop damage		HHs distance from NP	
		<2 km N	>2 km N
Animals responsible for crop damage	Rhinos	32	14
	Wild Boars and Others	13	8
	Rhinos and Wild Boars	2	0
	Rhinos and Elephants	4	0

The species that were responsible for crop damage differed significantly between the three buffer zones, but rhinos were reported to cause the most damage in all areas, with the highest damage reported in the buffer zone of the Nawalparasi district. Overall, wildlife interference with domesticated animals was not severe in the buffer zone areas. Only 3.5% of HHs reported animal depredation. Those were the cases in which domesticated animals such as chickens, ducks, goats, pigs, cows and buffalos, were injured and killed by wild animals, such as the tiger (*Panthera tigris*), leopard (*Panthera pardus*), jackal (*Canis aureus)* and python (*Python molrus).*

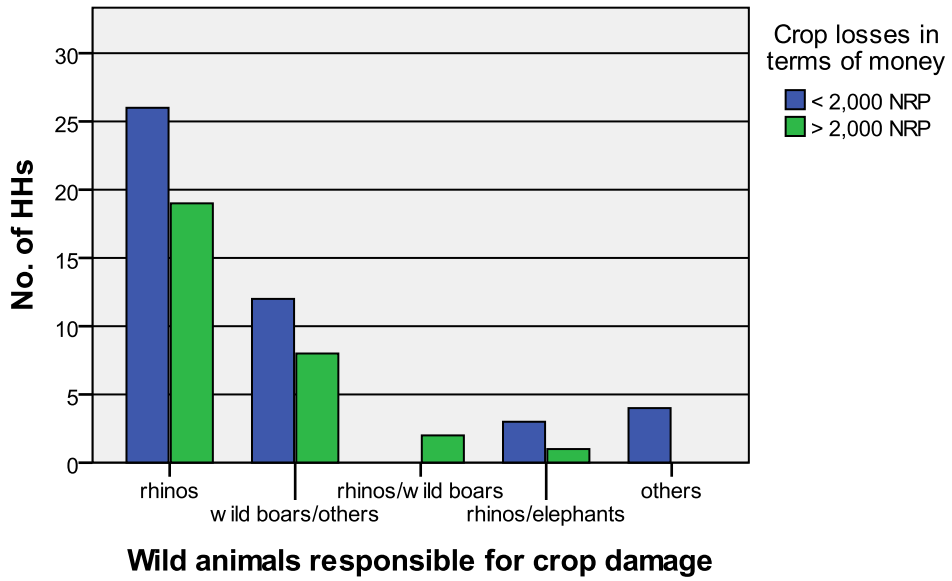


Figure 3: Wild animals responsible for crop damage within 3 BZ districts

Overall, the najority economic losses due to crop damage was caused by rhinos (Fig. 3). Wild boars (*Sus scrofa*) caused the next greatest amount of damage to crops (Fig. 3). However, only 4% of the respondents received compensation for their losses and they were not happy with the amount of compensation they received because it did not fully cover their losses.

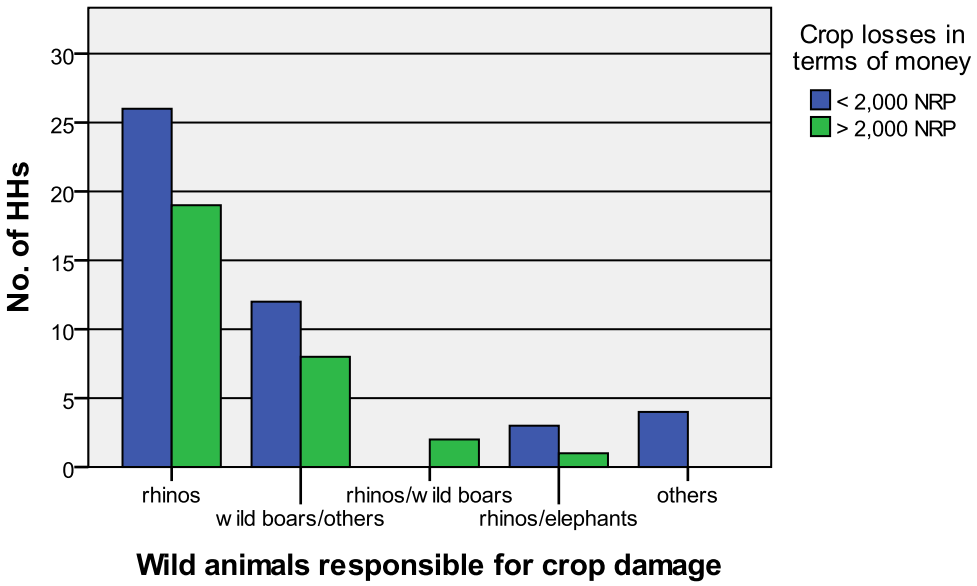


Figure 4: Wildlife responsible for crop losses in terms of money

Rhino frequency in Buffer Zone of the CNP

Among the respondents, 62.5 % reported the presence of rhinos outside of the NP, and more than half of the respondents (55 %) reported that the rhinos were most frequently in the village during the night. Very few respondents (6.5 %) reported that rhinos were nearby in the evening (Table 4).

Table 4: The time period for rhino occurrences in BZVDCs

Rhino occurrence in BZVDCs	Frequency	Percentage (%)
Evening	13	65
Night	110	55
Don't know	77	38.5
Total	200	100

In regards to the study area, respondents living in the Ratnanagar and Bharatpur municipalities along with the Kumroj and Gitananagar VDCs of the Chitwan Districts reported that rhinos do not come out of the National Parks. However, rhino frequency was highest in the Chitwan Districts of Gunjanagar, Bhandara, Jagatpur and Meghauli and in the Nawalparasi Districts of Koluwa, Parsauni, Dumbkibas, Rajhar and Argauli. The respondents in the other two study areas, Pragatinagar and Mukundapur (VDCs of the Nawalparasi District) reported a low frequency of rhino in the village compared with previous years.

Rhino Hunting and Poaching

Photo 2: Poaching in CNP

In response to the question asked about rhino hunting and poaching, only 7 respondents answered that rhino trading, hunting and poaching were still prevalent in the VDC. Respondents added that these activities were at a medium scale compared to the previous 3-4 years.

Benefits of the CNP and the Buffer Zone Community Forest (BZCF)

Benefits of the CNP

The findings of my study revealed that a high proportion (60 %) of respondents don't know whether park revenues are spent on village development. Fifty percent of the respondents were unfamiliar with the skill-generating opportunities officially provided by the NP. One fifth of the respondents were dependent on the National Park's forest for various resources (Table 5).

Table 5: Benefits of the Chitwan National Park

Category	Response	Frequency	% of Respondents
Park revenue	Yes	48	24
	No	32	16
	Don't Know	120	60
Skill-generating opportunity	Yes	25	12.5
	No	73	36.5
	Don't Know	102	51
Forest products and building materials	Yes	82	41
	No	101	50.5
	Don't Know	17	8.5

Table 6 shows the types of forest products used by respondents according to their residences' distance from the park boundary. Nearly half of the respondents are still dependent on the forest products of the NP.

However, the results of the chi square test (χ^2 =0 .425, df = 4, N = 200, p = 0.980) revealed that there are no significant differences in the types of forest products used by respondents living within 2 km of the park boundary and those living farther than 2 km from the boundary, even though the majority of the users live within 2 km from the NP boundary.

A step-wise linear regression analysis examining variations in the response of respondents towards the use of the NP as the dependent variable was tested with five independent variables (Table: 9), of which only two contributed significantly to the variation. The variable explaining the most variation was the tribe of the respondents, followed by the HHs annual income.

Table 6: Types of forest products used by respondents according to distance

Types of forest products	HHs distance from NP boundary		
	<2 km N (%)	>2 km N (%)	Total N (%)
Fodder	14 (23.7 %)	9 (24.3 %)	23 (24 %)
Fuel wood	7 (11.9 %)	6 (16.2 %)	13(13.5 %)
Fodder and fuel wood	26 (44.1 %)	15 (40.5 %)	41(42.7 %)
All purposes	12 (20.3 %)	7 (18.9 %)	19(19.8 %)

Benefits of the BZCF

The majority of the respondents (76.5 %) indicated that they depend on the buffer zone forest to fulfill their demand of fuel wood and fodder. Furthermore, 21 % of the respondents replied that they do not use resources from Buffer Zone Community Forest (BZCF) (Table 7). In the case of skill-generating opportunities provided from Buffer zone management committee (BZMC), almost equal numbers of respondents answered yes or no, whereas some of them did not know about the opportunity.

Table 7: Benefits of the Buffer Zone Community Forest

Category	Response	Frequency	% of Respondents
Forest Products and Building Materials	Yes	153	76.5
	No	42	21
	Don't Know	5	2.5
Skill-generating Opportunity	Yes	76	38
	No	82	41
	Don't Know	42	21

Regardless of their distance from the NP boundary, 77 respondents stated that they like the NP for its forest products and, similarly, 60 respondents stated that they were attracted to the NP for forest products, the green environment and employment. Respondents living near the National Park (<2 km from the park boundary) were also attracted to the park for employment and other purposes (fishing and tourism) (Fig 5).

However, one fourth of the respondents answered that they did not know about the important parts of the NP.

Compared to the respondents living farther (>2 km) from the park boundary, the people living near the park boundary (<2 km) disliked the NP because of the loss of life and property due to wild animals because of the limited access to park resources. One third of the respondents, regardless of their distance from the park boundary, indicated no reason to dislike the park, which showed a positive attitude of the NP (Fig 6).

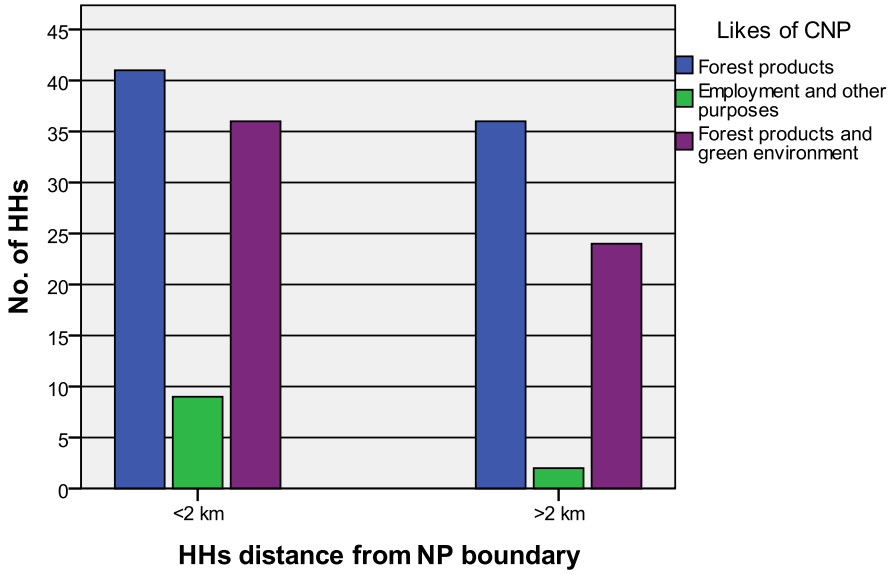


Figure 5: Reasons why people like the National Park

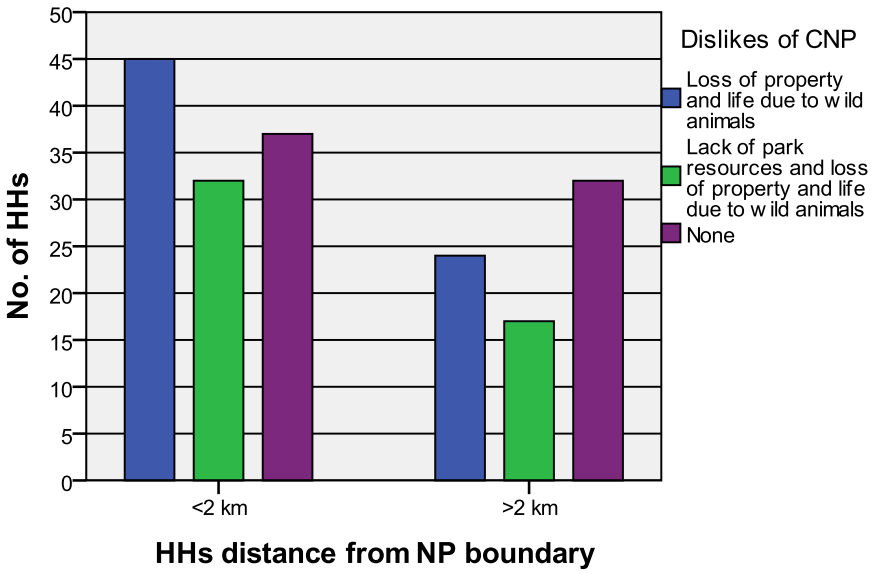


Figure 6: Reasons why people dislike the National Park

Respondent Involvement/Relationship with the BZMC and CNP

Respondent Involvement in the BZMC

Out of the 200 respondents, only 5 respondents were directly involved in the buffer zone management: three were members of the BZMC and one was a Secretary, and another respondent was the vice president of BZUC. Almost 80% of the respondents reported that they were involved in buffer zone management as a general member of the Forest User Group. This membership is mandatory to extract the forest resources of BZVDCs.

Respondent's Relationship with the CNP and BZMC

The majority of the respondents (78 %) had a good relationship with the BZMC, 6 % of the respondents had a bad relationship, and the remaining (16 %) were unsure of the status of their relationship with the BZMC. Similar, 52.5 % of respondents had a good relationship with the CNP, and 44.5 % of respondents were unaware of the status of their relationship with the CNP.

Peoples Perception's towards rhino conservation

The perception of people towards the rhino was assessed based on the socio-economic status of the people living within a certain distance of the park boundary (Table 8).

Table 8: The percentage of respondents stating their socio-economic status in relation to their distance from the park boundary

Socio-economic status of HHs		HHs distance from NP boundary		Total	χ^2	P	df
		<2 km	>2 km				
Tribe of Respondent	Brahmin/Chettri	29.5 %	51.3 %	38.0 %	14.15	0.007	4
	Mongolian/Newar/ Tamang/Magar	27.9 %	11.5 %	21.5 %			
	Tharu	24.6 %	25.6 %	25.0 %			
	Damai/Kami	8.2 %	7.7 %	8.0 %			
	Bote/Kumal/Chepang	9.8 %	3.8 %	7.5 %			
HHs Education	Illiterate	28.7 %	21.8 %	26.0 %	1.17	0.556	2
	Lower education	46.7 %	51.3 %	48.5 %			
	Higher education	24.6 %	26.9 %	25.5 %			
HHs landownership	<0.5ha	67.2 %	69.2 %	68.0 %	0.089	0.765	1
	>0.5ha	32.8 %	30.8 %	32.0 %			
HHs annual income	<100000	27.9 %	39.7 %	32.5 %	3.24	0.197	2
	100000-300000	44.3 %	34.6 %	40.5 %			
	>300000	27.9 %	25.6 %	27.0 %			

From the chi-square test results in (Table: 8), it is apparent that there are significant differences between the tribes living within a certain distance of park. Most of the Brahmin/Chettri tribe, who migrated to this area from the hills, lived >2 km of the NP boundary, whereas the majority of the people who are considered indigenous to the study area lived near the park (<2 km). However, there was no significant difference between HHs annual income, education or land ownership and the distance from the park boundary.

Out of 200 respondents, only 2 respondents answered that they do not care about the conservation of the rhino. Regarding rhino value, 78 % of respondents considered the rhino to have ecological value and to contribute to biodiversity, regardless of their distance from the park boundary. The remaining respondents indicated that the rhino had a recreational value. The value of the rhino varied significantly between the tribes

(χ^2 = 10.6, df = 4, N = 200, $p < 0.05$). Similarly, the value of the rhino varied significantly between the educational statuses of the respondents. More than half of the respondents who were illiterate answered that the rhino had a recreational value, whereas the majority of the respondents who had attained a primary or higher education understood ecological value of the rhino and its contribution to biodiversity (χ^2 = 21.48, df = 2, N = 200, $p < 0.05$). However, there were no significant differences in the respondents' perception of the rhino based on land holdings by HHs (χ^2 = 0.089, df = 1, N = 200, p = 0.76). Additionally, there was no significant difference in the response to the value of the rhino based on crop damage (χ^2 = 0.62, df = 1, N = 200, p = 0.43 or based on the HHs annual income (χ^2 = 4.01, df = 2, N = 200, p = 0.134). The linear regression analysis for the perception of whether wildlife species cause crop damage at the respondents' farms was tested with respect to the five demographic variables (Table 9). The regression analysis showed that education and land ownership were the two most significant predictors of the variation in perceptions.

Table 9: Results of the linear regression with the perceptions of respondents as the dependent variables in relation to the various independent variables (t = t-value, p = probability)

Independent Variables	Use of the National Park		Crop raiding by wild animals	
	t	P	t	P
Tribe	-3.32	0.001	0.789	0.431
Education	-0.40	0.683	2.19	0.29
HHs landownership	-1.59	0.113	-2.12	0.035
HHs annual income	1.59	0.112	1.02	0.308
Distance of respondents homes from park boundary	1.51	0.133	1.843	0.067

Eighty-five percent of the respondents answered that the rhino is a dangerous animal. However, respondents indicated that strict rules and regulations and more incentives for the local villagers were the best measures to reduce rhino hunting and poaching (Fig. 7).

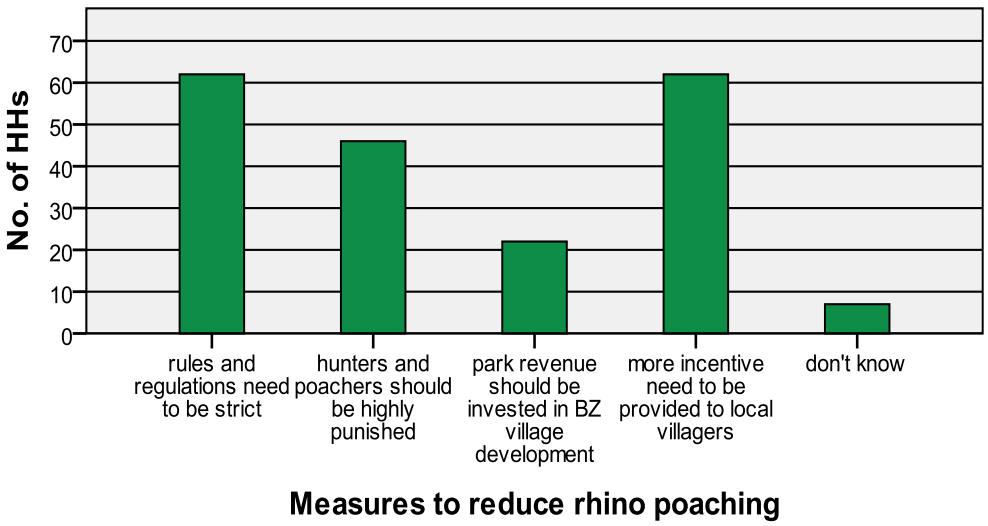


Figure 7: Measures to reduce rhino hunting and poaching

Discussion

Socioeconomic Condition

The prevalence of social inequality in Nepalese society is comprehensive and includes the disparity of access to livelihood resources, government services, and economic opportunity. Social inequality has caused great resentment among the groups at the bottom of the social hierarchy, who are typically the poorest and least educated members. The Buffer Zone comprises populations from various ethnic groups with various socio-economic statuses. The majority of respondents in the study area belonged to the Brahmin and Chettri (the hill migrants) tribes. Tharus (the indigenous) tribe, which has been settled in the study area for more than 10 years and, on average, holds more farm land compared to Damai/Kami and Bote/Kumal/Chepang tribes, which were represented by low percentage of respondents and had small land holdings, similar to results from a study conducted (Paudyal, 2007) on the Piple BZVDC of CNP. The indigenous tribe (Tharus), and the Damai/Kami and the Bote/Kumal/Chepang tribes reside closer to the National Park. The study further showed that the tribes with more land holdings had a greater annual income. In this study almost 70 % of the respondents had a less than 0.5 ha of land. Farmers holding small pieces of land (< 1 ha) are typical residents of the park (Milton and Binney, 1980). The occupations adapted by majority of the respondent were agriculture and livestock rearing including some others occupations, such as governmental services, business etc.

The majority of the population in the study area was literate, but only had a primary level of education. In the study, the education status of respondents was one of the important factors that determine the attitudes of respondents towards the NP and the rhino conservation. The study reported no significant differences in the attitudes towards the use of the NP or the likes/dislikes of the NP related to education status. However, education played a large role in determining the value of the rhino: educated respondents emphasized the ecological and biological value of the rhino, while uneducated respondents only recognised the recreational value of the rhino.

The average family size within the study area was 5.78 individuals, which is higher than the national average of 4.7 (CBS, 2011). This is most likely one of the

major factors indicating why the people living in the buffer zone rely upon subsistence agriculture and livestock rearing.

Rhino Occurrence, Crop damage and Conservation

Riverine forests and grasslands are prime rhino habitats and are continuously decreasing in size due to increasing deforestation by humans seeking fodder and fuel wood. The respondents reported that rhinos were one of the animals that frequently visited the BZVDC, and rhinos are known to cause the most damage to crops. More than half of the HHs reported rhino a high frequency of rhinos inside the buffer zone areas at night. The previous study showed that rhinoceros are most likely to enter a field between 12 a.m. and 4 a.m. (Laurie, 1978). People living more than 2 km from the NP boundary do not experience as much rhino damage as the people living within 2 km of the NP boundary. Most of the HHs reported rhino visits in the BZVDC during almost all seasons. The crop damage (by the rhinos) for respondents with <0.5 ha land holdings was higher than the damage for respondents with >0.5 ha of land holdings and, according to the respondents, the rhino caused 100% of the damage once they entered the BZVDC. Despite the problems experienced by rhinos, almost all respondents, including small land holders with a low annual income, replied that rhino conservation is important. At the same time, the respondents who had experienced crop damage were in favour of compensation. Some respondents indicated that even though there is a provision for compensation from the NP authorities, very few respondents received compensation, and those who did indicated that it was not sufficient to cover their losses. A compensation policy is not a good solution for wildlife damage because it discourages people to protect their crop from the wildlife (Wagner et al., 1997). Alternative ways to compensate the villagers include raising their economic status through community development, employment opportunities and education. All respondents mentioned that rhinos in the study had not affected humans. More than half of the respondents suggested that poaching was the main reason for the decline in the rhino population. Though, Nepal is not a major consumer of wildlife parts, poachers use its territory as a transit point for illegal trade in China and India. Others reasons for the decline in the rhino population include habitat loss and natural death. In some of the BZVDCs, such as Megauli, Argauli and Parsauni respondents reported some local involvement in rhino poaching; however, they hesitated to provide the names and

addresses of the poachers. Most of the respondents suggested strict rules and regulations and incentives for the development of the buffer zone village as measures to protect rhinos. Other alternative given for rhino conservation includes punishment for illegal hunting and poaching, increasing awareness, fencing, better security from the NP, habitat improvement, strict management, use of electric fence to deter crop damage, forestation in buffer zone and income generating activities for local people.

The Buffer Zone Community Forest and the National Park

The forest is the principle source of fuel wood in Nepal, and fuel wood represents 78 % of the total fuel consumption. In the rural areas, wood consumption exceeds 94% of the total fuel consumption, thereby causing excessive depletion of the forest area (WECS, 2006). The amount of forest wood needed to support a household's livelihood and the amount of land the household owns play vital roles in the acceleration of environmental degradation at the buffer zone. If properly maintained and used BZCF can effectively serves as the main source of fuel wood and fodder for the buffer zone community and also acts as a barrier against floods during monsoon. Almost all of the HHs obtain membership to the BZCF to access the forest resources. To minimise the dependencies on the BZCF and the NP, the use of alternative energy sources are important. However, due to a limited budget for providing subsidies to install biogas, the number of bio-gas plants used was limited, and only wealthy people were able to afford them (Lamsal, 2008). This study showed that only 11% of the respondents used biogas. Access to the different sources of energy varies between tribes, the Brahmin, Chettri, Newar and Magar have access to other alternative energy sources, such as LPG, biogas and electricity, but Tharu, Damai, Kami and Bote tribes, which represent nearly half of the respondents, are totally dependent on fuel wood. The traditional cooking method using fuel wood is prevalent in Nepal due to the lack of access to alternative energy. Heavy fines are not enough to stop the illegal extraction of park resources in the absence of alternatives. Both large and small landowners use the forest resources of the NP for fuel wood and fodder, although large farm HHs has a higher income and more access to alternative energy sources. Respondents from the Nawalparasi buffer zone districts extract more forest resources from the NP compared to the Chitwan and Makwanpur buffer zone districts. Those residents who extract resources from the National Park Forest say that the ‘buffer zone community forest is not sufficient for the buffer zone

resident's people'. Some HHs suggested legalising drift wood collection from the Narayani River during flooding, which could help to meet firewood and timber needs. The park administration provides skill-generating opportunities to local people periodically to enable them to be independent. Heinen (1990) reported that people who completed small-scale tourist guide training from the National Park administration were unable to find jobs after completion of the training. Likewise, the park administration launched education and awareness programs but very few respondents knew about those programs. The 30-50% of the revenue that is generated from tourism is invested in the development of the buffer zone areas, which includes the development of infrastructure such as roads, schools and irrigation canals etc. Similarly, the buffer zone management regulations help the buffer zone user group find alternative livelihoods and better opportunities to reduce the pressure on biodiversity and improve conservation. Examples include vegetable farming, beekeeping, animal husbandry (poultry, goats and pigs), handicrafts, and hotels and nature tourism. The BZUC also provides skill-generating opportunities to improve the economic conditions of the local people and reduce their dependency on the forest. However, these capacity-building opportunities are captured by the higher racial tiers of the community, such as members of the Brahmin and Chettri tribes.

People's Perceptions towards Rhino Conservation

The attitudes of people towards conservation can be assessed in relation to their socio-economic condition (Nepal and Weber, 1995). The distance of a residence from the NP boundary in relation to different socio-economic factors explained tribe as a significant factor affecting the use of the NP. Ignoring the indigenous people and other poor peoples' subsistence needs for fuel wood, fodder and their protection from wildlife depredations causes conflicts between the park and people. The majority of the indigenous people of the CNP, including the Tharu tribe, as well as others poor people such as the Bote, Majhi, Chepang and Kumal tribes living closer to the park (< 2 km) are significantly dependent on the extraction of resources from the park's forest, grasslands and rivers (McLean and StrÆDe, 2003). This study showed low crop damage for the HHs living far from the NP boundary in compared to those living close to the NP boundary. Similar results were found by Sarker (2011). Similarly, the education status of people affects their perception of the rhino's value. The positive

attitudes of respondents towards rhino conservation increases with an increased level of education (Fiallo and Jacobson, 1995). Most of the illiterate respondents recognised the recreational value of the rhino, whereas those respondents who had obtained at least a primary education recognised the ecological value of the rhino and its contribution to biodiversity. The majority of the respondents classified rhinos as a dangerous animal. Despite their fear and the amount of crop damage caused by the rhino, people still have a positive attitude towards the rhino conservation.

Conclusion and Recommendations

Conclusion

Indigenous people with traditional ways of life that depend completely on forest resources live in the vicinity of the park. The buffer zone forest alone is insufficient to meet the fuel wood and fodder demand of the HHs. Almost half of the respondents were still dependent on the NP forest resources, regardless of their distance from the park even though stripping wood from the NP forest has been illegal for more than 30 years. The attitudes of people living nearer to the NP boundary are negative towards rhinos because rhinos are responsible for the majority of their crop damage. Additionally, compensation for losses has not been provided by the NP authorities. The majority of the respondent owns a small amount of land and is considered typical farmers with a low annual income, causing their higher dependency on the NP forest resources which is the rhino's habitat. Due to the impact of rhino on the human settlements and livelihoods and vice versa, there is on-going conflict regarding this issue between the surrounding locals and the park authorities. Despite this conflict, the rhino count in the CNP is growing. This can be accredited to the awareness among local dwellers about the value of rhino. For the increased awareness about the rhino importance, the NP authorities as well as different civil society organisations, should be acknowledged.

Recommendations

- To control the dependency of the local people on the NP resources, their livelihood needs should be adequately addressed. By reducing the dependency of the local people on the NP, the rhino habitat will be preserved from degradation.
- Instead of compensation measures, more skill development and income generating opportunities should be provided, with special attention to minority' tribes from the BZVDCs to develop the community as a whole.

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Appendices

Annex: 1 Questionnaire

1. Questionnaire No:

2. Interviewer:

3. Date:

4. Household GPS Position:

5. Household information

a. Respondents gender:

b. Place of birth (and age):

c. Tribe:

d. Have you immigrated to this village? Yes/No, if yes what is the distance from the place of origin?

6. How long have you lived in the village? >5yr, >5to 10yr, >10yr

7. Do you consider moving to other village? Yes/No

8. Education and levels: No education ( ), Primary ( ), Secondary ( ), University ( ).

9. Household members and composition. How many members are there in your family?

Gender	**Number**	**Adults (18 yrs≥)**	**Youth (11-17yrs)**	**Children (6-10yrs)**
Males				
Females				
Infants (0-5yrs)				

10. Are you employed or not? Yes/No

11. Household Activities and Annual Income of Last Year

Activities	Annual Income (Last Year)
Agriculture	
Livestock	
Business	
Government Office	

Land Ownership:-

12. How much of the land do you own?

Bigaha……Kattha:……Dhur:……Ha:……

Note:- Bigha, Kattha and Dhur Nepali unit to measure land except Ha=Hectare,

13. Do you cultivate your own all land? Yes/ No

14. How much of land do you hold as tenure land from others?

Bigaha:…….Kattha:……Dhur:……Ha:……

15. What type of crop do you grow?

a. Food crops
b. Cash crops
c. Vegetables
d. Oil seeds
e. Others (Specify)

16. Do you have any crops destroyed by wildlife in last 12 months? Yes ( ) No ( ). If yes, what crops and what loss did you get?

Crops destroyed by Wildlife	Problem animals	Estimated Annual cost

Livestock

17. Do you own livestock? Yes ( ) No ( )

If yes, types of Livestock owned,

a. Cows/Buffalos
b. Goats
c. Pigs
d. Chickens
e. Others (Specify)

18. Did you have any domestic animals killed, injured or affected by wildlife in last 12 months? Yes ( ) No

Domestic animals	**Predators**	**Problem types**	**Animals Killed (Last 12mth)**

National park uses

19. Do you use National Park for fodder/fuel wood or timber? Yes/No

20. If yes what do you collect from National Park?

a. Fodder
b. Fuel wood
c. Timber
d. Medicinal Plants
e. Others

21. Do you have biogas plant in your home? Yes/No

Buffer zone Management

22. Have you been involved in Buffer zone management? Yes/ No

23. If yes, what is your status (Position) in Buffer zone management council, User Council, User Group?

Group	Status	If any other member of family (Relation with respondent)

24. Did you involved in buffer zone management in past? Yes/ No

25. If yes, what was your ex-status?

26. Do you want to join/continue to participate in buffer zone management? Yes/No

27. What is your relationship with Buffer zone committee and Buffer zone user group? Good /Bad /Not Aware

28. What is your and your family member's relationship with Chitwan National Park? Good /Bad /Not Aware

29. What is your and your family member's relationship with investors? Good /Bad / Not Aware

Benefits from Chitwan National Park

30. What benefits do the households receives from Chitwan National Park?

Series	Indicative benefits	Ranking		
1	Park revenue for village development	Yes	No	Don't know
2	Skill generating opportunity			
3	Forest products and building materials			

31. What benefits do the households receives from Buffer zone Village development committee?

Series	Indicative benefits	Ranking		
1	Forest products and building materials	Yes	No	Don't know
2	Skill generating opportunity			

32. What things you like and dislike about Chitwan National Park?

Series	Likes	Dislikes
1	Forest products	Loss of property and life due to wild animals
2	Employment	Lack park resources
3	Others	Others

33. Do you know anybody arrested because of illegal grazing and illegal hunting? Yes/No, If yes where?

Name of Place:-

34. What kinds of animals have been hunted and poached in which areas

Animals	Areas
	Inside Park
	Outside Park
	Within Village
	In both (Inside and outside Park)

Rhino related Issues

35. Does wildlife animal come outside of the National Park?

Yes/ No/ don't know

36. Please provide the coming frequency of rhino?

a. Morning
b. Day
c. Evening
d. Night.

37. How many months a year do you face crop damage by rhino?

>3 / <3 to 6< / >6 month

38. Crop damage caused by rhino

Time of Damage			
Morning	Day time	Evening	Night

39. How much compensation do you get for crop damage? Not/Little/Lot

40. Are you satisfied with the compensation? Yes, No, Don't Know

41. Do you know any households or any cases of rhino poaching and hunting in your village? Yes/No

42. Are there any cases of rhino horn trade, poaching and hunting yet in your VDC? Low/ Medium/High

43. What should be done to reduce rhino poaching?

a. Rules and regulations need to be strict
b. Hunters and poachers should highly punished

Snapshots:

Photo 3: Researcher busy on questionnaire survey

Photo 4: Researcher busy on tracking GPS Location