

Review Article

Asian elephants and their status in Nepal: a review

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ABSTRACT

Wild Asian elephants (*Elephas maximus*) are one of the most endangered wildlife species in Nepal. Currently, there are approximately 200 to 250 wild elephants counted in Nepal. Of them, 15-20 are in Jhapa district, 17 are in Koshi Tappu Wildlife Reserve, eight in Sindhuli, and 45-50 in Parsa National Park and Chitwan National Park. More than 100 elephants are in Bardiya National Parks and adjoining municipalities, and 25-30 are in Suklaphanta National Park and adjoining municipalities. Elephant conservation is challenged by habitat fragmentation, obstruction of migratory routes and human-elephant conflict. The governments of Nepal, law enforcement, NGOs, and local communities have made various initiatives to conserve elephants. In the paper, we have outlined the current status of the elephant population, and its conservative efforts. This study may be a useful tool for the scientific communities and ecologists to protect elephants from extinction.

Keywords: Elephant, Conservation, Habitat, Hattisar, Threats, Feeding behavior

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INTRODUCTION

The *Elephas maximus* (Asian elephant) is the largest of all mammals in Nepal. The height of the shoulder ranges from 250 to 300 cm and a male elephant can weigh up to 5,000 kg. Elephants have a very strong memory and a long lifetime-comparable to humans. Elephants are highly sociable. They live in groups of similar species, with a mature female leading. Members of the same group use sound, smell and touch to interact with each other. Elephants are capable of producing infrasonic sounds (low-pitched sounds that fall below human hearing range) that are particularly useful for long distance communication, as the lower-pitched sound is, the farther the sound waves can travel. A delicate tool is the trunk, which is an elongated nose with nostrils located at the very end. It can be used for a wide variety of activities, from lifting large tree trunks to gathering items that are as small as a peanut. The Asian elephant has a single 'eye' on the trunk's upper lip. The three major differences between the Asian elephant and its African counterparts are that the Asian elephants are smaller in size (weighing about 5,500 kg vs. an average of 8,000 kg of the African species), their ears are smaller, and their head is not only smaller but also has a different shape, usually referred to as a twin-domed head (Werneth, 2019).

Wild Asian elephants (*Elephas maximus*) in tropical and subtropical regions of Asia are endangered megafauna. It is native to 13 Asian countries including Nepal, and is classified in the International Union for Nature Conservation (IUCN) Red List of Threatened Species as "Endangered" (Choudhury *et al.*, 2008; IUCN, 2018) and appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2017). This species is also protected by the National Parks and Wildlife Protection Act 1973 of the Nepalese government (GoN, 1973). Nepal has devoted legal protection to Asian elephants by listing them as protected species under the National Parks and Wildlife Conservation Act, 1973. Wild elephants in Nepal occur in four isolated populations-eastern population in Koshi Tappu Wildlife Reserve and Jhapa district; central population in Chitwan National Park and Parsa National Park; western population in Bardia National Park and adjoining municipalities; and far-western population in Suklaphanta National Park and adjoining municipalities (NTNC, 2020).

Until the 1950s, much of Southern Nepal's plain region known as the Terai was covered by uninhabited forests caused by malaria. It is suspected that one contiguous population was constituted by the elephants in these Nepal forests and by elephants in north and northeast India (DNPWC, 2008). The eradication of malaria and government resettlement projects in the 1950s led to a massive influx of people into the Terai from the hills. In addition, thousands of Nepalese livings in Myanmar and India migrated to Nepal in the 1960's due to the land reform program (Kansakar, 1979). The arrival of settlers resulted in the destruction of more than 80% of the natural habitat (Mishra, 1980), resulting in the breakup of wild elephants into partially or totally separate groups of less than 100 animals each (Pradhan, 2007).

Asian elephants have great ecological and cultural significance throughout Asia (Sukumar, 2006). They are threatened throughout their range primarily due to habitat loss, human–elephant conflict and poaching for ivory (Jathanna *et al.*, 2015). Asian elephants need large areas to fulfill their seasonal food and water requirement, which often leads to conflicts with humans (Sukumar, 1991; Hoare & Du Toit, 1999; Williams *et al.*, 2001). In Nepal during the paddy and corn harvesting season, 120-140 elephants come to Jhapa from West Bengal of India. Likewise, 30-40 come to Katariyaghat, Bardiya, and 35-40 come to Suklaphanta, according to Ashok Ram, deputy warden of Parsa National Park (Khadaka, 2019). In a prior analysis, Acharya *et al.* (2016) found that the seasonal timing of elephant-related human injuries and fatalities was similar, with fewer events during summer and peak rates of injuries and fatalities in the late autumn. Efforts to mitigate human–elephant conflict are likely to be most effective if they are concentrated during August through December when elephant use of human-dominated landscapes and human–elephant conflict are most common (Lamichhane *et al.*, 2018). There is no elephant poaching but nearly two percent of the country's elephants die every year, largely due to conflicts with humans (Mandal, 2019). The government has been working for many years to conserve this endangered species from various political perspectives. Preparing Elephant Conservation Action Plans (2008) and more importantly, adopting the Terai Arc landscape level conservation program. The purpose of this program is to provide elephants as a metapopulation by restoring corridor, thus increasing their chances of long-term survival in their current habitat (DNPWC, 2008). The Government of Nepal has also acknowledged the importance of captive elephants by opening an elephant breeding facility in Chitwan National Park.

Past wild elephants' population distribution

In 13 countries, including Nepal, India, Bhutan, Bangladesh, Sri Lanka, Burma, Thailand, Kampuchea, Laos, Vietnam, South China, Indonesia and Malaysia, there are about 35,000 -

40,000 wild elephants (Kempf & Santiapillai, 2000; UNODC, 2016). Asian elephant (*Elephas maximus*) and African savanna elephant (*Loxodont afficana*) are two living species. Asian elephant has four subspecies: 1) Indian elephant (*Elephsnnxirttus bengalensis*), 2) Ceylon elephant (*E.m.maiimus*), 3) Srtrrratran elephant (*E.m.stmttrann*), and 4) Malavsiane lephant (*E.m.hitsutus*) (IEF, 2020). The Borneo pygmy elephant (*E. m. borneensis*) has recently been discovered, making it the fifth Asian sub-species. Elephants in Nepal are a protected species. The Asian elephants at endangered have been included in the List of Threatened Species by the World Conservation Unions (IUCN, 2018; Williams *et al.*, 2020).

Currently, there are around 200 to 250 wild elephants in Nepal. Of those elephants, 15-20 are in Jhapa, 17 are in Koshi Tappu Reserve, eight in Sindhuli, and 45-50 in Parsa and Chitwan National Park. Likewise, more than 100 elephants are in Bardiya, and 25-30 are in Suklaphanta National Park (Khadka, 2019). The number of resident wild Asian elephants in Nepal is currently estimated to be between 109 and 142 animals (DNPWC, 2012; Pradhan *et al.*, 2011) with distribution concentrated in the central and eastern parts of the country in protected areas of the Terai (low land) zone, with relatively low numbers in the west (Koirala *et al.*, 2015). In four isolated populations (Eastern, Central, Western and far-western), they occur. The elephant-inhabited area is spread over 19 districts of Nepal (17 in the Terai lowlands and 2 in the hills), covering approximately 10,982 km² of forest area (DNPWC, 2008). This widespread and fragmented distribution of elephants in the Terai highlights the importance of the need for planning for landscape level conservation as a strategy to protect elephants and humans by maintaining the country's forest corridors. Moreover, several incursions of over 100 elephants from the Indian state of West Bengal into Eastern Nepal have taken place in recent years. The eastern population consists of about 15 West Bengal resident animals and migratory animals, with herd sizes ranging from a few individuals to over 100 animals (Yadav, 2002; DNPWC, 2008). Seasonally, the resident elephants move through the seven eastern districts covering a forest area of 2228 km². This elephant population is confined to forest patches that are highly degraded and fragmented, resulting in very high human conflict in turn. With 4.59 km² of forest, KoshiTappu Wildlife Reserve, the only protected area in the east, is tiny. The movement of the trans-boundary herd is largely limited to the Jhapa district of the Bahundangi region and creates massive human-elephant conflict (DNPWC, 2008). 175 elephants, including 37 calves, entered Jhapa in November 2007 but were not reported to be moving beyond the borders of the Jhapa district. It is suspected that this herd, which lives on both sides of the border in a highly disturbed and fragmented landscape, extends from Assam to Eastern Nepal through the state of West Bengal in India. It is estimated that a population of 25 to 30 elephants in central Nepal (Fig. 1) mainly resides within the Parsa NP and Chitwan NPs (ten Velde, 1997; DNPWC, 2008). These elephants occasionally move towards the district of Mahhotarri in the east. It is estimated that the elephant population occurs in a forest area of 3227 km². Forest habitats and corridors are mainly intact except for a few settlements in the Bara, Rautahat and Mahhotarri district (DNPWC, 2008). The western elephant population is mainly found in Bardia National park and ranges over a forest area of 2943 km² spread over 3 districts). This is the elephant population that has been studied the most and its origins are very interesting. Prior to 1994, there were only 2 resident elephants and a seasonally migratory herd of 12 elephants in the park (Pradhan *et al.*, 2007; Pradhan *et al.*, 2008). Elephant numbers then started to increase, probably due to immigration from India. In 1994 rangers in Bardia NP counted 45 animals. Pradhan (2007) carried out the first systematic sampling for elephant numbers using non-invasive genetic microsatellite techniques. He estimated 50 elephants in the Karnali flood plain and over 30 in two separate herds in the Babai Valley, a total of 80 animals within Bardia NP. He also found that females and calves had high kinship coefficients indicating mother offspring relationships

and the overall population genetic variability was moderately low (ca. 60% heterozygosity) when compared with US zoo animals (80%). This can be explained by a limited number of founders from one single population in 1994. In contrast, most of the sub-adult males were not related, either among themselves or with the adult females suggesting non-random locational dispersal (Pradhan, 2007). This also indicates that the Khata (Nepal) - Katarniaghat (India) corridor is functional and landscape level biodiversity management benefits elephants. The elephants in the far western population range over an area of 2583 km² of forests, mainly in Churia foot hills of Nepal, which includes Suklaphanta NP and 2 districts. It is believed that 3-5 elephants permanently reside inside Nepal while the rest migrate seasonally from the bordering districts in the Indian state of Uttar Pradesh. These elephants are believed to be part of a population of 1500 elephants in the Indian states of Uttarakhand and Uttar Pradesh (Rangarajan *et al.*, 2010).

Captive elephants

Captive Asian elephants are often misinterpreted as domesticated, because they have been kept and trained by humans for thousands of years. However, the majority have historically been captured from the wild and tamed for use by humans. Although they can breed in captivity, like big cats and other wild animals, they are not selectively bred, largely because of their long reproductive cycle. For this reason, there are no domesticated breeds of Asian elephants: They remain wild animals (Werneth, 2019).

There are about 16,000 captive elephants throughout southern Asia which are mostly used as working animals (WWF, 2020). In Nepal elephant domestication has a fine history. Prithivi Narayan Shah, the first king of the Shah Dynasty, supported the East India Company with seven adult elephants annually from 1743 to 1775 for invasion by the Makawanpur Battle of Parsa-Mahotari (JBK, 1985). It has also been reported that in 1930 a Rana ruler used 315 elephants in a single hunt in Chitwan Valley. In the past, 31 elephant camps used to exist in Nepal's lowlands. One common practice was the capture and training of wild elephants. During 1954-1970 a total of 10 wild elephants were captured for domestication. However, data shows the trend declining number of domesticated elephants up until the 1970s. The Department of National Parks and Wildlife Conservation (DNPWC) has been entrusted with the management responsibility of domesticated elephants since 1978. In 1986 an elephant breeding center was established at CNP due to the growing demand for elephants for patrolling and park management duties and the difficulty of legal procurement of elephants from India. There are currently a total of 208 captive elephants in Nepal (Table 1), of which 94 government elephants are in the Terai in various Parks, namely Koshi Tappu Wildlife Reserve, Parsa National Park, Chitwan National Park, Bardia National Park, and Suklaphanta National Park. At its field station in Chitwan, Bardia and Central Zoo, Kathmandu, the National Trust for Nature Conservation (NTNC), a state NGO, possesses 8 elephants. Most private elephants are in and around Chitwan National Park, and are used mostly for tourism.

The number of domesticated elephants in various national parks and wildlife reserves are given in Table 1.

Table 1: Domesticated elephants in Nepal

Conservation areas	Government	NTNC	Private	Total
Chitwan NP	52	5	98	155
Bardia NP	16	2	8	26
Parsa NP	10	0	0	10
KoshiTappu WR	8	0	0	8
Suklaphanta NP	8	0	0	8
Central Zoo	0	1	0	1

(Source: Pradhan *et al.*, 2011), NTNC: National Trust for Nature Conservation

Nearly 250 captive elephants are estimated to exist in Nepal (DNPWC, 2009) across the narrow and fragmented landscape in Terai and Churia Hills (Pradhan *et al.*, 2011). Captive elephants in Nepal are owned by the Government as well as private organizations/ individuals, using the elephants for various human oriented activities. The population of captive elephants is given in Figure 1. Activities related to the national park involve patrolling, prevention of human-elephant conflict, tourism, enumeration of a few wildlife species within the park, etc. For all these tasks, the national park uses the services of a number of captive elephants maintained by the department within the park.

Government elephants are used mostly for patrolling and scientific purposes, while private elephants are often used for forest excursions and for entertaining visitors in park and reserve buffer zones. Because of the exhaustion of carrying five adult humans on their delicate backs every day, many of these elephants suffer from tuberculosis (*Mycobacterium tuberculosis*) (Werneth, 2019). Despite a reported decline in the disease, due in part to a younger population of working animals, these safari elephants don't get the necessary rest or nutrition they need, so the chances of recurrence are high. Scientists agree that stress and malnourishment can "reactivate" tuberculosis in elephants (Werneth, 2019). Elephant tuberculosis is a chronic disease affecting wild elephants across the globe. Tuberculosis in captured elephants was first reported in 2002 in Chitwan National Park in Nepal (Gairhe, 2002). Altogether seven captive elephants died from tuberculosis during the seven-year period (2002-2009) (DNPWC, 2011). In 2006, surveillance on elephant tuberculosis began to support the Government of Nepal and in 2008, TB care began by standardizing the treatment protocol. The Government of Nepal recently endorsed the Nepal Elephant Tuberculosis Control and Management Action Plan, aimed at reducing the risk of transmission of TB from captive elephants to wildlife by controlling tuberculosis at the captive-wild interface (DNPWC, 2011).

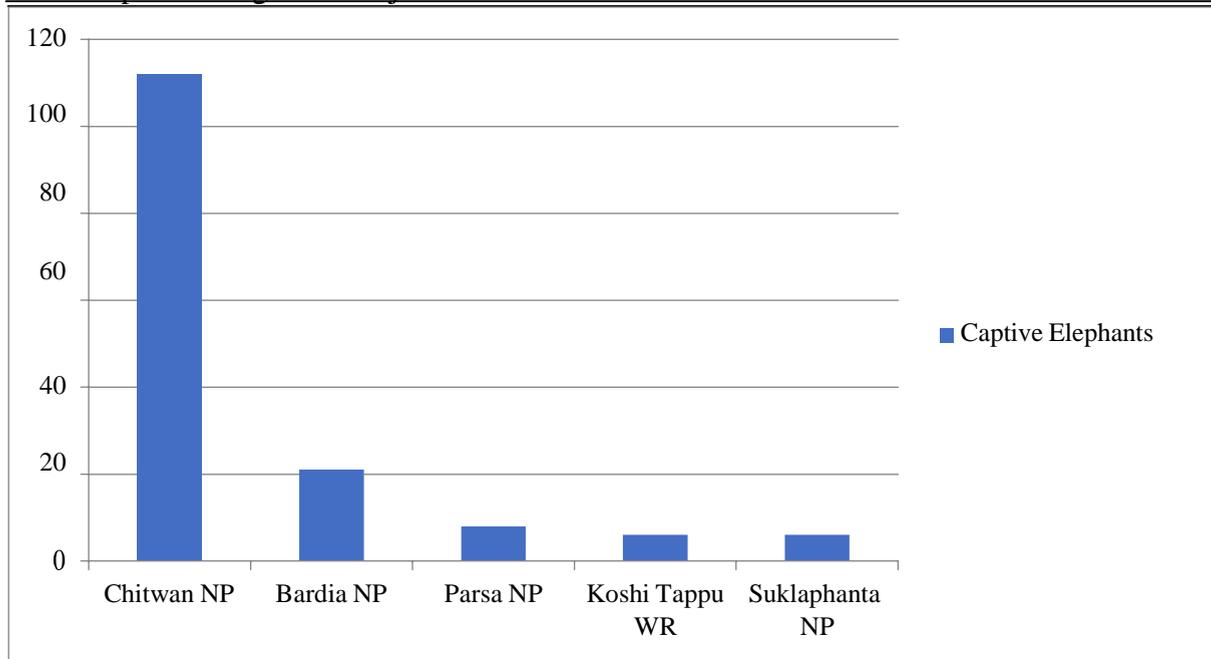


Figure 1: Captive elephant population in Nepal (NP and WR). NP: National park, WR: Wildlife reserve

Source: ECAPN 2009-18

Feeding behavior of elephants

Food and shelter are the basic needs of all living creatures including large body super herbivores Asian elephant *Elephas maximus* (hereafter elephant), endangered species globally

(Williams *et al.*, 2020). Elephants eat roots, grasses, fruit, and bark-and they eat a lot of them. An adult elephant can consume up to 300 pounds of food in a single day. Elephants are crepuscular-they typically sleep during the day and are most active at dawn and dusk. The essence of an animal's feeding habits signifies the right determination of the carrying ability of its ecosystem and its complex population pattern (Ashok Kumar, 2011; Swapna, 2008). The name of feeding grasses for wild elephants are listed in Table 2.

Table 2: List of feeding grasses

S.N.	Botanical name	S.N.	Botanical name
1	<i>Bambusa sp</i>	14	<i>Leea robusta</i>
2	<i>Bombax ceiba</i>	15	<i>Litsea monopetala</i>
3	<i>Bridelia retusa</i>	16	<i>Mallotus philppensis</i>
4	<i>Cleistocalyx operculata</i>	17	<i>Miliusa velutina</i>
5	<i>Cymbopogon sp</i>	18	<i>Paspalum sp</i>
6	<i>Desmostachya bipinnata</i>	19	<i>Phoenix humilis</i>
7	<i>Equisteum debile</i>	20	<i>Phragmites karka</i>
8	<i>Ficus racemosa</i>	21	<i>Saccharum bengalensis</i>
9	<i>Garuga pinnata</i>	22	<i>Saccharum spontaneum</i>
10	<i>Holarrhena pubescens</i>	23	<i>Semecarpus anacardium</i>
11	<i>Hypericum uralum</i>	24	<i>Spatholobus parviflora</i>
12	<i>Hypoxis aurea</i>	25	<i>Sterculiia villosa</i>
13	<i>Lagerstroemia parviflora</i>	26	<i>Thysanolaena maxima</i>

(Source: Koirala *et al.*, 2016)

Being mega herbivores, elephants need to take up more space, amount of forage and water every

day than smaller ones (Guy, 1976; Jackson & Erasmus, 2005; Stephenson, 2007; Wyatt & Eltringham, 1974; Owen-Smith, 1988) and also have a characteristic feature of hind gut fermentation with fast food passage times and low digestibility and energy consumption (Dumonceaux, 2006). In the wild, for feeding elephants was spent 75-85% of the day (Vancuylenberg, 1977). The elephant is a generalist feeder that eats various parts of a large assortment of grasses, herbs, shrubs, and trees. Its diet composition may differ depending on the availability of food, natural water and season. Long-term herbivore survival and conservation depends on the availability of suitable habitats, reduction of anthropogenic pressure, and thus preservation of the plant species used by elephants in their natural resources is an important factor.

Threats of elephants' conservation

Nepal's elephant range is under constant threat of fragmentation into lesser areas (DNPWC 2012). Most east Nepal's forest corridors are highly fragmented. The situation in western Nepal is marginally better where there is connectivity between forests along the north-south direction (Bardia National Park-Katarnia, Basanta-Dudhwa) and a small band along the east-west direction-the Churia foothill forest links Bardia National Park with the Suklaphanta National Park and further west with the Uttara Khand state forests in India. These forest corridors proved to be the critical connection for migrating elephants as they travel back and forth between the transboundary areas of Indo-Nepal in the west (ten Velde, 1997). However, due to the growing human population, the future of those corridors is uncertain. Owing to the demands of human populations living along the forest edge, forests outside the protected areas have undergone significant degradation.

Conservation works

Elephant Conservation Action Plan for Nepal

Recognizing challenges in elephant conservation, the Government of Nepal supported "The Elephant Conservation Action Plan 2009-2018," a guidance document outlining the highest priority conservation activities in Nepal for the overall management of the elephant. The strategy aims at saving the elephants from extinction in the wild, resolving habitat destruction immediately and reducing related conflict between humans and elephants. Consequently, the action plan focuses primarily on crisis management as the population is already divided, and on resolving the conflict between human elephants. The strategy emphasizes the protection of landscape levels and creates ecological corridors, so that fragmented elephant populations can be connected for genetic viability. Furthermore, it also emphasizes captive elephant management in Nepal.

Hattisar in Nepal

Historically, domestic elephants have not been raised for breeding in Nepal because elephants with a calf have had to be laid off from work for at least three to four years. Calves training are not only a challenge, but also a rather costly one. The availability of young wild elephants until a few decades ago for recruitment did not require the captive breeding of elephants. The establishment of an elephant breeding center provides an incentive for the training of elephants and their handlers to preserve conventional wisdom. In 1986, the Government of Nepal set up an Elephant Breeding Center in Khorsor, near Chitwan National Park, with this objective in mind. There are six major government-owned Hattisars spread across the lowland Terai protected areas of the country. With the exception of the Chitwan Hattisar, which moved from nearby Sonbarsa in 1966, all hattisars have recently been created. Elephants don't have a simple job in any way. Proper care includes providing healthy food and hygienic conditions, both of which

incur significant costs. The domesticated elephants of the Hattisars Government are used for wildlife surveillance, captive breeding, wildlife control, problem-finding, and the evacuation of trapped animals. They are also used for ecotourism, biodiversity research, environmental education and special programs.

CONCLUSION

Approximately 200-250 wild elephants and 250 captive elephants counted in Nepal. Captive elephants are an important source of income for the tourist industry. Asian elephants have great ecological and cultural significance. They are endangered, mainly because of habitat loss: most suitable habitats have been turned into fields and human settlements. There is no elephant poaching but every year 2-3 elephants are being killed due to elephant-human conflict. The destruction of dense forests has led to the shrinking of the habitat of the Asian elephant in Nepal. To cope with the situation, the government of Nepal (GoN), I/NGOs should take actions to provide strict protection to this species. Nepal needs to develop policy for handling human-elephant conflicts so that public support for protection of wild elephant populations can be maintained. As human-elephant conflicts are trans-boundary issues, both Nepal and India should launch joint efforts to minimize such conflicts by engaging and encouraging local communities in elephant conservation.

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Authors' contributions

S. Shrestha wrote the initial draft of this article and J. Shrestha provided necessary data and finalized initial draft of this manuscript. The final form of the manuscript was approved by all authors.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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