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THE CONSERVATION AND POTENTIAL HABITAT OF THE HIMALAYAN MUSK DEER, *MOSCHUS CHRYSOGASTER*, IN THE PROTECTED AREAS OF NEPAL

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Abstract
The Himalayan musk deer (Moschus chrysogaster) is a cervid distributed from the eastern to the western Himalayas of Nepal. The species is listed as endangered in appendix I of IUCN Red data, and protected in Nepal under the National Parks and Wildlife Conservation Act of 1973. Musk deer occupy the middle to the higher mountain regions, which cover 12 protected areas of Nepal (6 national parks, 5 conservation areas, 1 hunting reserve). However, of the 30177.19 km^2 potential habitat, only 19.26% (5815.08 km^2) is inside the protected areas and the remaining 80.73% falls outside the protected areas. Consequently, poaching, habitat destruction, livestock grazing and forest fire in the musk deer habitat are important challenges for the conservation of musk deer in the country. A thorough status survey in and outside the protected areas should be carried out and a species-focused conservation action plan should be prepared and implemented properly. A program for increasing awareness and enhancing livelihood of the local populations should be launched in the poor and poaching risk zones of Nepal.

Keywords: *Musk deer; potential habitat; poaching; protected area.*

Introduction

The Himalayan musk deer (*Moschus Chrysogaster*) (Nepali name: Kasturi Mriga) is a cervid distributed from the eastern to the western Himalayas of Nepal. The Himalayan Musk Deer is one of the five species of musk deer, namely Siberian *(M. moschiferus)*, black *(M. fuscus)*, forest (*M. berezovskii*), alpine *(M. sifanicus)* and Himalayan *(M. chrysogaster)*, found in different parts of the world, such as China, India, and Russia [1, 2]. In Asia it is distributed in Afghanistan, Bhutan, China, India, Myanmar, Nepal and Pakistan [1, 3]. In Nepal, it is found in Annapurna Conservation Area (ACA), Kanchanjanga Conservation Area (KCA), Manaslu Conservation Area, Sagarmatha National Park, Langtang National Park, Shey Phoksundo National Park, Rara National Park, Khaptad National Park, and Makalu Barun National Park [4].

The Himalayan musk deer is not only the most primitive, but also the smallest ungulate living above the altitude of 2500m [1,3,5,6]. The Government of Nepal protected musk deer as an endangered species, under the National Parks and Wildlife Conservation Act, 1973 and CITES listed it in appendix I and the IUCN Red List of threatened species listed it as endangered [7].

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In all Asian countries where musk deer live, wild populations are considered to be declining [1], yet, the status and habits of the musk deer populations and the domestic demand for musk in surrounding countries are inadequately documented [8].

Habitat destruction and predators pose threats to musk deer populations. However, intensive poaching to meet illegal demand for the scent gland or 'pod' of the male musk deer, is believed to be responsible for dramatic declines in the population of musk deer [5, 7, 8]. The indiscriminate methods employed to kill male musk deer, such as snares, mean that at least three to five animals may have to be killed in order to secure one male with a large enough musk gland [9]. Therefore this study has been carried out to know the potential poaching areas and habitat in Nepal.

In Nepal a detailed study on the distribution and threats was only carried out in a few protected areas. The potential habitat of musk deer throughout the country was unknown. Therefore, this study was carried out to provide information about the status, the potential habitat (in and outside the protected areas), the distribution pattern and the threats of musk deer in the protected areas of Nepal. The study provided valuable information for conservation specialists, to prepare a species conservation action plan and to perform further researches on this species.

Methods and materials

A key information survey was conducted to obtain information about the status, distribution and the threats of musk deer in each protected area. Local leaders, park staff and researchers (n = 63) were considered key informants and each person was interviewed by different means: by telephone, by direct interaction and by email. The persons who had been involved in the research of musk deer for a long time and who published researches articles, were taken as main referents for this study.

Musk deer distribution in Nepal

A distribution map was prepared based on previous [3, 5, 7, 11, 12] and current study data. We collected presence and absence information for the species from local peoples, parks staff and from publications. We used ArcGIS software and chose the elevation, settlement, river, road and ecological vectors layers with a 30 meter resolution (available for free at http://geoportal.icimod.org) to identify the potential musk deer habitat within Nepal. We assumed that birch, rhododendron, fir, *Betula utilis*, *Abies spp* and oak forests were a suitable habitat for the musk deer study [3, 5, 7, 11, 12]. Moreover, we considered the musk deer potentially lived at an altitude of 2500 to 4500m (Table 1). We also considered the distance to villages during the delineation of the potential distribution area. Finally, by crosschecking with local people and staff, potential distribution area ground validation GPS points were set up throughout the Nepal.

Table 1. Parameters for musk deer potential habitat map preparation

Parameters	Value	Reference
Elevation	2500-4500	[3, 5, 7, 11, 12]
Vegetation	Birch –Rhododendron forest, Juniper scrub Larch Forest Temperate Mountain Oak forest Upper Temperate blue pine forest Dwarf Rhododendron Scrubs Rhododendron forest Fir Forest	

Results

Distribution of musk deer in Nepal

Musk deer is distributed throughout the mountain region of the country, which covers 30177.19 km^2 and the potential habitat inside the protected areas was 5815.08 km^2. Musk deer were distributed mostly in 12 mountain protected areas of the country: Api Nappa Conservation Area (ANCA), Khaptad National Park (KNP), Rara National Park (RNP), Shey Phoksundo National Park (SPNP), Dhorpatan Hunting Reserve (DHR), Annapurna Conservation Area (ACA), Manaslu Conservation Area (MCA), Langtang National Park (LNP), Gaurishankar Conservation Area (GCA), Sagarmatha National Park (SNP), Makalu Barun National Park (MBNP) and Kanchanjanga National Park (KCP) from the western to the eastern part of the country (Fig 1).

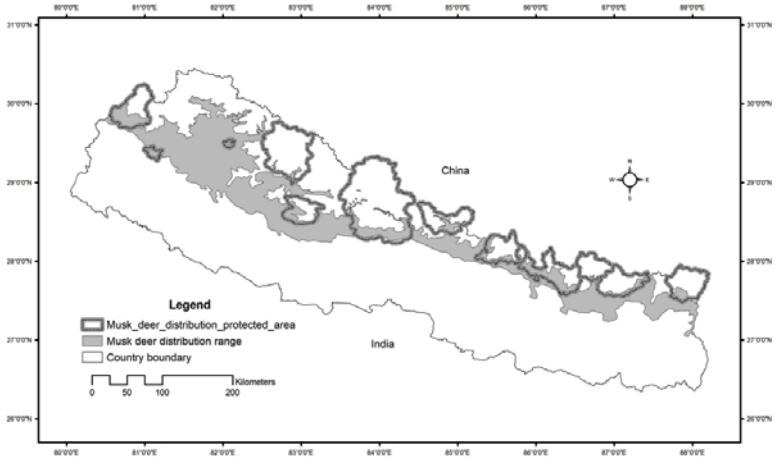

Fig. 1. Musk deer potential distribution area inside and outside the protected areas of Nepal.

Musk Deer Status, Distribution and Potential Habitat in PAs.

Sagarmatha National Park

The Sagarmatha (Mt. Everest) National Park (SNP) was established in 1976 and covered 1148 km^2 of the Himalayan ecological zone in the Khumbu region of Nepal. The park includes the upper catchments areas of the Dudhkoshi and Bhotehoshi Rivers and is largely composed of rugged terrain and gorges of the high Himalayas, ranging from 2,845m to the top of the world's highest Himal - Sagarmatha - 8,848m above the sea level. For its superlative natural characteristics, UNESCO listed SNP as a World Heritage Site in 1979. The vegetation found at the lower altitude of the park includes pine and hemlock forests, while fir, juniper, birch and rhododendron, scrub and alpine plant communities are common at the higher altitude [13**].**

The musk deer population was estimated to 600 – 800, with a density of up to 45 individuals/km² [12]. However, the recent study [5] reported only 39 musk deer (11 male, 16 female, and 12 unidentified) in Debuche, Tengboche, Phortse, Thanga, Dole and associated areas during the field survey. Musk deer was distributed over approximately 131 km² of the park area, in Khumjung, Namche and in Chaurikharka VDC's forests (Fig 2). In khumjung VDC musk deer have a wider range habitat than in others. Musk deer were found in Kyanjuma, Tasinga, Phungithanga, Thulo Odhar, Nagdin, Tengboche, Phortse, Thanga, Phortse Pakha, and Dhole (4200m) forests. In Nammche VDC, they were found in Thop Danda, Phurte, Thamo, Pare and Thame. They were also sited at Jorsalle, Kongde Danda, in Chaurikharka VDC, which was outside the park boundary and is called a Buffer Zone [5]. Musk deer was distributed both in and outside the park boundary.

The main threat for musk deer was poaching. The poachers mostly come from outside the district and set up the snares. They only take the pod of the musk deer after killing the animal and leave the remains of the body in the snare place. In the Phortse area, the Sherpa culture and religion consider wildlife as a god. They do not kill musk deer, so the musk deer population is frequently sighted in that area. The Pare, Tengboche, Nagding and Dhole areas of SNP were the most vulnerable sites for musk deer poaching. Under the mutual agreement between local people and the park authorities, the domestication of goat species within the SNP was prohibited [5], although the livestock frequently uses the musk deer habitat area and it was estimated that 35% is overlapped by livestock [5]. That is among the other threats to the survival musk deer in their natural habitat. The Snow Leopard (*Panthera uncia*) disappeared from the Everest region in 1960's but has made a come back in SNP [14], which led to an increase in the risk of musk deer being hunted. Lovari et al, [15] stated that 31% of Snow Leopard's diet consists of musk deer. That was also a risk considered to have reduced the viable population due to such new predators in the region. However, the collection of excess timber and firewood also degraded the habitat of musk deer.

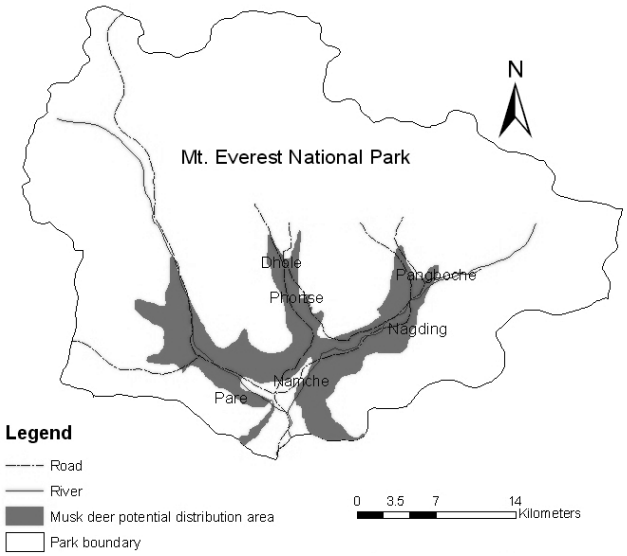

Fig. 2. Potential musk deer distribution areas in Sagarmantha (Mt. Everest) National Park

Langtang National Park

Langtang NP was established in 1976 to conserve the unique flora and fauna of the region. The 1710 km^2 of the park extends over parts of the Nuwakot, Rasuwa, and Sindhupalchok districts, in the southern mountainous terrain of the Nepal-China (Tibet) border. The park represents a meeting point between the Indo-Malayan and the Palearctic realms, and holds a rich biodiversity. The Nepalese larch *(Larix nepalensis),* the only deciduous conifer in the region, is found in this park and only few places elsewhere [13]. Musk deer were distributed in four VDCs of the Langtang National Park: Shyarphu Besi, Langtang, Helambu and Jhyang Phedi VDCs. They cover 897.03 km^2 as a potential musk deer distribution area in the park (Fig 3). There was an estimated population of 500 individuals in Langtang NP [12, 16]. A high density was recorded in Shyarphu Besi and Langtang VDCs. Eight anti-poaching units with the involvement of the local people were formed to reduce the poaching of wildlife. Regular patrolling was carried out by park staff and the Nepalese Army, which reduced poaching. Last year more than 100 snares were destroyed by the patrolling team. The Sacred Himalayan landscape project is also working for the conservation of wildlife and to strengthen the local

community in order to get the public support needed to conserve the biodiversity. The poaching and the habitat overlap due to the animal herding system created a problem of overgrazing and musk deer habitat degradation.

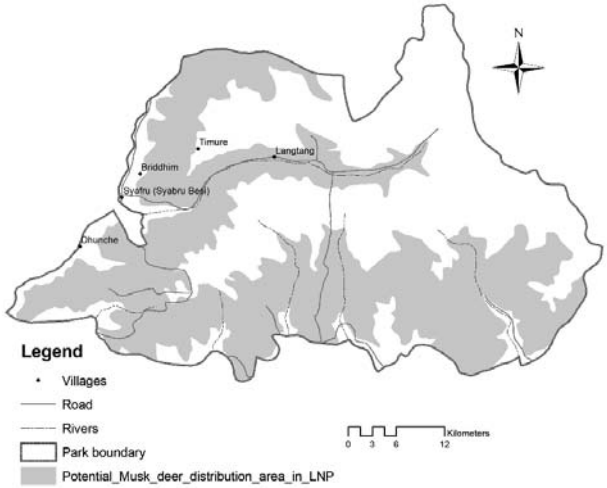

Fig. 3. Potential musk deer distribution areas in Langtang National Park (LNP)

Rara National Park

Rara National Park is located in the north-western high mountains of Nepal. The park was gazetted in 1976 to conserve the unique beauty of Lake Rara, and to protect the representative flora and fauna of the Northern Himalayan eco-region. The park is Nepal's smallest protected area comprising an area of 106 km^2. Rara Lake (Mahendra Tal) is situated at an elevation of 2990 m.

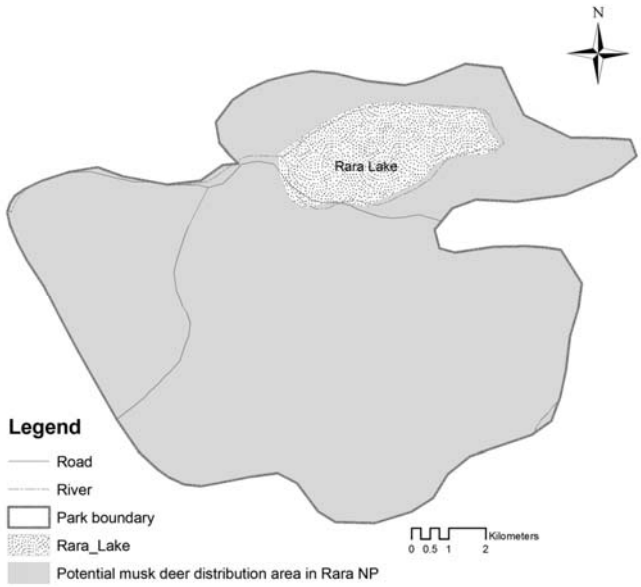

Fig. 4. Potential Musk deer habitats in Rara National Park

The reserve is characterized by sub-alpine and high temperate vegetation. Common plant species include fir, pine, and birch, rhododendron, hemlock, oak, juniper and spruce. The park is home to around 20 different species of mammals and 214 species of birds [13].

The estimated population of musk deer in the Rara National Park was 20 individuals [12]. Musk deer was recorded in Murma Top, Thali, Byauli, Hapka, Kand, Lama Pakha, Chayakala Paani and the Chuchemara Lekh region of the Rara National Park. The entire park was a potential musk deer distribution area of 96 km^2. However the Rara lake covered 9.7 km^2 (Fig 4). A high density of musk deer was recorded in Chuchemara Lekha, although the musk deer population decreased rapidly throughout the potential area of the park. There was an animal herding system in Rara National Park that caused a serious problem of habitat overlapping. Snares and dogs were used for poaching musk deer. The succession of pine led to a reduction in the food available to musk deer in Rara Lake.

Khaptad National Park

Khaptad National Park is located in the far-western region of Nepal. The park was gazetted in 1984 as covering an area of 225 km^2. The forests consist of lower temperate, mixed, broad-leaved species *(Lindera nacusua, Cinamomum tamala. etc),* temperate, mixed, evergreen species *(Spruce, fir, hemlock, oak. etc),* and upper temperate, broad-leaved species *(Aesculus indica, maple, etc.).* Intertwined into the landscape of the Khaptad plateau are the Patans (pastureland), with beautiful flowers *(about 135 species)* that bloom in the summer and late spring. The park is reported to have 266 bird species [13].

Musk deer were distributed over the 126.23 km^2 potential area of Shahasralinga, Dhauledhunga, Chhedipatan and Tilak Lagne Danda of the park (Fig 5). There were more than 200 animal herds (locally known as Goth) in Khaptad National Park. Khaptad NP is supporting 22 grasslands for animal herding. The population of musk deer rapidly decreased, due to poaching for its valuable musk pod. In some cases poachers get the support of the animal herders who provide the information about the movement of musk deer, potential sites etc., making it easier to poach musk deer. Habitat overlapping and excess harvesting of forest resources degrade the habitat quality and the growth of unpalatable grass and shrubs, which causes a serious problem the musk deer.

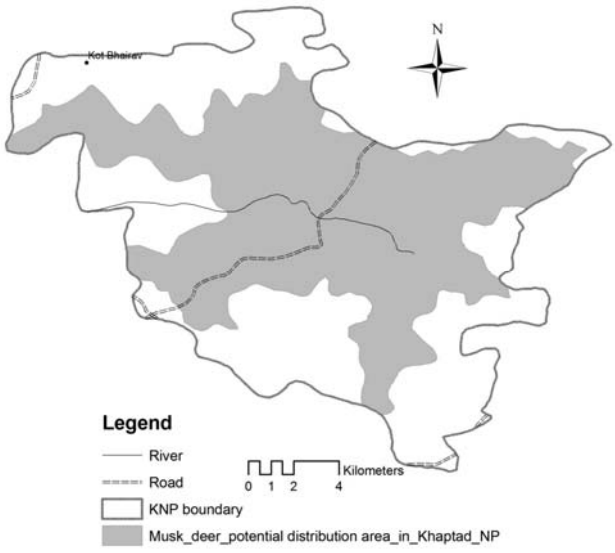

Fig. 5. Potential musk deer habitats in Khaptad National Park

Shey Phoksundo National Park

Shey-Phoksundo Narional Park is situated in the Trans-Himalayan region of northwestern Nepal. It is Nepal's largest national park, covering an area of 3,555 km^2. It was

established in 1984 to preserve a unique Trans-Himalayan ecosystem with a diversity of flora and fauna. Elevations in the park range from 2,130m in Ankhe, to 6,883m at the summit of Kanjiroba Himal. The flora found within the park is extremely diverse. Less than five percent of the park is forested, with much of the forests covering the southern portion [17]

Shey Phoksund o National Park provides one of the main habitats of musk deer in Nepal. Musk deer were distributed in Bhijer, Kaigaun, Saldang, Phoksundo, Dolpu, Pahada and Kimri VDCs of the park, which covered 1282.16 km^2 (Fig 6). There were more than 1000 musk deer reported in the national park [12, 16]. Poaching, fire and grazing were associated threats to the survival of musk deer in the park.

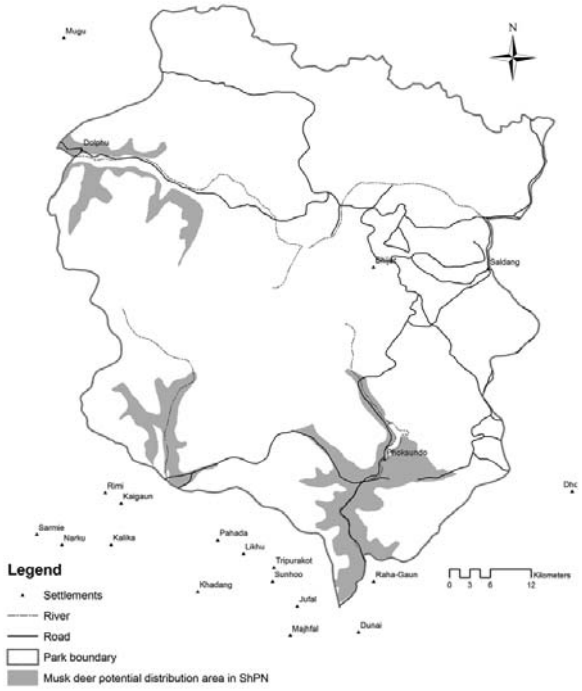

Fig. 6. Potential Musk deer habitats in ShPN

Makalu Barun National Park

Makalu Barun National Park and Buffer Zone area (previously conservation area) was established in 1992 and covered 1500 km^2. The buffer zone area covered 830 km^2. The park integrates a protected area management and community development program, to encourage local people to actively participate in protecting the forests and natural resources upon which their lives depend and to conserve their own rich cultural heritage. Traditional resource management systems, such as community controlled grazing and forest guardianship are being strengthened and basic technologies are introduced where appropriate. Recognized for its tremendous diversity of plants, animals and people, the area contains 25 species of rhododendron, 47 types of orchids, and 56 rare plants [13].

Musk deer were distributed in Kimanthanka, Chepuwa, Hatiya, Pathivara, Makalu, Yaphu, Tamku, Bala, Sishuwakhola, Bung and Chheskam VDCs of Makalu Barun NP. The Popti Bhanjyang catchment area of the Kasuwa, Ipsuwa and Apsuwa river side were the most appropriate potential sites for musk deer habitation. The potential musk deer distribution area was 788.99 km^2 in the park (Fig 7). Poaching, forest fires and the grazing problem were the main threats for musk deer in this area.

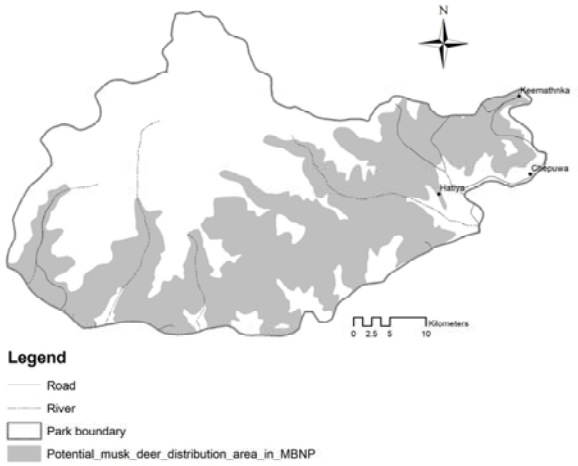

Fig. 7. Potential musk deer distribution areas in MBNP

Annapurna Conservation Area

The Annapurna Conservation Area (ACA) contains some of the world's highest peaks the world's deepest valley, the Kali Gandaki River Valley. It is Nepal's largest protected area, covering 7629 km^2. It was established in 1992. The ACA has an wide habitat range, from sub tropical sal forests, to perennial snow, harboring 22 different forest types, with 1226 plant species including 55 endemics, 30 mammals and 456 birds [13].

Fig. 8. Potential musk deer distribution areas in ACA

Annapurna Conservation Area provided a significant habitat for musk deer. In the Manang district they were distributed in Thoche, Tache Bagarchap, Dharapani, Chame,

Manang, Tanki Manang, Khansar, and Nar VDCs. The Nyeshang valley (which is the largest valley of Manang and stretches from Pisang VDC to Throng Phedi, covering all the six VDCs) harbors a high density of Musk deer population [3]. In the Mustang district Musk deer is found in Tukuchhe, Marpha, Muktinath, Kobang, and Kagbeni, Kunjo and Lete VDCs. Musk deer is also found in Parche and Namarjung VDC of the Kaski district, within the ACAP region [3]. Musk deer were potentially distributed over 1116.85 km^2, as a potential habitat in the Annapurna Conservation area (Fig 8).

The Marpha VDC's forest is one of the potential poaching areas of the Mustang district. From the previous experience of the local people, the best sites for poaching in the area are the Kuplithang forest, the Lumbuniyo forest, and the Chicheghang forest, where a large number of snares were collected by the CAMC members, during their patrolling [10]. Every year a large number of snares were recorded by the patrolling teams of CAMC, Marpha. 400 snares were recorded in 2001, 287 in 2002, 87 in 2003 [10]. In 2010, 8 musk deer poachers were arrested by the ACAP legal authorities.

Poaching and forest fire were the major threats in the area.

Manaslu Conservation Area

Manaslu was declared a Conservation Area in December 1998, under the National Parks and Wildlife Conservation Act of Nepal. It covers an area of 1663 km^2. The region harbors a mosaic of habitats for 33 species of mammals, 110 species of birds, 11 species of butterflies and 3 species of reptiles. There are approx 2000 species of plants, 11 types of forests and over 50 species on useful plants. The bio-climatic zones vary from sub-tropical to nival. The altitude ranges from 600m to the summit of Mt. Manaslu (8,163m), the eighth highest peak in the world [13].

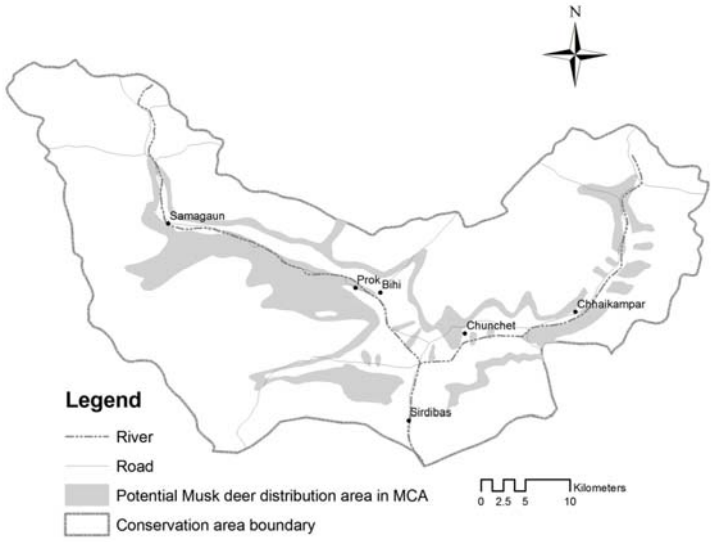

Fig. 9. Potential Musk deer distribution areas in Manasalu Conservation Area

In The Manaslu Conservation Area, musk deer were found in three VDCs: Prok, Chumchet and Chhekampar. There were 51 individuals within the potential habitat of 9.67 km^2 [11]. In Prok VDC, the Kaltal area has the highest density of musk deer. There is an animal herding system, as well. The local religion is Buddhism, so the locals were not involved in poaching. Poachers from the neighboring district used to poach musk deer mostly during winter, after the movement of the herders to the lower belt. According to animal herders, they

destroyed more than 30 snares last year. The total potential habitat of musk deer was 282. 58 km^2 in the CA (Fig 9).

The Kanchanjunga Conservation Area

Kanchenjunga was designated as a conservation area in March 1998. It covers an area of 2035 km^2 in the Taplejung district and lies in the northeast corner of Nepal. The conservation area, with unique mountain ecosystems is envisioned as a tri-national peace park, with the Tibet Autonomous Region (TAR) of China to the north and Sikkim, India, in the east. In April 1997 the Government of Nepal declared the Kanchenjunga region as a **Gift to the Earth,** as part of the WWF's **Living Planet Campaign** 2000. The vegetation consists of subtropical evergreen forests, lower temperate mixed broad-leaf forests, upper temperate mixed forests, temperate cloud forests and alpine forests [13].

Musk deer were found in all four VDCs: Taplethok, Lelep, Yamphudin and Olangchung of the Kanchanjunga Conservation Area which covered 628.38 km^2 of potential musk deer habitat (Fig 10). Poaching, habitat degradation, excess harvesting of the forest, grazing and forest fires were the main threats for the survival of musk deer in the region.

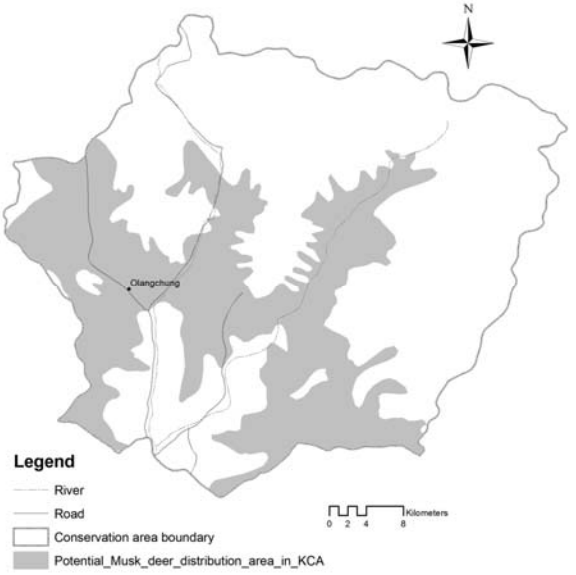

Fig. 10. Potential musk deer distribution areas in KCA

The Api Nampa Conservation Area

Api Nampa Conservation Area covers 1903 km² and was declared a protected area in 2010. It covers 22 VDCs of the Darchula district, within an altitude range from 518m to 7132m. Subtropical forests (Hill Sal forest), temperate forests (fir, hemlock, oak, junipers), lower and upper sub alpine forest (pine, oak, rhododendron), lower and upper alpine (Juniper, rhododendron grazing and shrub land) are the major forest types of the Api Nampa Conservation Area [13].

Musk deer were distributed in Ghusa, Khandeshwori, Byas, Sunsera, Hikila and Airkot VDCs, which cover 574.84 km^2 of potential musk deer habitat (Fig 11). Ghusa, Khandeshwori and Byas VDCs contain denser population than the other VDCs. A detailed study still needs to be conducted in this newly established protected area.

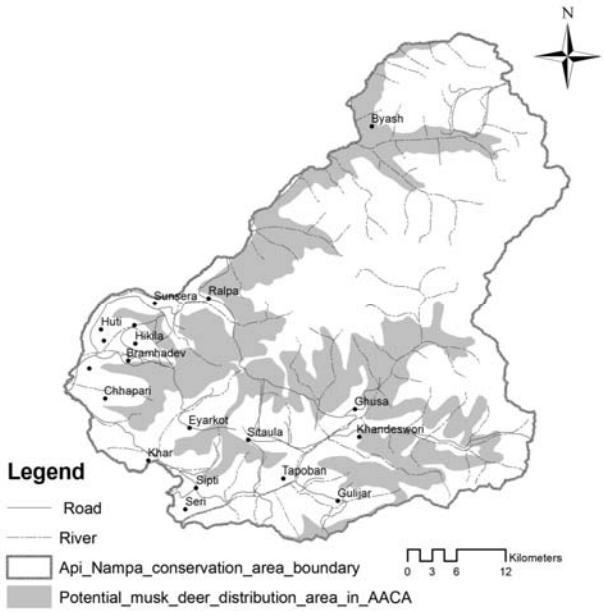

Fig. 11. Potential musk deer distribution areas in AACP

The Gaurishankar Conservation Area

The Gaurishankar conservation area covers 2,179 square kilometers and encompasses 22 Village Development Committees of 3 districts. It was declared protected area in 2010. GCA comprises 16 major vegetation types. Confirmed observations of faunal diversity inside the GCA recorded 34 species of mammals, including musk deer, 16 species of fish, 10 species of amphibians, 8 species of lizards, 14 species of snakes, 235 species of birds [18].

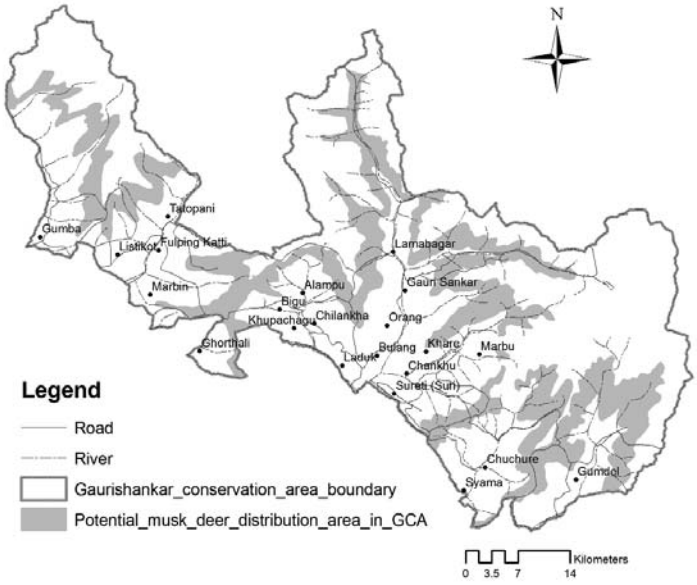

Fig. 12. Potential musk deer distribution areas in GCA

Musk deer is distributed mainly in the Gaurishankar and Lamabagar VDC, which covered 588.99 km^2. That was the best potential musk deer distribution area in the Gaurishankar conservation area (Fig 12). Animal herders have a large number of cattle to graze in the protected areas. Since the protected area was only recently declared a Conservation area, a detailed study has not been done yet.

The Dhorpatan Hunting Reserve

The Dhorpatan Hunting Reserve was established in 1983 and was gazetted in 1987. The management objectives of the reserve allow sports hunting and they preserve a representative high altitude ecosystem in Western Nepal. The reserve extends over an area of 1325 km^2 and is the only hunting reserve in the country to meet the hunting requirements for Nepalese and foreign hunters of blue sheep and other game. Every year livestock grazing activities begin from February and they last until October. The **reserve** is characterized by alpine, sub-alpine and high temperate vegetation. Common plant species include fir, pine, and birch, rhododendron, hemlock, oak, juniper and spruce. Pastures occupy more than 50 % of the total area of the reserve at a higher elevation [13].

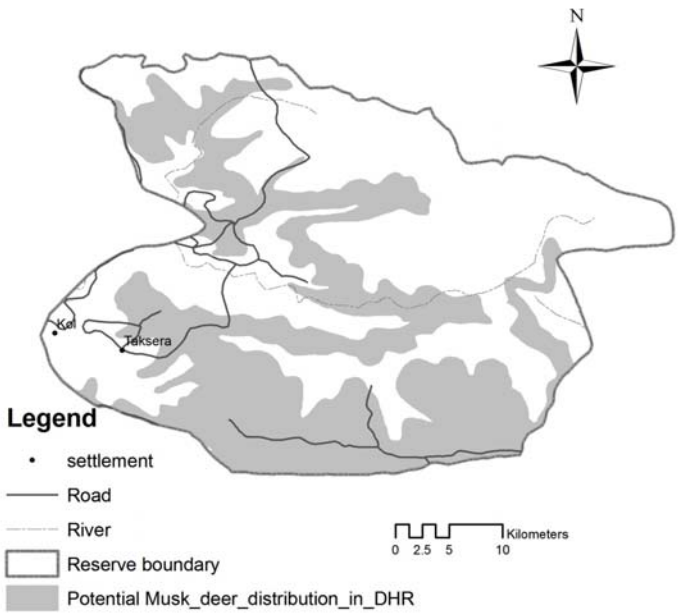

Fig. 13. Potential musk deer distribution areas in DHR

The Dhorpatan hunting reserve is divided into six major blocks, namely Surtiwang, Falgune, Barse, Ghusthung, Seng, Dawadi and Sundaha. Musk deer were sighted in all six blocks and they were distributed over a potential 549.8 km^2 area throughout the reserve (Fig 13). Sundaha has the highest population, due to the low human interference and the low density of animal herding, compared to the other blocks. Herders stay in the upper region up to the middle of November and move down to the lower region after the middle of November. The Falgune and Barsa blocks have a very low population density, due to the high human influence. There was a severe poaching problem in the Dhorpatan hunting reserve during the insurgency period, due to the absence of a park authority. After the peace process started in Nepal,

poaching decreased due to the frequent monitoring performed by the park authority. The population of musk deer rapidly decreased during the insurgency period. Poachers preferred snares to guns to kill the musk deer. It takes more than 2 days to prepare one snare, so poachers take the preparation of snares seriously. Poachers normally go to the field to monitor snares once a week, to know whether there is any trapped musk deer. Last year about 500 snares were destroyed by the park authority.

Discussions

The Distribution of Musk Deer in Nepal

Musk deer were distributed from the middle to the higher mountain regions of Nepal, including 12 protected areas (6 national parks, 5 conservation areas, 1 hunting reserve). The potential habitat of musk deer throughout the country was 30177.19 km^2. However, only 19.26% (5815.08 km^2) of potential habitat was inside the protected area and the remaining 80.73% was outside the protected area (Table 2). It was proved that there was more potential habitat of musk deer outside the protected area, but there are no specific management activities outside the protected area. Therefore, specific management strategies for musk deer should be implemented outside the protected areas.

Table 2. Musk deer distribution areas in the protected areas in Nepal

S.N	Protected area	Total area (Km^2)	Potential musk deer habitat (Km^2)	
1	Sagarmathan National Park	1148	131	Total musk deer potential habitat throughout the country was 30177.19 Km2.
2	Langtang National Park	1710	897.03	
3	Rara National Park	106	96	
4	Khaptad National Park	225	126.23	
5	Shey Phoksundo National Park	3555	316.97	
6	Makalu Barun National Park	1500	788.99	
7	Annapurna Conservation Area	7629	1116.85	
8	Manaslu Conservation Area	1663	282. 589	
9	Kanchanjunga Conservation Area	2035	628.38	
10	Api Nampa Conservation Area	1903	574.84	
11	Gaurishankar Conservation Area	2179	588.99	
12	Dhorpatan Hunting Reserve	1325	549.8	
	Total	**24978**	5815.08	

Army forces are deployed in the most of the protected areas to protect biodiversity. However, the management authorities do not believe that it is enough to manage the biological diversity, so they involved the local people to conserve those resources in the different protected areas, by forming buffer zone management committees and the conservation area management concept. Still poaching and the high illegal market value of mammals like musk deer could not be stopped entirely. Due to the high demand, related products are traded in different parts of the world, particularly in Hong Kong, China and Japan [2,3,5]. Poaching was more common during the insurgency period (1996 -2007), due to lack of frequent monitoring

and patrolling. After the initiation of the peace process, the park authority increased the monitoring and patrolling in the potential poaching areas. However more than 2000 snares were destroyed by the conservation authority in the protected areas last year. The low level of public awareness and the high level of poverty in such rural areas enhanced the risk of poaching and the trade of musk deer in Nepal. Traditionally, musk pods were harvested by killing the deer, although it is possible to obtain musk from a live deer [2,3,5]. Therefore musk deer farming helps reduce the poaching and maintain a viable population in the wild.

Conservation efforts in regard to the musk deer should be directed toward the maintenance of essential ecological processes and life support systems, to preserve the genetic diversity and to ensure a sustainable use of the species and its ecosystem. First and foremost is the urgent need to provide proper protection to the species within existing protected areas and outside. Second is the need to control the trade of musk, both at national and international levels, and third is the need to use the species at a sustainable level for the benefit of rural communities, by herding the species in its natural habitat.

A detail status survey in and outside the protected area should be carried out and a species focused conservation action plan should be prepared and implemented properly. Awareness raising and livelihood enhancement programs should be launched in the poor and poaching vulnerable zones.

The Godawari Musk Deer Farming Center, Nepal was established as musk deer farming center, however, it is not successful to getting its aim. Therefore, we should consider this issue and an experimental study in the natural habitat should be carried out to extract the musk from live musk deer by involving local people. At the same time, the existing wildlife farming policy and guidelines should be revised and should have clear norms on the use of the farm animal.

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