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Tiger conservation and its feasibility analysis in Nepal

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Abstract: Tiger range and numbers have collapsed despite of substantial conservation efforts, so conservation efforts must prioritize regions that have good feasibilities to harbor tigers. This review paper addresses the possibility of tiger conservation in the Chitwan National Park (CNP), Nepal considering social, ecological and management aspects. The social aspect especially tiger-human conflict and people's attitude towards tiger conservation at CNP area is in vulnerable condition. Government Acts and legislation for tiger conservation are favorable but the execution level of these seems to be problematic. The review analyzed that ecological aspects such as prey availability and population dynamics are very positive for conservation of tiger and the tiger will not be a threat animal for maintaining the optimum density of wild prey populations at CNP area. The review also evaluated that Buffer zone management and engaging 'Bag Heralu' with other guarding system should be able to reduce the tiger-human conflict in a significant manner. Indeed, the compensation for losses of cattle or human life of the local community is not sufficient and it will need more attention from the top level. Therefore, the management and ecological analysis would be good for tiger conservation at CNP while social aspect needs to improve for sustainable conservation of tiger in Nepal.

INTRODUCTION

The tiger (*Panthera tigris*) ranged widely throughout the Asia, including the Caspian region in the west into Indian subcontinent, the far east of Russia, southeast Asia and the Sunda Island before the turn of 20th century. Of the eight tiger subspecies found in the world, the Royal Bengal tiger (*Panthera tigris tigris*) is found on the Indian sub-continent (e.g. Nepal). This subspecies accounts for approximately 60% of all the subspecies remaining in the world today; it, therefore, has the best chance of long-term survival (Tiger Conservation Action Plan for Nepal report 2007). While Sanderson et al. (2006) reported that tiger may have vanished in as much as 40% of their remaining habitat in last 10 years. Tiger population sharply declined during the 20th century due to habitat destruction and fragmentation, spot hunting, and eradication of problem tigers by various means [2]. In the earlier days tigers were spread out through the lowland Terai and the foothills of Nepal. Within a decade, forests and core habitats of tigers were diminished and the animal was on the verge of extinction [3]. To overcome this crisis the government of Nepal endorsed the National Park and Wildlife Conservation Act at 1973 and Royal Chitwan National Park (CNP) was the first protected area established under this act in 1973[4]. This review paper mainly deals with feasibility analysis of tiger conservation at CNP of Nepal and the main question of this study: Is it possible to conserve the tiger population and its habitat in CNP? To answer this question there are several sub question that need to be solved. The sub questions are- what are the legislation and policy of Government towards tiger conservation? Are the local communities accepting the tiger conservation program? Is the ecology of the tigers

favorable for its natural conservation process? What are the management strategies of tiger conservation in CNP and are they sufficient to conserve tiger or not? Different sections of this article deals with the existing answer of the above questions.

DESCRIPTION OF THE STUDY AREA

Tiger is now endangered species of the world and the Bengal tiger of South Asia in one of the red listed wild animal of the IUCN. CNP is located at the South central part of Nepal (27° 20' 40" N to 83° 82' 45" E), which is category II (National park) according to IUCN. The total area of CNP is about 93,200ha where the buffer zone covers 76,700ha and this park is managed by the Department of National Parks & Wildlife Conservation (DNPWC) under the ministry of Forest & Soil Conservation of Nepal.

SOCIAL ASPECTS

Legislation and Government policy

In 1973, Nepal introduced the National Park and Wildlife Conservation Act 2029 (NPWCA) and it provided legislation for the protection of areas only. According to Heinen and Kattel (1992), in section 2 of this Act it classifies protected areas into four categories -*National Park*: An area set aside for conservation, management, and utilization of mammals, birds, vegetation, and landscape together with the natural environment, *Controlled (Strict) Nature Reserve*: An area of ecological significance or significant in other respect, set aside for scientific study, *Wildlife Reserve*: An area set aside for the conservation and management of mammals, birds, and other resources and their habitat, and *Hunting Reserve*: An area set aside for conservation and management of birds and mammals and other resources to provide hunting to hunters. The first three categories are according to IUCN Nature and Natural Resources categories II, I, and IV, respectively. But the hunting reserves defined above are not recognized by the IUCN. In case of tiger, poaching is strictly banned by the NPWCA and its international trading is also restricted according to CITES to which Nepal is also a party. According to this ACT, the penalty for a person involved in the poaching of a tiger, or in the trade of its parts is a fine of Rs. 50,000 -100,000, or imprisonment of 5-15 years, or both [6]. This Act clearly indicates that the tiger is strictly protected wild animal of Nepal and it helps tiger conservation in Nepal. Despite such strict penalties, poaching and trade in tiger parts is still taking place mainly by the local people, because of the high demand for tiger parts in the international markets. The Government of Nepal established anti-poaching units (APUs) in national parks and reserves, with the cooperation of local people and various organizations, have curtailed the rate of poaching and trade in tiger parts. Moreover the Government of

Nepal established Buffer zone management Guidelines in 1999 to protect the core habitat of CNP and their wildlife, which can help to conserve the tiger and it also serve both the objectives of developments and conservation [7]. Local people resources use rights was establishment in the buffer zone areas where as their rights and intervention to the core habitat of the park was strictly banned by the government, it seems to help the conservation of tiger habitat in CNP. Therefore, the Government policy and legislation is favorable for tiger conservation in Chitwan and other protected areas Nepal (Tiger Conservation Action Plan for Nepal 2007).

View of the local community

Chitwan National park is surrounded by numerous settlements and most of the research findings stated that the main threat to tiger conservation in Nepal is human intervention into their core habitats. Straede and Treue (2006) opine that, relocation of a settlement within the territorial jurisdiction of CNP has influenced natural resource extraction and also the habitat of tiger. Losses of livestock and threat to human live from wild animals from parks resulted in the local people's antagonistic behavior towards the park and negative attitude towards wildlife conservation [4]. People living outside the park boundary had no legal means/right to claim any compensation for their loss and damages caused by the park wildlife. The local people had doubts if the local authorities consider people more vulnerable than park wildlife. They displayed dissatisfaction and disobeyed the park legislations. Their negative attitude and illegal activities severely impact wildlife conservation [4]. Most of the local people near the park show their negative behavior towards tiger conservation due to not being allowed to enter the park for collection of fuelwood, timber, grasses and other NTFP. Even they can still continue the poaching activities of park tiger and other endanger wild animal to get some financial benefits. This attitude of local people and poaching are the most destructive activities for decreasing of tiger in the CNP area. Therefore, the conflict between the tiger-human and local authority is the day-to-day reality of the CNP.

Tiger-human conflict

The buffer zone forest increases the possibility of ecotourism but also puts animals like tigers and rhinos in direct confrontation with the surrounding communities [9]. With the implementation of projects like Terai Are Landscape (TAL), ecological status of forests has considerably improved in the buffer zones resulting in higher number of tigers around such areas [10]. This ultimately leads to higher cases of tigers killing humans and livestock. There has been a rapid increase in the number of humans killed by tigers after the gradual restoration of forest in buffer zones from an average of 1.2 (± 1.2) persons/year prior to 1998 to 7.2 (± 6.9) persons/year between 1998 to 2006. Based on these findings, TAL-Nepal strategy plan 2004–2014 and the second Nepal Tiger Conservation Action Plan of the Government of Nepal have listed human-tiger conflict as a major threat for long-term survival of tigers [3]. Loss of livestock and human lives is mostly at the individual level whereas compensation by conservation agencies is rather for the communities. Such facilities do not separate a

person who is losing at the cost of biodiversity conservation and another person who is gaining at the cost of biodiversity loss. When they are not able to participate in such income generating opportunities, they can pursue poaching as a self-compensatory, retaliatory and livelihood coping strategy [11]. Thus community support can depend on economic opportunities to a great extent. Human behavior regarding wildlife conservation has been seen to be regulated by their existing livelihood strategies [12], impact of wildlife conservation on them and possible compensation for their losses.

International Agencies Involvements

As an UNESCO world heritage site and as an important part of Global Eco-region 200, CNP holds a crucial position in international conservation arena as it is the area with good tiger density (more than 100) in the world. Therefore, lot of international agencies and donor organizations were involved to protect wildlife and CBC (Community Based Conservation) activities. By the 1980s, conservation focus had shifted from conventional flagship species and protected areas to broader themes like biodiversity and ecosystems as life support systems for rural communities [13]. This approach led to innovative management strategies to address livelihood issues. Starting with the early emphasis on species conservation in 1960-1970s, WWF's efforts have strategically shifted towards ICDPs during 1980-1990s and to eco-region based landscape level conservation and sustainable development [10]. WWF's Terai Are Landscape (TAL) program started in 2001 and is based on landscape approach. The goal of TAL is "to conserve the biodiversity, forests, soils and watersheds of the Terai and Churia Hills in order to ensure the ecological, economic, and socio-cultural integrity of the region" [10, 13]. This clearly reflects the links between global conservation priorities and national alignment to it. The program itself is funded by UNDP and international development agencies like DFID, SNV and USAID. These events were observed worldwide and Brosius (2004) has elaborated on the importance of science and technology in driving conservation.

UNDP funded project that is working in CNP area said that the biggest threat to conservation of resources of the protected areas was the ongoing conflict between parks and peoples' subsistence needs [15]. To reduce such conflicts, UNDP focused on developing alternatives to parks' resources, providing compensation to communities for their exclusion from parks, and creating incentives for local peoples to modify their resource extraction practices from the park [16]. The above evidence show that the focus of conservation among international agencies has shifted from wild animal species to human communities [17], where local participation has been the underlying value [18]. The International agencies are mainly focusing on how to improve the local livelihood opportunities rather than wildlife conservation. Though, their main strategy is conservation of biodiversity and wildlife resources management of the park. To implement this goal they identified that first need to fulfill the local people basic needs and they invest maximum funds to create buffer zone forestry of CNP. So, the role of the International Organization is somewhat complex and need to be more

specific on wildlife conservation aspect of the CNP area at Nepal.

ECOLOGY

Reproductive capabilities

The tiger is a territorial wild animal. It occupies a relatively large habitat, depending on the availability of the prey species. Its ideal habitat includes forest, with tall alluvial grasslands that have water. Where conditions are favorable, tiger populations can grow rapidly. Gestation is short, only 103 days; female breed relatively early, and they come into oestrus rapidly following loss or dispersal of young. Demographic parameters are well documented for tigers in Nepal's CNP [19]. Their report shows that females first breed at about three years of age (mean= 3.4 years), after establishing residency. Litter size is commonly three (mean= 2.98, range 2-5), but may be up to five, and the interbirth interval may be as short as 20 months (mean=21.6 months, range= 20-24). A relatively short interbirth interval enhances the reproductive output of tigresses, especially if litters are large, and survival of young is high. In three cases when entire litters were lost shortly after birth, the interval between litters was 7-8 months. Tiger population can recover relatively rapidly from substantial losses, as long as the habitat and prey populations remain intact. They also stated that tiger habitat quality and prey density had a great impact on litter number and size while CNP tiger litter sizes are higher than Russian tiger. Therefore, reproductive ability of the tiger is very much helpful for its conservation aspect in the Chitwan National Park of Nepal.

Population dynamics

To ensure tiger conservation, an important factor is the viability of its population. A population is considered viable when it contains a sufficient number of individuals. Genetics risk a population faces mainly depends on Genetic diversity. It indicates the differences between individuals of the same species. This variation ensures a species can adapt to the changing environment. However, nature does not maintain this by itself. There are two main processes by which genetic diversity is influenced. First is genetic drift which is a random process of changing the gene pool. More specific, it changes the allele frequencies of a population due to chance events. Smuldrs et al. (2006) says that some alleles are lost and others are taken along with evolution. The second process is gene flow which maintains the genetic diversity of a population by the exchange of genetic material between populations. A viable population (large and connected), then, will remain stable. In a molecular experiment of tiger specimen by Sunquist et al. (1999) found that tiger showed little genetic diversity and no variation was observed among sampled tigers for the 16S RNA gene or for mtDNA-REL P variation. If we consider the generation time (17) and mean number of effective no of population size (11%) [22]. Total number of tiger of CNP is 110 and over 173 (according to DNPWC 2001 and 2007) and number of effective population is near to 0.70 [25], then the tiger population size is sufficient to maintain the genetic diversity above 95% level after 100 years of time [26]. Here the probability of changing allele frequencies is low

and thus genetic drift is not dominating factor. The life span of a tiger in the wild is estimated to be less than 20 years [27] but the population dynamics of Chitwan tiger is also positive for its sustainable or long time conservation program. Though this number of tigers is not enough to maintain 100% genetic diversity but quite okay for preventing the genetic diversity over 95% mark.

Dispersal capabilities

Another important aspect of resilience is a measure of dispersal capabilities. However, little is known about how tigers move, especially through fragmented landscapes. Smith (1993) reported that male tiger dispersed about three times higher than females; most females were philopatric, settling next to their mothers. Dispersal distances in Chitwan were rather short. The average dispersal distance for male was 33 km, the longest was 65 km. The average dispersal distance for female was slightly less than 10 km, the longest was 33 km. This does not mean that tiger are incapable of dispersing greater distance. Before the study by Smith, there was evidence to suggest that a sub-adult male from Chitwan traveled 150 km to the Trijuga-Koshi-Tappu area in eastern Nepal [21]. Age of dispersal varied even within the same area, with some young leaving their natal area at 19 months, while others stayed to 28 months. Smith (1993) also found that

Table1: Food requirement of 100 tiger per year in CNP

| Prey species | % of prey eaten by tiger* | Amount of meat (Kg) | Average body Wt of prey species** | Number of prey spp. |
|---------------|---------------------------|---------------------|-----------------------------------|---------------------|
| Chital | 33.3 | 86913 | (75-100)= 88 Kg | 987 |
| Sambar | 29.3 | 76473 | (100-150) = 125kg | 611 |
| Hog Deer | 15.4 | 40194 | (50-110)= 80 Kg | 502 |
| Wild Pig | 10.6 | 27666 | (70-90)= 80 Kg | 345 |
| Common Langur | 4.1 | 10701 | (4-24)= 14Kg | 764 |
| Muntjac | 5.7 | 14877 | (15-20)= 18 Kg | 826 |
| Others | 1.6 | 4176 | 50 Kg | 84 |

tigers did not disperse across open cultivated areas (10-20 km wide), but they did travel through degraded forest habitat. Ultimately, the dispersal capability rests on the animal surviving to reproduce. Smith (1993) found that four out of four young females successfully established breeding territories, whereas only four out of 10 males survived to breeding age. Dispersal is male based in mammals and usually the dispersing sex has high mortality rate than the philopatric sex in Chitwan conditions. So, the possibility of tiger dispersal from Chitwan to other Terri area or vice versa is rare but they can easily establish their suitable new territory at any distance of CNP. Most of the time the tiger dispersal had taken place to find suitable prey habitat and establishment of new territory. So, the tiger dispersal capability is positive for its conservation at CNP area.

Food availability and requirements

A review of tiger food habit from just a few selected Asian parks shows that the mean weight of prey killed by tigers can be quite variable, the mean mass of prey killed by tigers in Chitwan 61.8kg [29]. In a scat analysis experiment at the Chitwan area by Biswas and Sankar (2002) found that, most of the tiger food habitat was covered by the Deer species while a few percentages was

also covered by the domestic animal (Figure 1). In another report, Sunquist, et al. (1999) described the similar type of food habitat of tiger based on mammal scat analysis of CNP area. A tigers requires 5-6 kg of meat a day for a maintenance diet [21]. This translates to 1825-2190 kg/year of meat but as 30% of each carcass is inedible, a tigers needs to kill some 2373-2847 kg/year of meat (considering 110 tigers in CNP) on the hoof. MacGilney (2008) reported that the total number of tiger in the Chitwan National park is increasing and now the number is almost 110. In another report of DNPWC (2001) the total number of tiger in the CNP is over 100 while in 2007 report the total number of tiger is more than 173. If we make a simple analysis of 100 tigers food requirement of the CNP area $(2373+2847)/2 =$ average of 2610 kg meat per tiger per year, the total meat requirements of all tiger is 261000 to 287100 kg. The analysis is presented in the table 1 considering 2610 kg meat of each tiger/year at CNP area. Biswas and Sankar (2002) also found that on an average the wild prey availability of Chitwan area is 2933 kg of biomass per square kilometer area. The data clearly indicate that the prey availability of tiger at Chitwan area is sufficient for its total food consumption throughout the year. McDougal and Tshering (1998) in their report mentioned that at best a tiger makes 40-50 kills per year. While Sunquist et al. (1999) mentioned that a tiger could just as well kill one 20 kg Muntjac (barking deer) every 2-3 days or one 200 kg Sambar every few weeks but they may eat together (4-6 tigers) or occasionally alone.

Effect on prey

To determine the tiger affects on wild prey population we need the prey abundance data and tiger food requirements of that area.

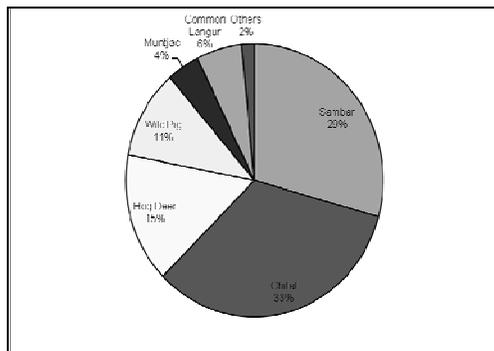


Figure 1: Major prey species percentages of tiger in CNP from scat analysis

Biswas and Sankar (2002) and Bagchi et al. (2002) stated that, in terms of prey density of groups, Chital was the most abundant followed by Sambar, swamp deer, Nilgai, common langur, wild pig, hog deer and Muntjac. On an average 96.65 individuals were estimated to occur per km square [31, 33]. Of these group 22% are small animal (<20kg); 37.5% were of medium sized animal (20-50 kg) and 40.5% were of large animals (> 50kg). The core habitat of Chitwan is now 93,200 ha, so, the number of prey availability the CNP area is more sufficient than the whole tiger's requirements. It seems that the prey availability is not a problem for tiger conservation at the CNP. It can also indicate that tiger predation didn't have

any effect on wild prey population density or effective population size of the CNP area.

MANAGEMENT

Buffer Zone Management

A buffer zone is described as an area surrounding a park or a reserve encompassing forests, agricultural lands, settlements and various other forms of land use [34]. The CNP is famous for its buffer zone area and officially the area is managed by the Buffer Zone Management Council (BZMC). BZMC comprises of Government official and local representatives (nominated by the different user groups in CNP area). The buffer zone forest helps to protect the core forest habitat while some area of the buffer zone forest is like as real forest [3]. It decreases the pressure of human intervention to the core forest habitat of tigers. The BZMC had already implemented some strategies for its effective management, and the most important one is the buffer zone regulations that couldn't permit the local people to enter the core forest area. They also involved/employed guards to monitor the user groups and local people activities in the buffer zone area continuously. So, the local communities are somehow forcing to maintain the management approaches which helps tiger conservation scheme of CNP. Following management approaches of the CNP area may reduce the tiger-human conflicts-

Bag Heralu: it is an effort to tackle tiger attacks on human and livestock have been initiated by local user groups and communities. They employ 'Bag Heralu' (Tiger watchers) to monitor tigers and inform local people about any possible areas which could be dangerous for humans and their livestock. This approach has been successful to some extent and Gurung et al. (2008) have also recommended a similar approach to tackle this problem. They have proposed radio collaring problem tigers and impaired ones and developed a communication mechanism where surrounding communities can be timely informed about "no go" zones that decreases the risk of conflict.

Compensation for livestock and human life losses: the BZMC has received the 50% net profit of the CNP income (MFSC, 1999). This money is used for the conservation purposes of buffer zone forest area and only 10% is for administrative purposes. There is already a Wildlife damage relief Guideline in place established by the government of Nepal which has provisions for compensation of loss of human life and livestock, damages to crops and physical assets and treatment in case of injuries. It is very helpful and may create the positive attitude of the local people for tiger conservation rather than tiger poaching or hunting.

Lethal control: though it is contradictory to tiger conservation but sometimes the tiger in the buffer zone areas needs lethal control. It creates the positive attitude of the local people for tiger conservation. Furthermore, lethal control can be used to prevent the tiger establishment in the unsuitable area.

Using pet dog: the dog has the capability to predict the tiger presence and the local people may notice it in well advance by the dog burking. In Bangladesh, the pet dogs are used as a guard of local people from the man eating tiger at the boarder of the Sundarban area [35]. So, this could be an effective management approach of the CNP area to save the human life from man eating tiger.

Wild prey management

Tiger is the opportunistic predators and select the vulnerable prey. It can predate on mot species throughout its range, but it prefers wild animals rather than livestock. At present the number of wild prey is sufficient for tigers but still poaching and legal hunting of wild animal in CNP area is going on. Sambar and Chital is the main prey of tiger diet, so, wild prey management will very helpful for future tiger conservation.

Corridors

Corridors are narrow landscape elements that connected the landscape to each other. The development of new corridors between buffer zone and core habitat of CNP will enhance the tiger territory. Sometimes impaired or female tigers may use these corridors for their shorter stay to the buffer zone of the CNP. Furthermore, the corridors are used for dispersal of tigers between two protected areas and not for their dispersal into buffer zone forests as their presence in buffer zone forests could rather be dangerous for the local communities. The Terai Arc Landscape aims to establish and strengthen these corridors in an effort to enhance dispersal of tigers among the protected areas across India and Nepal to maintain a healthy exchange of genetic diversity as well.

Information, education and awareness

Public information and education about the tiger conservation issue attributes to public support for tiger conservation. Most of the people of the CNP area are illiterate and posses an anti tiger conservation concepts and they thought tiger as their main opponents. The awareness campaign by different institutions and motivation program at the local household level is helpful for tiger conservation program in Bangladesh [35]. The socioeconomic status and livelihood condition of the Bangladeshi and Nepali people are more or less similar, so, these programs are also useful for Nepal point of view. These programs may create the positive attitude of the local people for tiger conservation and also try to resolve the conflict.

EVALUATION

The evaluation section is presented by a tabular format, where + sign shows positive significance and – shows negative significance (Table 2).

Table 2: Evaluation of tiger conservation at CNP

| | | |
|------------|-----------------------------|-----|
| Social | Govt. policy & regulation | + |
| | Society views | - |
| | Conflict | - |
| | International agencies | + |
| Ecological | Reproductive capability | + |
| | Population dynamics | + |
| | Dispersal capabilities | + |
| | Food availability | + |
| | Effect on prey | + |
| Management | Buffer zone | + |
| | Wild prey | +/- |
| | Corridor | + |
| | Information, awareness, etc | - |

CONCLUSION

Finally we conclude that the legislation strongly supports the tiger conservation of CNP but its execution level will need more attention. Management strategies especially local people attitude and compensations will require more emphasis. More research will be needed to resolve the wildlife-human conflict at the CNP area. The ecological aspects are also positive for its conservation. Finally, the above analysis clearly indicating that the possibility of tiger population and its habitat conservation is favorable at CNP. Still the Nepal Government has to go lot of miles for tiger conservation due to societal constraint at the CNP.

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