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COMMUNICATION

THE STATUS OF NEPAL'S MAMMALS

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THE STATUS OF NEPAL'S MAMMALS

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Abstract: The main objectives of the Nepal National Mammal Red Data Book (RDB) were to provide comprehensive and up-to-date accounts of 212 mammal species recorded in Nepal, assess their status applying the IUCN Guidelines at Regional Levels, identify threats and recommend the most practical measures for their conservation. It is hoped that the Mammal RDB will help Nepal achieve the Convention on Biological Diversity target of preventing the extinction of known threatened species and improving their conservation status. Of the 212 mammal species assessed, 49 species (23%) were listed as nationally threatened. These comprise nine (18%) Critically Endangered species, 26 (53%) Endangered species and 14 (29%) Vulnerable species. One species was considered regionally Extinct. A total of seven species (3%) were considered Near Threatened and 83 species (39%) were Data Deficient. Over sixty percent of Nepal's ungulates are threatened and almost half of Nepal's carnivores face extinction (45% threatened). Bats and small mammals are the least known groups with 60 species being Data Deficient. Habitat loss, degradation and fragmentation are the most significant threats. Other significant threats include illegal hunting, small and fragmented populations, reduction of prey base, human wildlife conflict and persecution, climate change, invasive species, disease and inadequate knowledge and research. Adequate measures to address these threats are described. It was also concluded that re-assessments of the status of certain mammal groups be carried out every five years and the setting up of a national online species database and mapping system would also greatly help in land-use planning and policies.

Keywords: Biodiversity, conservation, mammals, Nepal, Red List, threatened species.

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INTRODUCTION

The IUCN Red List is the World's most authoritative and objective inventory of the global status of plant and animal species. It, however, is not always possible to integrate this information at the global scale into conservation planning and priority-setting at national level, where most conservation policies are implemented. National Red listing was introduced to resolve this issue (Gärdenfors et al. 2001) and guidelines for assessments at the national or regional level were published (IUCN 2003). National Red Lists can gauge the extinction risk faced by native species, provide information about the rate of change of a nation's biodiversity over time, and help in the development of effective conservation policies and action plans based on robust and well established criteria. The approach can also provide an excellent basis for measuring a country's progress towards achieving one of the Convention on Biological Diversity (CBD) targets "By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained".

In a relatively small area of 147,181km², Nepal harbours an extraordinary variety of landscapes, habitats, wildlife and cultures. Its diverse physiographic features range from the Arctic high Himalayan peaks (the highest terrestrial ecosystem in the world), to the tropical lowlands of the Terai. Also important is Nepal's

geographical position in the central Himalayas, in a region of overlap between the Palearctic realm to the north and the Oriental (Indomalayan) realm to the south. Although it occupies only 0.1% of the world's total landmass, Nepal is home to 3.2% and 1.1% of the world's known flora and fauna, respectively (MoFSc 2014), including around 4.2% of the world's known mammal species (Jnawali et al. 2011).

A large proportion (>23%) of the country's landmass is designated as protected areas, with 12 national parks, one wildlife reserve, one hunting reserve and six conservation areas (Fig. 1). Between 2002 and 2013 eight areas were declared as protected forests (1,337km²); eight additional areas (6,701km²) have been proposed by the Government of Nepal because of their high biodiversity, wildlife habitats and corridors (DoF 2015). In addition, 37 Important Bird Areas (IBAs) have been identified (BCN and DNPWC in prep.).

Nepal Mammal Red Data Book

In October 2009, a team consisting of Nepalis and two British scientists embarked on a project to compile the Nepal Mammal Red Data Book (Jnawali et al. 2011), which was completed in March 2012. This Red List is the first comprehensive status assessment of all Nepal's mammal species using the IUCN Categories and Criteria (IUCN 2003). The results from this assessment are presented here.

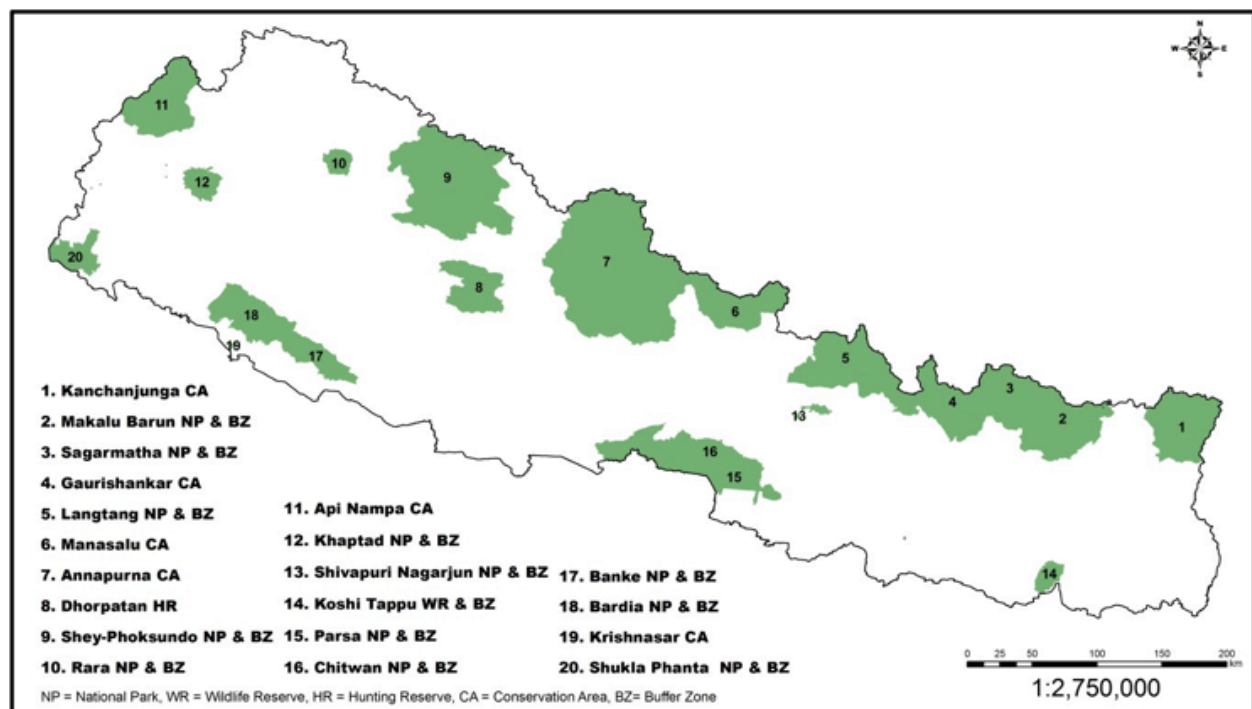


Figure 1. Protected areas of Nepal

MATERIALS AND METHODS

The Nepal National Red List work was initiated with the setting up of a National Red List project steering committee which included members of the Government of Nepal - Ministry of Forests and Soil Conservation, National Trust for Nature Conservation and WWF-Nepal. Initially, a desk study of published and unpublished literature was undertaken to compile a comprehensive bibliography of references. Using this bibliography, a taxonomic list of mammals of Nepal was prepared following the international rules of zoological nomenclature. Detailed draft reports for each species annotated with relevant references were then compiled in an IUCN Species Information Service Database for Regional Red Lists. This database was used as the reference source to assess the threat status of all the mammal species using the IUCN categories and criteria (IUCN 2003).

During the assessment process, two national Red List workshops were held. The first workshop in Chitwan National Park, in January 2010 (three days), was specifically aimed at field managers and technicians who helped to check and fill in information gaps in the species accounts. Initial species status assessments were also undertaken. Updated species reports were then circulated for further input prior to the second workshop in Kathmandu, in April 2010. During the second workshop (two days), the conservation status of all the mammal species were reviewed and final conservation assessments were applied with main threats and recommendations for each species. Each workshop was attended by over 40 mammal experts.

RESULTS

Following the international rules of zoological nomenclature, a total of 212 mammal species including two endemic species (Himalayan Field Mouse *Apodemus gorkha* and Csorba's Mouse-eared Myotis *Myotis csorbai*) has been recorded in Nepal. Twenty-nine of Nepal's mammal species are globally threatened and 17 species are globally Near Threatened (IUCN 2015, Appendix 1).

In contrast, 49 (23%) species were assessed as nationally threatened. The nationally threatened species comprise nine (18%) Critically Endangered species, 26 (53%) Endangered species, and 14 (29%) Vulnerable species (Appendix 1). One species (Pygmy Hog *Porcula salvania*) was considered regionally Extinct.

A further seven species (3%) were considered Near Threatened, meaning they are likely to be threatened in the near future if current levels of threat continue. Eighty-three species (39%) were classified Data Deficient. Four of the species were found after the National Red List book was published (2012) and are listed as Data Deficient. These are Rusty-spotted Cat *Prionailurus rubiginosus*, Pallas's Cat *Otocolobus manul*, Steppe Polecat *Mustela eversmanii* and Ruddy Mongoose *Herpestes smithii* (Chetri et al. 2014; Shrestha et al. 2014; Subba et al. 2014; Lamichhane et al. 2016).

Ungulates (28 species) are the most threatened group of mammals in Nepal with 17 species (61%) on the threatened list. This includes five Critically Endangered species (Blackbuck *Antelope cervicapra*, Ganges River Dolphin *Platanista gangetica*, Indian Chevrotain *Moschiola indica*, Tibetan Gazelle *Procapra picticaudata* and Wild Yak *Bos mutus*) and six Endangered species (Alpine Musk Deer *Moschus chrysogaster*, Asian Elephant *Elephas maximus*, Greater One-horned Rhino *Rhinoceros unicornis*, Hog Deer *Axis porcinus*, Swamp Deer *Rucervus duvaucelii* and Water Buffalo *Bubalus arnee*).

A further two species (7%) are Near Threatened (Fig. 2). In addition to the Pygmy Hog, the Indian Spotted Chevrotain *Moschiola indica* may also be regionally extinct as there have been no reports of this species from Nepal since the 1970s. Only two species (7%) of ungulates were considered Least Concern and six species (21%) Data Deficient (Fig. 2).

Almost half of Nepal's carnivores (47 species) are facing extinction (19 species) or will do so in the near future (2 species) (Fig. 3). The threatened species include two Critically Endangered species (Grey Wolf *Canis lupus* and Brown Bear *Ursus arctos*) and 12 Endangered species (Red Panda *Ailurus fulgens*, Dhole *Cuon alpinus*, Striped Hyaena *Hyaena hyaena*, Smooth-coated Otter *Lutrogale perspicillata*, Honey Badger *Mellivora capensis*, Sloth Bear *Melursus ursinus*, Clouded Leopard *Neofelis nebulosa*, Royal Bengal Tiger *Panthera tigris*, Snow Leopard *Panthera uncia*, Fishing Cat *Prionailurus viverrinus*, Spotted Linsang *Prionodon pardicolor* and Himalayan Black Bear *Ursus thibetanus*). Ten species (21%) were considered Least Concern and sixteen species (34%) were classified as Data Deficient.

Primates (5 species) are currently considered the least threatened group of mammals in Nepal with only the Assam Macaque *Macaca assamensis* assessed to be the threatened (Vulnerable). Himalayan Grey Langur *Semnopithecus ajax* has been included based on observations by Brandon-Jones (2004) but requires

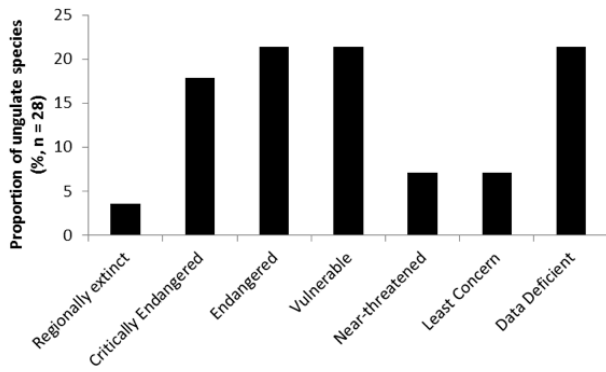


Figure 2. Status of ungulates in Nepal

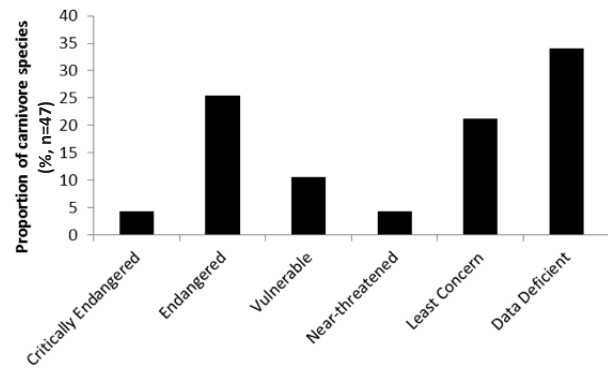


Figure 3. Status of carnivores in Nepal

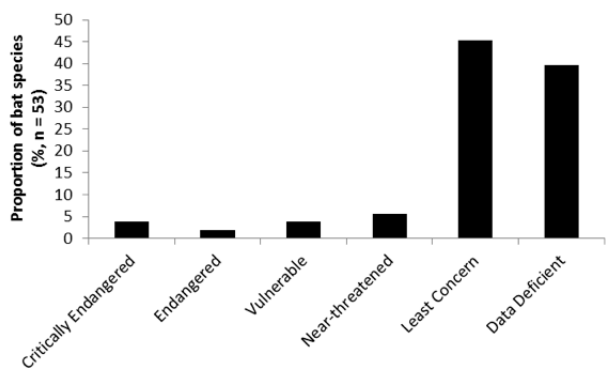


Figure 4. Status of bats in Nepal

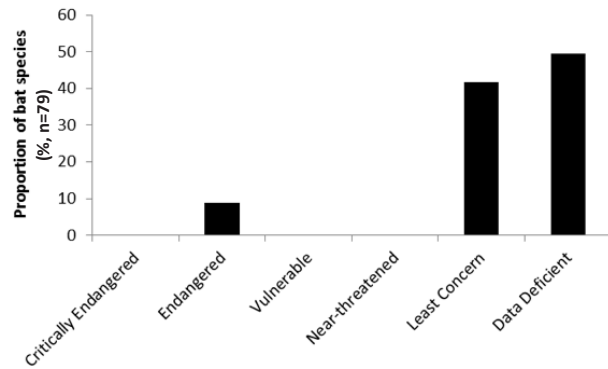


Figure 5. Status of small mammals in Nepal

concrete evidence (IUCN 2015).

A quarter of Nepal mammals are bats (53 species) and more species can be expected as they have been largely neglected in terms of research until recent years. This is also reflected in the Red List assessment with 21 species (40%) listed as Data Deficient. Five species (9%) are considered threatened including the Critically Endangered Csorba's Mouse-eared Myotis *Myotis csorbai* and the Great Evening Bat *la io*, and further three species (6%) considered Near Threatened (Fig. 4).

Although small mammals make up over a third of all mammal species in Nepal (79 species), it is the most underrepresented group in terms of available information and research (Fig. 5). About half the small mammal species are considered Data Deficient (39 species, 49%). Thirty-three species (42%) are listed as Least Concern and seven species (9%) considered Endangered (Black Giant Squirrel *Ratufa bicolor*, Himalayan Field Mouse *Apodemus gurkha*, Himalayan Pika *Ochotona himalayana*, Himalayan Water Shrew *Chimarrogale himalayica*, Hispid Hare *Caprolagus hispidus*, Indian Pangolin *Manis crassicaudata* and Chinese Pangolin *Manis pentadactyla*).

DISCUSSION

Threats to Nepal's mammals

Whilst Nepal is rich in biodiversity, it is one of the least developed countries in the world, ranked in the low human development category, positioned at 145 out of 187 countries and territories in 2014 (United Nations Development Programme, UNDP 2014). The country's rapidly increasing human population is putting huge pressure on natural resources and wildlife with shortages of water and electricity; even meeting basic human needs is a struggle. The main threats to Nepal's mammals include:

Habitat loss, degradation and fragmentation

Habitat loss, degradation and fragmentation are the most important threats to Nepal's mammals (Appendix 2). These include loss of forests, grasslands and wetlands due to the encroachment of settlements and especially due to agriculture and unsustainable resource extraction, such as logging for local and commercial use and sand and gravel mining of river beds. Extreme natural and climatic events such as floods, earthquakes

and landslides also cause habitat loss and degradation.

Fragmentation of habitats is particularly affecting many wide ranging species such as the Royal Bengal Tiger, Asian Elephant and Snow Leopard. The lowland grassland region of Terai has experienced significant habitat loss and fragmentation. Eradication of malaria in the mid-1950s resulted in large scale settlements in the Terai and today almost half of Nepal's population resides here in an area representing only 14 percent of the total area of the country (CBS 2009; Grimmer et al. 2009; Pant 2010). Outside protected areas there are no significant remaining grassland areas that are capable of supporting lowland grassland species (Jnawali et al. 2011).

Forests and grasslands are being degraded by overgrazing and excessive burning, and removal of undergrowth to provide fodder for livestock. The Pygmy Hog is now considered Regionally Extinct mainly due to indiscriminate burning of grasslands and habitat loss. Similarly, Hispid Hare *Caprolagus hispidus* has experienced dramatic declines and is now considered Endangered.

One quarter of Nepal's forest area is heavily degraded (World Bank 2008). The deforestation of primary forests and lack of planned regeneration are reducing the amount of suitable habitat available to many bat species, which are also suffering from a lack of protection of roosting sites.

Lowland grasslands in protected areas are suffering from inappropriate grassland management including intensive annual cutting and burning, and also ploughing, which alter species composition (Baral 2001; Jnawali et al. 2011). Over-grazing by domestic livestock, fodder collection and human disturbance are also degrading grasslands.

The spread of invasive plant species is making it very difficult for some mammal species to feed. One rapidly spreading invasive is Mikania *Mikania micrantha* which is blanketing Terai floodplain vegetation (Murphy et al. 2013). For example over forty percent of the Greater One-horned Rhino *Rhinoceros unicornis* habitat is affected by Mikania in Chitwan National Park which has over 90 percent of Nepal's rhinos.

Chemical poisoning

Water pollution from households and industrial discharges and agricultural run-off is seriously degrading lowland wetlands. Diffused pollution from fertilizers has led to over-enrichment in many wetlands in the lowlands. While the effect of water-borne pollution on wildlife and the environment in Nepal is poorly known,

the over-use of pesticides and other chemicals in the country and evidence of failing to adhere to government regulations has been well documented (e.g., Palikhe 2005; Nepal Forum for Justice 2006). The Critically Endangered Ganges River Dolphin *Platanista gangetica gangetica* is now restricted to very few river systems and these systems continue to be threatened. These are also important habitats for many other species including the fishing cat *Prionailurus viverrinus* and otters.

Poaching and illegal trade

Poaching remains a significant threat to many species. Even within protected areas, animals continue to be illegally hunted for commercial or subsistence purposes. The Greater One-horned Rhino, Royal Bengal Tiger, Alpine Musk Deer and Indian and Chinese Pangolins are some of the most seriously affected species, illegally hunted for commercial trade in their body parts and used for medicinal purposes and cosmetics. Many species illegally hunted for subsistence go unrecorded.

Reduction in prey base

A large number of ungulate species are now considered threatened in Nepal. Many of these species constitute the main prey base for a number of carnivores, and for large predators such as the Royal Bengal Tiger, prey depletion is considered a major factor in their decline (Karanth & Stith 1999).

Human-wildlife conflict and persecution

Human-wildlife conflict often occurs as a result of crop raiding, predation on livestock and damage to property due to the increasingly close proximity of people and wildlife and with increasing habitat degradation and declining prey numbers. This situation is escalated often by human fear and frequently results in the injury or fatality on both sides. The Asian Elephant, Leopard *Panthera pardus*, Greater One-horned Rhino, Royal Bengal Tiger and bears are most commonly involved in attacks on people (Acharya et al. 2016). Methods to discourage wildlife from invading human occupied areas often include non-discriminative and fatal measures, such as poisoned bait and electrocution.

Some species are unduly persecuted due to traditional beliefs and a lack of awareness. Negative attitudes towards bats based on myth and folklore result in persecution, despite their great importance for pollination, seed dispersal, and pest and disease control. Small mammals are considered pests and transmitters of disease. As such, the negative attitude and association of unhygienic conditions towards

rodents and small mammals often results in non-species specific persecution, commonly using poisoning.

Disturbance

The gathering of Non-Timber Forest Products (NTFPs), including the highly valuable Yarsagumba *Ophiocordyceps sinensis* and Medicinal and Aromatic Plants (MAPs), by influxes of large numbers of people annually, is affecting many high-altitude areas. This is leading to high levels of disturbance to mammals and other wildlife, including poaching, and forest losses and degradation due to fuel wood collection (Jnawali et al. 2011; BCN and DNPWC in prep.). Disturbance is a widespread threat to bat populations, especially around roosting sites.

Disease

The threat of disease to wildlife in Nepal is largely un-quantified for many species. But due to the close association, dietary and habitat overlap of many wild and domestic species, the risk of transmission of diseases such as tuberculosis, mange, foot-and-mouth disease and rabies is ever increasing. Widespread prevalence of tuberculosis in captive Asian Elephants (ca. 25% of population) of Nepal was detected in the past decade. Segregation and treatment of the infected individuals have reduced tuberculosis prevalence in captive populations but still remains a threat as it could easily pass to wild populations which would be catastrophic. Rapid decline in vulture populations is leading to a situation where large number of dogs and other scavengers congregate to feed on the carcasses increasing the possibilities of rapid disease transmission among themselves and ultimately transmitting it to wild species such as Dhole, Lynx *Lynx lynx* and Golden Jackal *Canis aureus*.

Small and/or fragmented populations

Fragmented, small and isolated populations are at greater risk from demographic and environment stochasticity (Purvis et al. 2000). Species with small populations, such as the Blackbuck *Antelope cervicapra* and Ganges River Dolphin may also suffer from loss of heterozygosity and inbreeding depression.

Climate change

The impacts of climate change on Nepal's mammals are poorly understood. Some species will be able to migrate through fragmented landscapes whilst others may not be able to do so. Some of Nepal's threatened mammals are largely confined to the protected areas,

notably grassland mammals. As the climate changes, habitats, particularly floodplain grasslands, in these protected areas may eventually become no longer suitable for these mammals. Furthermore, as natural habitats outside protected areas have been converted to agriculture or developed areas, the grassland mammals will have no suitable habitat to colonise (Adhikari 1999; Jnawali & Wegge 1999).

Many forest mammals, including a high proportion of threatened forest species, depend on moist forests and are likely to lose their habitat if the climate becomes drier. High alpine areas are also likely to be significantly affected by climate change with resulting consequences to high altitude species such as the Snow Leopard and its prey species.

Linear structures and hydropower

Recently, development of many linear structures has come up as a priority national agenda for the country. Such structures include highways and railroads, high voltage electric lines, canals as well as some larger airports. Such linear structures act as obstacles for migration of many animals, especially mammals; and also significantly increase mortality while crossing these barriers.

Nepal's high annual precipitation and dense river networks provide high potential for hydroelectricity resulting in a significant increase in hydropower plants in recent years. Dams can inundate important habitats, lead to associated development, displace people into new sensitive habitats, and can alter local habitats.

Intensification of agriculture

In recent years, agriculture has been intensified in many areas, especially in the Terai. This has led to a loss of uncultivated field corners and edges which often supported bushes and herbaceous vegetation. Trees have been lost from field boundaries. All these microhabitats form valuable feeding and breeding sites for small mammals.

Limited conservation measures, and inadequate knowledge and research

Forty percent of Nepal's mammals are considered Data Deficient. This situation is especially acute for small mammals and bats of which 49% and 40% respectively are lacking in even baseline data on their population size, distribution and ecology. Without this information, it is difficult to develop effective conservation programmes for these species or groups and to assess their risk of extinction.

Nepal's national policy and research priorities are ambitious, but targets have not been met due to lack of funding and support in already poorly resourced government departments. Since the early years of its establishment, the Department of National Parks and Wildlife Conservation (DNPWC) has been under-resourced in terms of finances and trained manpower, so crippling its effective conservation work in the country.

Despite the many conservation awareness programmes on mammal conservation that have taken place in the country, especially in recent years, there is still an urgent need for the continuation of such programmes with innovative ideas to put across the conservation message and more widely throughout Nepal.

Mammal research and conservation are heavily biased in Nepal because overseas conservation agencies, which have very largely funded this work, are interested mainly in the globally prioritised large charismatic fauna while species that are only nationally threatened or data deficient have been very largely unstudied.

The main threats to Nepal's threatened mammal species are summarised in Appendices 3 and 4.

CONSERVATION RECOMMENDATIONS

Minimizing habitat losses, degradation and fragmentation

There is enormous potential for improved management of existing low density and depleted forests. The 2014–2020 National Biodiversity Strategy and Action Plan includes a target of a significant reduction (by at least 75% of the current rate) in the loss and degradation of forest. Another valuable target is the promotion of alternative energy sources (such as biogas, solar energy, and hydropower) and fuel-efficient technologies (such as bio-briquettes, improved stoves) to reduce demand of firewood (MoFSC 2014). Other important targets include the development and implementation of plans to reduce occurrence of forest fires and overgrazing; reclaiming at least 10,000ha of encroached forestland through effective implementation of the Forest Encroachment Control Strategy (2012) and the establishment of protected forests where necessary and feasible (MoFSC 2014). The provision of more resources to park and forestry field staff should help improve their monitoring of forest exploitation.

Degraded forests with on-going people pressure can be handed over to the community for management through the District Forest Office. Under community

management, protection of most forest areas has been extremely successful and regeneration of lost cover has been phenomenal. Communities throughout Nepal have demonstrated that they can effectively protect and sustainably use the forests under their care. The community forestry programs should therefore be extended and strengthened, giving priority to biodiversity conservation in addition to the forest products (MoFSC 2014). Another target is to promote mixed forests of native plant species in community managed forests (MoFSC 2014).

Regulating NTFP and MAP harvesting with effective management plans would reduce pressure on forests, which annually results from the influx of huge numbers of people to harvest these products. This will also reduce disturbance to mammals and other wildlife (MoFSC 2014).

The effective implementation of Nepal's National Wetland Policy is urgently needed. This policy aims to put people at the center of conservation and natural resource management. While all communities benefit from wetlands, about 17% of the populations from 21 ethnic communities have traditionally based their livelihoods on wetlands. These are some of the most marginalised and poorest people in Nepal. The conservation and restoration of wetlands will benefit many wildlife species which directly or indirectly depend on these wetlands.

The participation by user groups and community-based organizations in collaborative management of wetland resources, as advocated in Nepal's Wetland Policy, will be key to achieving sustainable resource use. These measures should help to prevent over-exploitation including over-fishing, the use of poisons to kill fish, over-grazing and excessive grass cutting along watercourses.

Regulating sand and gravel mining of rivers is urgently needed. MoFSC (2014) includes a target for the development and implementation, by 2015, of an effective mechanism to control mining of gravel and sand from rivers and streams. Areas suitable for sand mining and quarrying should be identified and designated and mining banned in the conservation areas.

Reducing pollution of wetlands is very important, especially in the rivers of Chitwan National Park, which are particularly affected. Enforcement of the Industrial Policy (2011) should help reduce water pollution. MoFSC (2014) states that plans should be developed and implemented to control industrial pollution in five major rivers and five major wetlands, by 2020. MoFSC (2014) also includes a target to control encroachment

and eutrophication in at least ten major wetlands and restore at least five major degraded wetlands by 2020.

Strict enforcement of Nepal's already existing pesticide regulations would greatly reduce the threat from pesticides to people, wildlife and the environment. The Integrated Pest Management (IPM) approach was emphasized in Nepal's National Agricultural Perspective Plan to try and reduce pesticide use. An increase in training of IPM use is badly needed. The use of effective microorganisms (EM) technology should be encouraged by running training camps for farmers in the buffer zones of lowland protected areas. Using EM technology, a combination of various beneficial organisms is formed, that is helpful for plant growth, acting as a fertiliser. The combination of organisms can also act as a bio-pesticide.

Effective grassland management is vital for biodiversity conservation; grassland small mammals are often highly sensitive to changes in habitat quality and the microenvironment around them (Adhikari 1999). People are allowed into Terai protected areas for three to ten days annually to cut grass, at which time the grasslands are also burned; in the case of Chitwan this involves an influx of many thousands of people (Peet et al. 1999). Management should therefore aim to maintain areas of intact grassland that are not cut or burnt, on a rotational basis, whilst allowing other areas to be harvested by local people (Peet 1997; Peet et al. 1999). Burning by management should also be carried out during the early part of the dry season to minimize loss of breeding animals (Peet et al. 1999). Saplings of various trees and bushes should be removed periodically from grasslands to prevent succession to shrubland and eventually forest. Ploughing has been found to be counterproductive and should be avoided (Peet 1997; Baral 2001). In addition to better management of existing grasslands, the expansion and conservation of new grassland areas are recommended (Baral 2001; Jnawali et al. 2011) and degraded grasslands should be restored. Livestock grazing should be stopped in protected areas by improving law enforcement. Livestock management practices should be improved, for example by including stall feeding. Grazing pastures outside protected areas should be identified, promoted and managed.

More community-managed grasslands should be set up in lowland Nepal (Jnawali et al. 2011). This is already happening in Chitwan National Park buffer zone in Nawalparasi District, where a community-managed grassland is working along similar lines to that of community forestry and fulfills the needs of local village people for cattle fodder and thatch grasses (Dhan Bahadur Chaudhary pers. comm.).

Corridors to connect fragmented habitats such as isolated grasslands and forest patches should be restored, and land use planning and policies should be improved to ensure these areas are conserved.

Urgent action is needed to control the spread of invasive alien plant species such as *Mikania micrantha*. MoFSC (2014) includes a target for nation-wide survey and research on the control of at least five most problematic invasive alien plant species by 2020, although no specific species have been suggested. The development and implementation of a national invasive plant species control plan should be a priority.

Environmental Impact Assessments should be ensured with compulsory input from biodiversity experts on development projects, including hydropower dams and infrastructure such as road construction, power lines and bridges. The long term impacts of large scale development projects, such as hydropower dams and the proposed east-west railway network and postal road, on mammals and other wildlife need to be studied. Some of these projects would be highly detrimental to wildlife. Therefore, before embarking on any large infrastructure projects, consultation should be made with biodiversity experts.

Reducing poaching and persecution

Integrated law enforcement efforts by the security forces, park authorities, conservation partners, and local communities have been very effective in Nepal to control poaching and illegal wildlife trade (Lamichhane et al. 2017). Such efforts should be further strengthened and scaled up outside protected areas.

More conservation awareness programs should be launched, especially in buffer zones of protected areas. Conservation awareness activities should be targeted at schools, colleges, community groups, farmers, protected area army staff, religious and political leaders using electronic and print media, radio and TV programs, social media, street dramas, talks and presentations, wildlife fair / festivals, media campaigns, celebrities, sports icons and documentaries. It is important that conservation messages are relevant and effective. Nature clubs should be established in schools and within communities and wildlife watching activities carried out regularly for school children. Awards and recognition of local achievements should be established. A National Mammal Day could be introduced; each district could adopt its own mammal species to celebrate.

Resolving human-wildlife conflict

Much of the attempts to resolve conflicts have focussed around protected areas. Some of the more successful strategies include the deployment of electric fences, building predator-proof corrals, construction of trenches and planting of crops that are unpalatable to wildlife. At the national level, however, there is minimal infrastructure and support to address some of these issues. For example, common Leopard attacks on livestock and sometimes humans is widespread across the mid-hill region of Nepal, but district forest offices have no institutional capacity to respond (e.g., capturing leopards, engaging in conservation planning and monitoring animals). The same is true for dealing with conflicts with elephants in lowland Nepal. Therefore, there is an urgent need to build the institutional capacity to address conflicts as part of the framework of overall conservation planning (Acharya et al. 2016).

Improvements in mammal conservation measures and in mammal research

Conservation projects should support livelihood of local communities to ensure their active participation. More conservation engagement programs are urgently needed. Capacity building of local communities including wildlife monitoring is important. The programs should also aim to improve understanding of the global and national importance of Nepal's conservation areas amongst government and civil society.

Conservation strategies for threatened groups of mammal species (besides flagship species) based on appropriate baseline data should be developed and implemented. Key research projects need to be identified, especially on nationally threatened species and data deficient species. Collaboration between universities and NGOs needs to be developed. An annual funding program should be established with a committee set up to review proposals and monitor research projects, also enabling development of wildlife research capacity.

Protected areas' staff and the Nepal Army working in the protected areas should be trained in the various aspects of wildlife conservation. Protected areas' staff should also be provided with adequate resources including field equipment such as binoculars and field guides and training so they can carry out periodic wildlife monitoring in the protected areas.

The Government should establish strong networking between national and local NGOs and agencies; annual national meetings should be held with representatives from relevant organizations ensuring implementation

and enforcement of existing laws for the protection of wildlife.

Re-assessments of the status of certain mammal groups, for example lowland grassland mammals using camera-trap survey data, carried out every five years would be useful. An online species database and mapping system would also greatly help in land-use planning and policies.

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Appendix 1. National and global status of Nepal's mammals [Regionally Extirpated (RE), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD)].

	Scientific Name	Common Name	National Status	Global status
	Order: CARNIVORA			
1	<i>Ailurus fulgens</i>	Red Panda	EN	EN
2	<i>Aonyx cinerea</i>	Asian Small-clawed Otter	DD	VU
3	<i>Arctictis binturong</i>	Binturong	DD	VU
4	<i>Arctonyx collaris</i>	Hog Badger	DD	VU
5	<i>Canis aureus</i>	Golden Jackal	LC	LC
6	<i>Canis lupus</i>	Grey Wolf	CR	LC
7	<i>Cuon alpinus</i>	Dhole	EN	EN
8	<i>Felis chaus</i>	Jungle Cat	LC	LC
9	<i>Herpestes edwardsii</i>	Indian Grey Mongoose	LC	LC
10	<i>Herpestes javanicus</i>	Small Asian Mongoose	LC	LC
11	<i>Herpestes Smithii</i>	Ruddy Mongoose	DD	LC
12	<i>Herpestes urva</i>	Crab-eating Mongoose	VU	LC
13	<i>Hyaena hyaena</i>	Striped Hyaena	EN	NT
14	<i>Lutra lutra</i>	Eurasian Otter	NT	NT
15	<i>Lutrogale perspicillata</i>	Smooth-coated Otter	EN	VU
16	<i>Lynx lynx</i>	Lynx	VU	VU
17	<i>Martes flavigula</i>	Yellow-throated Marten	LC	LC
18	<i>Martes foina</i>	Stone Marten/Beech Marten	LC	LC
19	<i>Mellivora capensis</i>	Honey Badger	EN	LC
20	<i>Melogale personata</i>	Large-toothed Ferret Badger	DD	LC
21	<i>Melursus ursinus</i>	Sloth Bear	EN	VU
22	<i>Mustela altaica</i>	Altai Weasel	DD	NT
23	<i>Mustela erminea</i>	Ermine/Stoat	DD	LC
24	<i>Mustela eversmanii</i>	Steppe Pole-cat	DD	LC
25	<i>Mustela kathiah</i>	Yellow-bellied Weasel	DD	LC
26	<i>Mustela sibirica</i>	Siberian Weasel	LC	LC
27	<i>Mustela strigidorsa</i>	Stripe-backed Weasel	DD	LC
28	<i>Neofelis nebulosa</i>	Clouded Leopard	EN	VU
29	<i>Otocolobus manul</i>	Palla's cat	DD	NT
30	<i>Paguma larvata</i>	Masked Palm Civet	LC	LC
31	<i>Panthera pardus</i>	Common Leopard	VU	VU
32	<i>Panthera tigris</i>	Royal Bengal Tiger	EN	EN
33	<i>Panthera uncia</i>	Snow Leopard	EN	EN
34	<i>Paradoxurus hermaphroditus</i>	Common Palm Civet	LC	LC
35	<i>Pardofelis marmorata</i>	Marbled Cat	DD	NT
36	<i>Pardofelis temminckii</i>	Asiatic Golden Cat	DD	NT
37	<i>Prionailurus bengalensis</i>	Leopard Cat	VU	LC
38	<i>Prionailurus rubiginosus</i>	Rusty-spotted Cat	DD	NT
39	<i>Prionailurus viverrinus</i>	Fishing Cat	EN	VU
40	<i>Prionodon pardicolor</i>	Spotted Linsang	EN	LC
41	<i>Ursus arctos</i>	Brown Bear	CR	LC
42	<i>Ursus thibetanus</i>	Himalayan Black Bear	EN	VU
43	<i>Viverra zibetha</i>	Large Indian Civet	NT	LC

	Scientific Name	Common Name	National Status	Global status
44	<i>Viverricula indica</i>	Small Indian Civet	LC	LC
45	<i>Vulpes bengalensis</i>	Bengal Fox	VU	LC
46	<i>Vulpes ferrilata</i>	Tibetan Fox	DD	LC
47	<i>Vulpes vulpes</i>	Red Fox	DD	LC
Order: CETARTIODACTYLA				
48	<i>Antilope cervicapra</i>	Blackbuck	CR	NT
49	<i>Axis axis</i>	Axis Deer	VU	LC
50	<i>Axis porcinus</i>	Hog Deer	EN	EN
51	<i>Bos gaurus</i>	Gaur	VU	VU
52	<i>Bos mutus</i>	Wild Yak	DD	VU
53	<i>Boselaphus tragocamelus</i>	Nilgai	VU	LC
54	<i>Bubalus arnee</i>	Wild Water Buffalo	EN	EN
55	<i>Capricornis thar</i>	Himalayan Serow	DD	NT
56	<i>Hemitragus jemlahicus</i>	Himalayan Tahr	NT	NT
57	<i>Moschiola indica</i>	Indian Chevrotain	CR	LC
58	<i>Moschus chrysogaster</i>	Alpine Musk Deer	EN	EN
59	<i>Moschus fuscus</i>	Black Musk Deer	DD	EN
60	<i>Moschus leucogaster</i>	Himalayan Musk Deer	DD	EN
61	<i>Muntiacus vaginalis</i>	Barking Deer	VU	LC
62	<i>Naemorhedus goral</i>	Himalayan Goral	NT	NT
63	<i>Ovis ammon</i>	Argali	DD	NT
64	<i>Pantholops hodgsonii</i>	Tibetan Antelope	DD	NT
65	<i>Platanista gangetica</i>	South Asian River Dolphin	CR	EN
66	<i>Porcula salvania</i>	Pygmy Hog	RE	CR
67	<i>Procapra picticaudata</i>	Tibetan Gazelle	CR	NT
68	<i>Pseudois nayaur</i>	Blue Sheep	LC	LC
69	<i>Rucervus duvaucelii</i>	Swamp Deer	EN	VU
70	<i>Rusa unicolor</i>	Sambar	VU	VU
71	<i>Sus scrofa</i>	Wild Boar	LC	LC
72	<i>Tetracerus quadricornis</i>	Four-horned Antelope	DD	VU
Order: CHIROPTERA				
73	<i>Arielulus circumdatus</i>	Bronze Sprite	DD	LC
74	<i>Barbastella leucomelas</i>	Asian Barbastelle	LC	LC
75	<i>Cynopterus sphinx</i>	Greater Short-nosed Fruit Bat	LC	LC
76	<i>Eonycteris spelaea</i>	Dawn Bat	DD	LC
77	<i>Eptesicus dimissus</i>	Surat Serotine	DD	DD
78	<i>Eptesicus serotinus</i>	Serotine	DD	LC
79	<i>Falsistrellus affinis</i>	Chocolate Pipistrelle	DD	LC
80	<i>Hesperoptenus tickelli</i>	Tickell's Bat	DD	LC
81	<i>Hipposideros armiger</i>	Great Himalayan Leaf-nosed Bat	LC	LC
82	<i>Hipposideros cineraceus</i>	Least Leaf-nosed Bat	DD	LC
83	<i>Hipposideros fulvus</i>	Fulvus Leaf-nosed Bat	DD	LC
84	<i>Hipposideros pomona</i>	Andersen's Leaf-nosed Bat	NT	LC
85	<i>Ia io</i>	Great Evening Bat	CR	LC
86	<i>Kerivoula hardwickii</i>	Hardwicke's Woolly Bat	DD	LC

	Scientific Name	Common Name	National Status	Global status
87	<i>Kerivoula picta</i>	Painted Bat	LC	LC
88	<i>Megaderma lyra</i>	Greater False Vampire	LC	LC
89	<i>Miniopterus pusillus</i>	Small Long-fingered Bat	DD	LC
90	<i>Miniopterus schreibersii</i>	Common Bentwing Bat	LC	NT
91	<i>Murina aurata</i>	Tibetan Tube-nosed Bat	NT	LC
92	<i>Murina cyclotis</i>	Round-eared Tube-nosed Bat	LC	LC
93	<i>Murina huttoni</i>	Hutton's Tube-nosed Bat	DD	LC
94	<i>Murina leucogaster</i>	Rufous Tube-nosed Bat	DD	LC
95	<i>Myotis blythii</i>	Lesser Mouse-eared Bat	DD	LC
96	<i>Myotis csorbai</i>	Csorba's Mouse-eared Bat	CR	DD
97	<i>Myotis formosus</i>	Hodgson's Bat	LC	LC
98	<i>Myotis muricola</i>	Nepalese Whiskered Bat	LC	LC
99	<i>Myotis nipalensis</i>	Nepal Myotis	LC	LC
100	<i>Myotis sicarius</i>	Mandelli's Mouse-eared Bat	VU	VU
101	<i>Myotis siligorensis</i>	Himalayan Whiskered Bat	LC	LC
102	<i>Nyctalus montanus</i>	Mountain Noctule	DD	LC
103	<i>Nyctalus noctula</i>	Noctule	DD	LC
104	<i>Philetor brachypterus</i>	Short-winged Pipistrelle	VU	LC
105	<i>Pipistrellus coromandra</i>	Coromandel Pipistrelle	LC	LC
106	<i>Pipistrellus javanicus</i>	Javan Pipistrelle	LC	LC
107	<i>Pipistrellus tenuis</i>	Least Pipistrelle	LC	LC
108	<i>Plecotus auritus</i>	Brown Big-eared Bat	DD	LC
109	<i>Plecotus austriacus</i>	Grey Long-eared Bat	DD	LC
110	<i>Pteropus giganteus</i>	Indian Flying Fox	LC	LC
111	<i>Rhinolophus affinis</i>	Intermediate Horseshoe Bat	LC	LC
112	<i>Rhinolophus ferrumequinum</i>	Greater Horseshoe Bat	LC	LC
113	<i>Rhinolophus lepidus</i>	Blyth's Horseshoe Bat	NT	LC
114	<i>Rhinolophus luctus</i>	Woolly Horseshoe Bat	LC	LC
115	<i>Rhinolophus macrotis</i>	Big-eared Horseshoe Bat	LC	LC
116	<i>Rhinolophus pearsonii</i>	Pearson's Horseshoe Bat	LC	LC
117	<i>Rhinolophus pusillus</i>	Least Horseshoe Bat	LC	LC
118	<i>Rhinolophus sinicus</i>	Chinese Horseshoe Bat	LC	LC
119	<i>Rhinolophus subbadius</i>	Little Nepalese Horseshoe Bat	DD	LC
120	<i>Rousettus leschenaultii</i>	Leschenault's Rousette	LC	LC
121	<i>Scotomanes ornatus</i>	Harlequin Bat	EN	LC
122	<i>Scotophilus heathii</i>	Greater Asiatic Yellow House Bat	LC	LC
123	<i>Scotophilus kuhlii</i>	Lesser Asiatic Yellow House Bat	DD	LC
124	<i>Sphaerias blanfordi</i>	Blandford's Fruit Bat	DD	LC
125	<i>Taphozous longimanus</i>	Longed-winged Tomb Bat	DD	LC
	Order: EULIPOTYPHILA			
126	<i>Chimarrogale himalayica</i>	Himalayan Water Shrew	EN	LC
127	<i>Crocidura attenuata</i>	Indochinese Shrew	LC	LC
128	<i>Crocidura horsfieldii</i>	Horsfield's Shrew	DD	DD
129	<i>Crocidura pergrisea</i>	Pale Grey Shrew	DD	DD
130	<i>Episoriculus caudatus</i>	Hodgson's Brown-toothed Shrew	LC	LC

	Scientific Name	Common Name	National Status	Global status
131	<i>Episorculus leucops</i>	Long-tailed Brown-toothed Shrew	LC	LC
132	<i>Episorculus macrurus</i>	Arboreal Brown-toothed Shrew	DD	LC
133	<i>Euroscaptor micrura</i>	Himalayan Mole	DD	LC
134	<i>Nectogale elegans</i>	Elegant Water Shrew	DD	LC
135	<i>Sorex bedfordiae</i>	Lesser Stripe-backed Shrew	DD	LC
136	<i>Sorex excelsus</i>	Highland Shrew	DD	LC
137	<i>Sorex minutus</i>	Eurasian Pygmy Shrew	DD	LC
138	<i>Soriculus nigrescens</i>	Sikkim Large-clawed Shrew	LC	LC
139	<i>Suncus etruscus</i>	Pygmy White-toothed Shrew	DD	LC
140	<i>Suncus murinus</i>	House Shrew	LC	LC
141	<i>Suncus stoliczkanus</i>	Anderson's Shrew	DD	LC
Order: LAGOMORPHA				
142	<i>Caprolagus hispidus</i>	Hispid Hare	EN	EN
143	<i>Lepus nigricollis</i>	Indian Hare	LC	LC
144	<i>Lepus oiostolus</i>	Woolly Hare	LC	LC
145	<i>Ochotona curzoniae</i>	Plateau Pika	DD	LC
146	<i>Ochotona Himalayana</i>	Himalayan Pika	EN	LC
147	<i>Ochotona lama</i>	Lama's Pika	DD	
148	<i>Ochotona macrotis</i>	Large-eared Pika	DD	LC
149	<i>Ochotona nubrica</i>	Nubra Pika	DD	LC
150	<i>Ochotona roylei</i>	Royle's Pika	DD	LC
151	<i>Ochotona thibetana</i>	Moupin Pika	DD	LC
Order: PERISSODACTYLA				
152	<i>Equus kiang</i>	Kiang	VU	LC
153	<i>Rhinoceros unicornis</i>	Greater One-horned Rhinoceros	EN	VU
Order: PHOLIDOTA				
154	<i>Manis crassicaudata</i>	Indian Pangolin	EN	EN
155	<i>Manis pentadactyla</i>	Chinese Pangolin	EN	CR
Order: PRIMATES				
156	<i>Macaca assamensis</i>	Assam Macaque	VU	NT
157	<i>Macaca mulatta</i>	Rhesus Macaque	LC	LC
158	<i>Semnopithecus ajax</i>	Himalayan Grey Langur	DD	EN
159	<i>Semnopithecus hector</i>	Terai Grey Langur	LC	NT
160	<i>Semnopithecus schistaceus</i>	Nepal Grey Langur	LC	LC
Order: PROBOSCIDEA				
161	<i>Elephas Maximus</i>	Asian Elephant	EN	EN
Order: RODENTIA				
162	<i>Alticola roylei</i>	Royle's Mountain Vole	DD	NT
163	<i>Alticola stoliczkanus</i>	Stoliczka's Mountain Vole	DD	LC
164	<i>Apodemus Gurkha</i>	Himalayan Field Mouse	EN	LC
165	<i>Apodemus pallipes</i>	Ward's Field Mouse	DD	LC
166	<i>Apodemus sylvaticus</i>	Long-tailed Field Mouse	LC	LC
167	<i>Bandicota bengalensis</i>	Lesser Bandicoot Rat	LC	LC
168	<i>Bandicota indica</i>	Greater Bandicoot Rat	LC	LC
169	<i>Bandicota indica</i>	Giant Bandicoot-Rat	DD	LC

	Scientific Name	Common Name	National Status	Global status
170	<i>Belomys pearsonii</i>	Hairy-footed Flying Squirrel	DD	DD
171	<i>Callosciurus pygerythrus</i>	Hoary-bellied Squirrel	LC	LC
172	<i>Cannomys badius</i>	Bay Bamboo Rat	DD	LC
173	<i>Cricetulus alticola</i>	Ladakh Hamster	DD	LC
174	<i>Dacnomys millardi</i>	Millard's Rat	DD	DD
175	<i>Diomys crumpi</i>	Crump's Mouse	DD	DD
176	<i>Dremomys lokriah</i>	Orange-bellied Himalayan Squirrel	LC	LC
177	<i>Funambulus pennantii</i>	Five-striped Palm Squirrel	LC	LC
178	<i>Golunda ellioti</i>	Indian Bush Rat	LC	LC
179	<i>Hylomyscus alboniger</i>	Particolored Flying Squirrel	LC	LC
180	<i>Hystrix brachyura</i>	Himalayan Crestless Porcupine	DD	LC
181	<i>Hystrix indica</i>	Indian Crested Porcupine	DD	LC
182	<i>Marmota bobak</i>	Bobak Marmot	LC	LC
183	<i>Marmota himalayana</i>	Himalayan Marmot	LC	LC
184	<i>Millardia meltada</i>	Soft-furred Metad	LC	LC
185	<i>Mus booduga</i>	Common Indian Field Mouse	LC	LC
186	<i>Mus cervicolor</i>	Fawn-colored Mouse	LC	LC
187	<i>Mus cookii</i>	Cook's Mouse	DD	LC
188	<i>Mus musculus</i>	House Mouse	LC	LC
189	<i>Mus phillipsi</i>	Wroughton's Small Spiny Mouse	DD	LC
190	<i>Mus platythrix</i>	Flat-haired Mouse	DD	LC
191	<i>Mus saxicola</i>	Brown Spiny Mouse	LC	LC
192	<i>Mus terricolor</i>	Earth-colored Mouse	LC	LC
193	<i>Neodon sikimensis</i>	Sikkim Vole	DD	LC
194	<i>Nesokia indica</i>	Short-tailed Bandicoot Rat	LC	LC
195	<i>Niviventer eha</i>	Little Himalayan Rat	LC	LC
196	<i>Niviventer fulvescens</i>	Chestnut White-bellied Rat	DD	LC
197	<i>Niviventer niviventer</i>	Himalayan White-bellied Rat	LC	LC
198	<i>Petaurista elegans</i>	Spotted Giant Flying Squirrel	DD	LC
199	<i>Petaurista magnificus</i>	Hodgson's Giant Flying Squirrel	DD	LC
200	<i>Petaurista nobilis</i>	Bhutan Giant Flying Squirrel	DD	NT
201	<i>Petaurista petaurista</i>	Red Giant Flying Squirrel	LC	LC
202	<i>Phaiomys leucurus</i>	Blyth's Vole	DD	LC
203	<i>Rattus andamanensis</i>	Sikkim Rat	DD	LC
204	<i>Rattus nitidus</i>	Himalayan Field Rat	LC	LC
205	<i>Rattus norvegicus</i>	Brown Rat	LC	LC
206	<i>Rattus pyctoris</i>	Himalayan Rat	LC	LC
207	<i>Rattus rattus</i>	Black Rat	LC	LC
208	<i>Ratufa Bicolor</i>	Black Giant Squirrel	EN	NT
209	<i>Tamiops maccllellandii</i>	Himalayan Striped Squirrel	LC	LC
210	<i>Tatera indica</i>	Indian Gerbil	LC	LC
211	<i>Vandeleuria oleracea</i>	Asiatic Long-tailed Climbing Mouse	LC	LC
	Order: SCANDENTIA			
212	<i>Tupaia belangeri</i>	Northern Tree Shrew	DD	LC

Appendix 2. Summary of the main threats to threatened mammal species of Nepal

	<i>Primary Threat</i>
	<i>Secondary Threat</i>
	<i>Tertiary Threat</i>
	<i>Potential / suspected Threat</i>
Specific key threats / drivers of species declines	
Illegal hunting	
1	Poaching for oil used as fish bait
2	Commercial poaching for use of animals/animal parts in trade or for medicinal purposes
3	Subsistence poaching
Human Wildlife conflict	
4	Crop raiding
5	Property damage
6	Human injury
7	Livestock depredation
8	Retaliatory killing
9	Persecution
Habitat loss, degradation and alteration	
10	Invasive plant species
11	Vegetation succession leading to scrub encroachment
12	Indiscriminate burning of grasslands
13	Fragmentation (human encroachment, clearance for agriculture, urbanization)
14	Disturbance (roosting sites)
15	Water pollution (industrial, agricultural and domestic)
16	Barriers (dams, fences)
17	Water development projects
18	Sand and gravel mining of river beds and other surface quarrying
19	Degradation of forests (fuel and fodder collection, logging, selective timber felling, burning, overgrazing)
20	Degradation of grasslands and pastures (livestock over-grazing, inappropriate grassland management in protected areas, vegetation succession leading to scrub encroachment)
Disease	
21	Tuberculosis
22	Rabies
23	Foot-and-mouth
24	White nose or Mange
Resource depletion	
25	Depletion of natural prey base (due to over-fishing, hunting etc.)
Genetic loss	
26	Inbreeding depression (small isolated populations)
27	Hybridization
Other	
28	Flooding, landslides etc.
29	Predation (feral dogs)
30	Entanglement in fishing gear such as gill nets

Primary, secondary and potential/suspected threats to threatened mammal species of Nepal

Category of threat	Species	Illegal hunting	Human wildlife conflict	Habitat loss, degradation and alteration	Disease	Resource depletion	Genetic loss	Other
CR	<i>Antilope cervicapra</i> , Blackbuck	2,3	4,8	20	23		26	29
	<i>Canis lupus</i> , Grey Wolf	2	7,8,9	13	22	25		
	<i>la io</i> , Great Evening Bat	3		13,14,19	24			
	<i>Moschiola indica</i> , Indian Chevrotain	3		10,12,13,20	23		26	
	<i>Myotis csorbai</i> , Csorba's Mouse-eared Myotis	3		13,19	24			
	<i>Platanista gangetica</i> , Ganges River Dolphin	1		15,16,17,18		25	26	30
	<i>Procapra picticaudata</i> , Tibetan Gazelle	2,3		16,20			26	29
	<i>Ursus arctos</i> , Brown Bear	2	4,7,8,9	13		25	26	
	<i>Bos mutus</i> , Wild Yak	3		13	23			
EN	<i>Ailurus fulgens</i> , Red Panda	2		13,19			26	29
	<i>Apodemus gorkha</i> , Himalayan Field Mouse		9	13,20				
	<i>Axis porcinus</i> , Hog Deer	3		10,11				28
	<i>Bubalus arnee</i> , Wild Water Buffalo	3	4,8	10,11,20	23		26,27	28
	<i>Caprolagus hispidus</i> , Hispid Hare			11,12,13,20				
	<i>Chimarrogale himalayica</i> , Himalayan Water Shrew		9	13,15				28
	<i>Cuon alpinus</i> , Dhole		7,8,9	13	22	25		
	<i>Elephas maximus</i> , Asian Elephant		4,5,6,8	13,19	21			
	<i>Hyaena hyaena</i> , Striped Hyeana		7,8,9	13,19,20		25		
	<i>Lutrogale perspicillata</i> , Smooth-coated Otter	2	9	13,15,16,17		25		30
	<i>Manis crassicaudata</i> , Indian Pangolin	2,3	9	13,19				
	<i>Manis pentadactyla</i> , Chinese Pangolin	2,3	9	13,19				
	<i>Mellivora capensis</i> , Honey Badger		9	13				
	<i>Melursus ursinus</i> , Sloth Bear	2	4,8,9	13,19				
	<i>Moschus chrysogaster</i> , Alpine Musk Deer	2		13,20	23			
	<i>Neofelis nebulosa</i> , Clouded Leopard	2	7,8	13,19				
	<i>Ochotona himalayana</i> , Himalayan Pika		9	20				
	<i>Panthera tigris tigris</i> , Bengal Tiger	2	6,7,8	13,19,20		25		
	<i>Panthera uncia</i> , Snow Leopard	2	7,8	13,19,20		25		
	<i>Prionodon pardicolor</i> , Spotted Linsang	2		13,19				
	<i>Prionailurus viverrinus</i> , Fishing Cat	2		15,17,19		25		
	<i>Ratufa bicolor</i> , Black Giant Squirrel	2,3	9	19				
	<i>Rhinoceros unicornis</i> , Greater One-horned Rhino	2	4,5,6,8	10,11,12,13,19				
	<i>Rucervus duvaucelii</i> , Swamp Deer	3		13,20	23			
	<i>Scotomanes ornatus</i> , Harlequin Bat	3		13,20	24			
	<i>Ursus thibetanus</i> , Himalayan Black Bear	2	4,6,7,8	13,19				

Category of threat	Species	Illegal hunting	Human wildlife conflict	Habitat loss, degradation and alteration	Disease	Resource depletion	Genetic loss	Other
VU	<i>Axis axis</i> , Chital	3		10,13,20	23			
	<i>Boselaphus tragocamelus</i> , Nilgai	3	4,8	13,20	23			
	<i>Bos gaurus</i> , Gaur	3		11,13,19,20	23			
	<i>Equus kiang</i> , Kiang			20				
	<i>Herpestes urva</i> , Crab-eating Mongoose	2		13,15,17,19				
	<i>Lynx lynx</i> , Lynx	2	7,8,9	13,20	22			
	<i>Muntiacus vaginalis</i> , Barking Deer	3		10,13,19,20	23			
	<i>Myotis sicarius</i> , Mandelli's Mouse-eared Myotis	3		13,14,19	24			
	<i>Panthera pardus</i> , Leopard	2	6,7,8,9	13		25		
	<i>Philetor brachypterus</i> , Short-winged Pipistrelle	3		13,14,19	24			
	<i>Prionailurus bengalensis</i> , Leopard Cat	3	7,8,9	13				
	<i>Rusa unicolor</i> , Sambar	3		10,13,19	23			
	<i>Vulpes bengalensis</i> , Bengal Fox	2	7,8,9,11	13				

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Nepali abstract:

नेपालका स्तनधारी जन्तुहरूको रातो किताबको मुख्य उद्देश्य २१२ प्रजातिहरूको विस्तृत र अध्यावधिक गरिएको जानकारी उपलब्ध गराउनुका साथै आई.यु.सी.एन रातोसुची कार्यविधिलाई क्षेत्रीय स्तरमा लागु हुने मापदण्डहरूको प्रयोगद्वारा यी प्रजातिहरूको संरक्षणमा देखिएका खतराहरूलाई सम्बोधन गर्न व्यवहारिक सुझावहरू प्रस्तुत गर्नु हो। यस रातो किताबमा उपलब्ध जानकारीको आधारमा जोखिममा रहेको प्रजातिहरूको संरक्षणमा सहयोग पुगी जैविक विविधता महासन्धिमा नेपालले निर्धारण गरेका लक्ष्यहरू प्राप्त गर्न सहयोग हुने छ भन्ने विश्वास छ। अध्ययन गरिएका २१२ मध्ये ४१ प्रजाति (२३ प्रतिशत) राष्ट्रिय स्तरमा खतराको सुचीमा (threatened) रहेको पाइयो जसमध्ये ९ प्रजाति (१८ प्रतिशत) अति संकटापन्न (CR - Critically Endangered), २६ (५३ प्रतिशत) संकटापन्न (EN - Endangered) र १४ (२९ प्रतिशत) लोपोन्मुख (Vu - Vulnerable) रहेका छन् भने एउटा प्रजाति नेपालबाट लोप भएको अनुमान गरिएको छ। सात प्रजाति (३ प्रतिशत) लाई खतराको नजिक (NT - Near Threatened) रहेको आंकलन गरिएको छ भने ८३ वटा प्रजातिहरू (३९ प्रतिशत) वर्गीकरण गर्न तथ्यांक अपर्याप्त रहेको (DD - Data Deficit) पाइएको छ। नेपालका ६० प्रतिशत भन्दा बढी चित्तल, जरायो, निलगाई, चोँरी, गौरीगाई जस्ता चौपाया प्रजातिहरू तथा झण्डै आधा ४५ प्रतिशत मांशाहारी वन्यजन्तुहरू खतराको सूचीमा परेका छन्। चमेरो, मुसा, छुचुन्द्रा र साना स्तनधारीकोबारे नेपालमा न्यून जानकारी उपलब्ध छ र ६० वटा यस्ता स-साना प्रजातिहरू अपर्याप्त तथ्यांक भएको सूचीमा पर्दछन्। बासस्थानको विनास, न्यूनीकरण र खण्डिकरण प्रमुख खतराको रूपमा देखिएका छन् भने अन्य खतराको रूपमा चोरीशिकारी, वन्यजन्तु स-साना खण्डिकृत समूहमा रहनु, आहारा प्रजातिमा हुन गएको कमी, मानव-वन्यजन्तु द्वन्द्वका कारण वन्यजन्तु माथि हुने आक्रमण तथा प्रतीशोधात्मक हत्या, जलवायु परिवर्तन, मिचाहा प्रजाति, रोग र अपर्याप्त अनुसन्धान तथा जानकारी नहुनु रहेका छन्। यी समस्याहरूलाई सम्बोधन गर्न पेश गरिएका सुझावहरूको व्याख्या गरिएको छ। हरेक पाँच वर्षमा केहि खास स्तनधारी समूहहरूको पुनर्मूल्यांकन गरि राष्ट्रिय स्तरको डाटाबेस र नक्सानक तयार गर्नाले भू-उपयोग योजना तथा नीति निर्माणमा सहयोग पुग्ने निष्कर्षमा पुगिएको छ।

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Author Contribution: RA, HSB and SRJ conceived the idea; RA, HSB, BRL, DJ, JG, APK and SL collected data and performed analysis; all authors wrote the manuscript.



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Miscellaneous

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