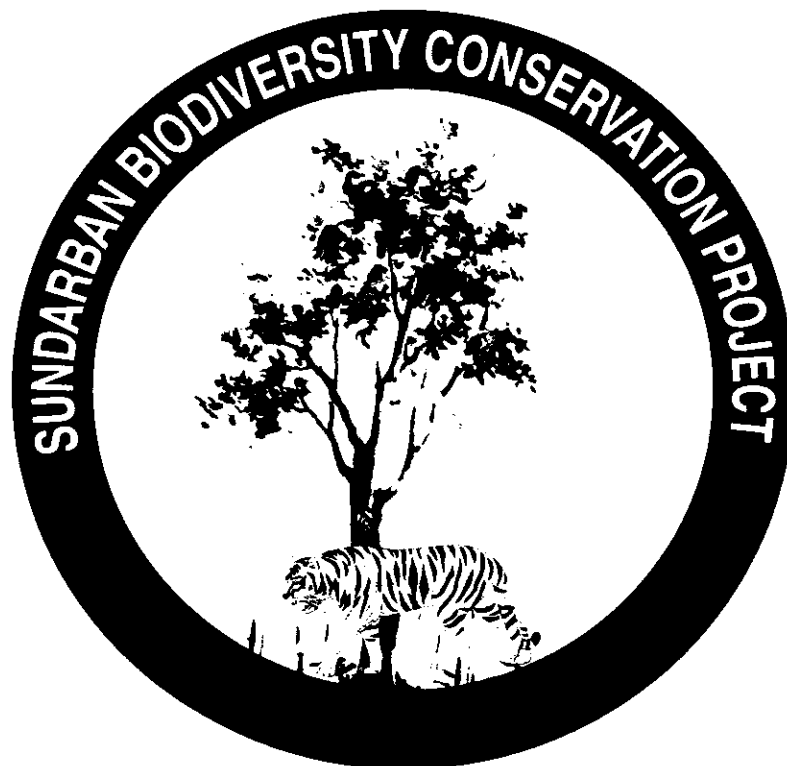


**Government of Bangladesh
Ministry of Environment and Forests
Dhaka, Bangladesh**

**Asian Development Bank
Global Environment Facility
Government of the Netherlands**



Internal Notes- In No. 80

**Study on the Current Regional Herbivore Status and
Potential Stock Supply of Extirpated Herbivore Species**

**IUCN-The World Conservation Union, Bangladesh
September 2003**

**ARCADIS Euroconsult, The Netherlands
Winrock International, USA
Kranti Associates Ltd., Bangladesh
Nature Conservation Management, Bangladesh**

Government of Bangladesh
Ministry of Environment and Forests
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Asian Development Bank
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Sundarban Biodiversity Conservation Project

W.T. B.
PRO-037

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TECHNICAL ADVISORY GROUP

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- Mr. Floris Deodatus, Wildlife Specialist
- Mr. Sailendra Chandra Saha, Community Development Specialist
- Mr. Robert van Zalinge, Associate Expert.
- SBCP Library (2 copies).

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NGO's AND CONTRACTED PARTNERS

- Dr. Anwarul Islam, Zoology Dept. Dhaka University
- Dr. S.U. Sarker, Zoology Dept. Dhaka University
- Dr. Mohammad Mostafa Feeroz, Associate Professor, Zoology Dept. JU, Dhaka.
- Dr. M. Mujaffar Hossain, Professor, Department of Animal Science, BAU, Mymensingh.

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Final Report

**MINISTRY OF ENVIRONMENT AND FOREST
SUNDARBANS BIODIVERSITY CONSERVATION PROJECT**

**STUDY ON THE CURRENT REGIONAL HERBIVORE STATUS AND
POTENTIAL STOCK SUPPLY OF EXTIRPATED HERBIVORE SPECIES**

**IUCN-THE WORLD CONSERVATION UNION, BANGLADESH
ARCADIS Euro. Consult**

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1. Introduction

This is the final report on the “ study of current regional herbivore status and potential stock supply of extirpated herbivore species”.. The selection of candidate species for possible reintroduction in the Sundarbans is one of the objectives of Sundarbans Biodiversity Conservation Project (SBCP). Hence a feasibility study is designed to investigate the potential for wildlife reintroduction. Consequently, it is important to learn the past and present situation of some of the potential herbivore mammalian fauna.

The SBCP species reintroduction feasibility study has the following components:

- Current regional herbivore status and potential stock supply,
- Literature review on habitat requirements,
- Habitat study
- Proposal of management options,
- Analysis of risks and impacts

Therefore, the present study is mainly concentrated on the regional status and potential stock supply. Overall, the purpose of this study is to provide information on the possibilities of re-introduction of some locally extirpated herbivore mammals.

1.1 Background and Justification

The Department of Forest has carried out several studies under a number of projects with the mission to develop and implement a management plan for the wildlife of the Sundarbans. Most of them recommended in favor of reintroduction of the extirpated herbivore species that includes Indian one-horned rhino, Javan rhino, Water Buffalo and deer species (swamp and hog deer). The Sundarbans Biodiversity Conservation Project has considered these recommendations and commissioned a pre-feasibility study on the same. Accordingly an assignment was given to IUCN-Bangladesh

Country Office to conduct deskwork and prepare an information base on the following aspects of reintroduction:

- Current Regional Herbivore Status and Potential Stock Supply
- Specified and targeted species are: Indian One-horned Rhino, Javan Rhino, Wild Buffalo, Swamp Deer and Hog Deer
- Information on Potential Stock Population
- Review of Reintroduction Projects

1.2. Terms of Reference

The following objectives were identified under the Terms of Reference of the study.

1. Collect, collate, and review both published and gray literature for assessing the present state of some selected herbivorous mammalian fauna of South East Asia.
2. Collect information on the past occurrence and distribution status of the extirpated herbivore species in Sundarbans.
3. Identify potential population stock source of the locally extinct herbivores.
4. Provide information on regional sources and contacts.
5. An assessment and over view of other reintroduction projects having similar goals, context and their contact procedure.
6. Prepare a report and present it before the stakeholders of the project.

The expected output of the activity is to produce a research report targeting feasibility of specified wildlife reintroduction in the Sundarbans.

1.3. Scope of Work

The scope under the feasibility study has been identified as follows:

- Assess the current status of the following herbivores in South- and South East Asia: Indian one-horned rhino (*Rhinoceros unicornis*), Javan rhino (*Rhinoceros*

sondaicus), Wild buffalo (*Bubalis bubalis*) Swamp deer (*Cervus duvauceli*) and Hog deer (*Axis porcinus*).

- Potential stock populations of these species, including contacts.
- A review of reintroduction projects, including contacts.

2. Methodology and Approach

2.1. Information Review

To learn the past occurrence, distribution and present population state of the locally extirpated herbivores a number of information centers were visited and all most all the available literature was studied.

The centers visited are: Forest Department, Center for Sustainable Development, Community Development Library, Society for Environment and Human Development Library, Dhaka University Zoology Library, National Museum, Dhaka Zoo, Forest Department Library, Bangladesh Agricultural Research Council, Forest Research Institute and IUCN library. The list of literature reviewed is included in the Bibliography section. The status of species is described under the result chapter.

Various publications are available on the wildlife of the Sundarbans. These are mostly reports as an outcome of a forestry project. Very few studies have so far been conducted which provide details about the wildlife in general and the locally extinct mammalian fauna in particular.

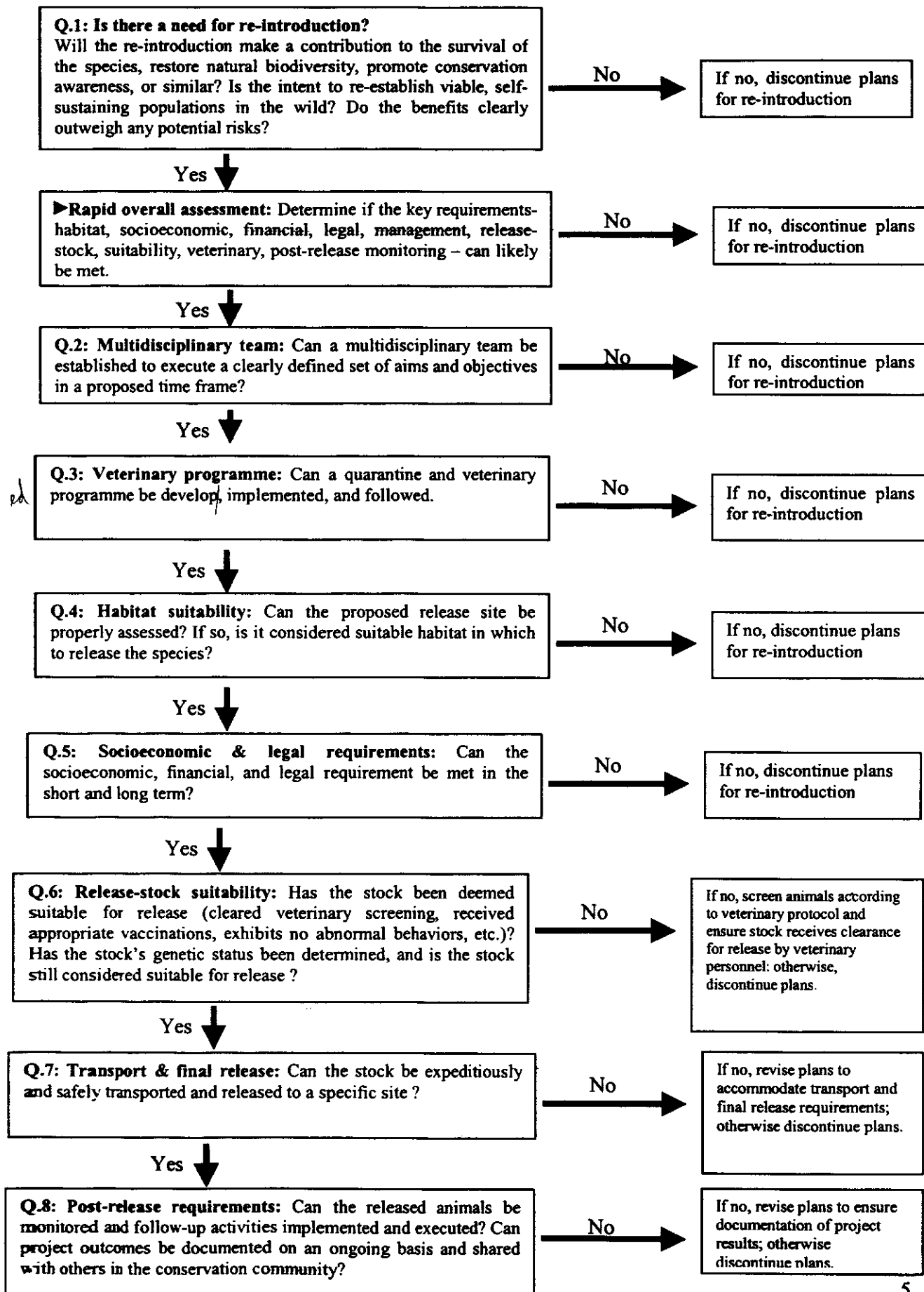
For any reintroduction of wildlife it is important to understand the ecosystem structure and function and the habitat condition.. To judge the prevailing state of the Sundarbans a number of the most promising sites were visited to get an initial perspective.

2.2. Understanding Sundarbans Ecology: Habitat for potential target species reintroduction

For any reintroduction program it is necessary to know the present habitat condition. If the ecology is not known properly then often the initiative fails due to some generic reasons such as the linkage in food chain, diseases outbreak and lack of adjustment to the given situation. Therefore, it is vital and a pre-condition for a manager to have an extensive database upon which necessary actions can be taken in response to any disorder in reintroduction projects. Such a detailed review of the suitability of the ecological conditions for reintroduction was outside the scope of this study, but preliminary field observations on the most suitable sites for reintroduction have been included in the report (see chapter 3.6).

2.3 Decision Tree: Re-introductions

For any re-introduction project the globally practiced decision tree is depicted in the next page. The initially listed species are scrutinized through these questions in the scope of a reintroduction matrix (see decision tree in figure below and chapter 4 for the matrix) and finally based on these criteria the names of the possible species are proposed for reintroduction.



3. Results

3.1. Brief History of Extinction in the Sundarbans

In previous reports some preliminary information is available on the occurrence and distribution of wildlife. Based on the literature search it was observed that in the past, the northern areas of the Sundarbans extending further up in the districts of greater Khulna and part of Jessore and Faridpur were the habitat of Rhinos, Deer and Buffalos.

The Sundarbans has lost several large mammalian fauna during the last century. These are mostly herbivorous in nature. The extirpated species are Swamp deer, the different species of Asiatic Rhinoceros, Water buffalo and Hog deer. The original habitat in the north of the Sundarbans (reeds, grass and swamps and floodplain jungle) is destroyed. Only the estuarine and coastal mangroves with its associated small patches of grasses still exist. In old publications (District Gazetteer and hunter's stories) it is mentioned that it was mainly because of hunting and poaching that this massive loss occurred in the Sundarbans biological diversity. But there exists very little information on the ecological and geomorphologic aspects of the decline of these unique herbivores from Sundarbans.

According to Alexander Hamilton (1727), tigers, leopards, rhinos, wild buffalo, wild pigs, wild cats, porcupines, and monkeys were common and were found for the most part in the Sundarbans to the south and were comparatively scarce in the settled tracts to the north. Even as late as 1859, the country at the mouths of the Malancha and the Raimangal rivers was infested by rhinoceros and deer, the ground being cut up by their feet. Both rhinoceros and buffaloes had however almost been exterminated by native shikaris already in the early 1900's (O' Malley, 1908). In 1792, rewards were paid for killing the tigers in Madaripur, and even as late as 1875, wild buffaloes were common in the cold season (Hunter 1875).

Based on literature review it is revealed that the Sundarbans what we see today was spread over further north which has reduced to 25% of its original size compare to that of 1727. The locally extirpated species of herbivore mammals were used to roam in the upper periphery of the then Sundarbans. Hence, the loss of habitat and massive degradation of habitats are some of the major causes of local extinction of swamp deer, water buffalo and rhinoceros.

However, it is mostly because of hunting followed by habitat conversion and degradation, large herbivores from in and around Sundarbans became extinct by the middle of the twentieth century.

3.2. Asian Rhinos: Status and Conservation

There are three species of Asian rhino: the Indian or greater one-horned Asian rhino (*Rhinoceros unicornis*); the Javan or lesser one-horned Asian rhino (*Rhinoceros sondaicus*); and the Sumatran or Asian two-horned rhino (*Dicerorhinus sumatrensis*). The Indian rhino is, along with the African white rhino, the second largest living species of land mammal and inhabits riverine grasslands in India and Nepal. The Javan rhino is in the same genus as the Indian rhino but is a smaller species and inhabits tropical forests, particularly along watercourses.. The Sumatran rhino is the smallest of all rhino species and inhabits the densest habitat in tropical forests. Both the Indian and Javan rhinos are one-horned while the Sumatran rhino has two horns, similar to the African rhino species. The Sumatran rhino is also known as the hairy rhinoceros and is closely related to the woolly rhino that inhabited Eurasia during the Ice Ages. The Indian rhino is a grazer similar to the African white rhino. The Sumatran rhino is a browser similar to the African black rhino. The Javan rhino is a mixed feeder.

Historically, all three species were abundant and rather widely distributed in Asia through at least the middle of the 20th century. The Indian occurred all along the Indus, Ganges, and Brahmaputra River Basins; earlier it was even more broadly distributed, extending even into southern India. The Javan occurred from eastern India throughout the rest of mainland Southeast Asia and on the islands of Sumatra and Java. The Sumatran rhino also extended from eastern India through mainland Southeast Asia and on the islands of Sumatra and Borneo.

Currently, all three species are threatened with extinction, two critically so, as assessed by the new IUCN Red List Categories.

- The Sumatran rhino is the most critically endangered of all rhino species with a population of 250-400 distributed fragmentarily in Sumatra, Peninsula Malaysia, and Sabah. Remnants may survive in Sarawak, Thailand, Myanmar, and Laos but their existence is unconfirmed and the viability of any populations unlikely.
- The Javan rhino is the rarest of all rhino species with fewer than 100 individuals estimated to survive, most in a single protected area in Indonesia; a few in an unprotected area in Vietnam.
- The Indian rhino is the success story in Asian rhino conservation with over 2,000 individuals in India and Nepal. This population has recovered from very low numbers comparable to the current situation for the Sumatran and even Javan. However, threats to this species are significant and only continued and increased protection will enable survival.

The critical situation for Asian rhinos is emphasized by the fact that the number of all three Asian species combined is approximately equal to or perhaps slightly fewer than the rarer of the two African rhino species, the black rhino, which has received much more publicity over the last decade.

As in Africa, poaching for the horn is the major threat to Asian rhinos. Poaching is significant for all three species and is still rampant on the Sumatran rhino. The primary demand for the horn is its use in traditional Chinese medicine throughout the Far East. Asian rhino horn also appears to be a speculator's commodity in several consumer states.

Habitat degradation is also a significant threat, more so than for the African rhinos since two of the Asian species are denizens of tropical rainforest which continues to decrease in extent. Forest habitat is being destroyed through unsustainable exploitation of timber and conversion of land to agriculture and other human uses.

Immediately, the major requirement for Asian rhino conservation is increased protection *in situ* through core areas similar to the intensive protection zones and sanctuaries that have been successful in Africa.

Managed breeding remains a potential tool for Asian rhino conservation and is successful for the Indian rhino. However, traditional captive propagation methods have not succeeded for Sumatran rhino and have not been tried for Javan rhino. Attempts are under development to establish managed breeding centers in native habitat at least for the Sumatran and perhaps for the Javan rhino to assist in their protection and conservation.

Ultimately, major requirements for rhino conservation are:

- Cessation of the illegal trade in rhino horn and products
- Stabilization, extension, and improvement of rhino habitat
- Recovery of rhino populations to viable levels
- Support of local communities for and hence benefit to local communities from rhino conservation.

Significant funds are required both from governmental and nongovernmental sources, both inside and outside range states, if Asian rhinos are to be protected from extinction. A rigorously defined set of projects with estimated costs has been prepared to indicate the actions and support required. The total cost of these projects is approximately U.S. \$33 million for the period 1996-2000. IUCN/SSC/Asian Rhino Specialist Group (Foose and van Strien, 1997).

Ideally, rhino conservation would become financially sustainable and self-sufficient obviating dependence on the vagaries of donor support. At least one program is in progress and others are under discussion to try to generate such self-sustaining income. This is a joint venture of Government of Nepal and King Mahindra Trust Fund in Nepal for patronizing the Rhino Conservation in Royal Chittawan National Park.

3.2.1. The Sumatran Rhinoceros

3.2.1.1. Past Distribution

The Asiatic two horned rhinoceros was according to Blanford, in his 'Mammalia' in the *Fauna of British India*, first named *Rhinoceros sumatrensis* by Cuiver in 1817. Hubback 1939 in a review wrote, " I have been unable to ascertain when the first record was made establishing the fact that there was a two-horned rhinoceros in Asia".

Prince Henri d' Orleans in his book *From Tonkin to India*, being an account of a journey made by him in 1895, records seeing the head of a two-horned rhinoceros in a druggist's shop at Mong-le, a small Chinese town in Yunnan, close to Tonkin borders. The rhinoceros was alleged to have been killed about four miles away. Prince Henri records that they found plenty of the spoor of rhinoceroses in the valley of the Nam-Tsai, near Assam. The rhinoceros trails must have been numerous because Prince Henri writes 'we had to thank the latter (rhinoceros) for many an enlarged path and flattened bank.' He also stated that their guide Poulanghing explained that these were the tracks of the two-horned rhinoceros and that their flesh was good.

Because all three species of Asiatic rhinos (Indian, Javan and Sumatran rhinos) occurred in the same general region, and early reports often failed to distinguish between them, it is impossible to be certain of the precise historical range.

The Sumatran rhino's range probably extended from eastern India through mainland South East Asia and the islands of Sumatra and Borneo.

3.2.1.2. Present Distribution and Status

The Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) is extinct in Bangladesh.

Prior to the end of 1993, estimates of the Sumatran rhino were 600-1000 worldwide with about 420-875 in Indonesia. The more rigorous assessment of Indonesian populations conducted at the end of 1993 indicate that only 200-300 survive there.

The population of Sumatran rhinos has declined by 50% due to poaching over the last 10 years. Experts estimate that the current total population is less than 300 with Indonesia and Malaysia being the only significant range states.

The Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) is probably the most critically endangered of all the rhinoceros species. It is true that the population of Javan Rhinoceros (*Rhinoceros unicornis*) is lower in numbers with only about 50 surviving in Indonesia and perhaps 10+ in Vietnam. However, the numbers of this species have been stable over the last few years in Indonesia.

Among rhinoceros species, the rate of decline has been greatest in the African Black Rhinoceros whose population has decreased 85% over the last 10 years. However, there are still an estimated 2,400 Black Rhino in Africa; wild population numbers appear to have stabilized, and there is a self-sustaining captive population.

In contrast, the population of Sumatran Rhino:

- is very low (fewer than 500)
- the rate of decline is high (at least 50% over the last ten years)
- there is no indication the situation is stabilizing
- the captive population is not reproducing at all

3.2.1.3. Reintroduction Attempts

A few attempts were taken in the range countries where populations have survived. In peninsular Malaysia, both at Melacca Zoo and Sungkai forest, captive propagation

and reintroduction of species has been practiced. Similarly some attempts were also made in Indonesia. The address and contact details of the persons involved are attached in annex 5.

3.2.1.4. Biology and Ecology

There does not appear to be much difference between the male and female rhino in size. This counts for all animals across the distribution range.

Head and Body Length (Adult)	236cm - 318cm
Head and Body Length (Newborn)	91cm - 92cm
Weight (Adult)	800kg - 2000kg
Weight (Newborn)	Approximately 25kg
Height	112cm - 145cm
Horn	25cm - 79cm

The life span of the Sumatran rhino is about 32 to 33 years. A captive specimen lived for 32 years and 8 months. *Dicerorhinus sumatrensis* is herbivorous and their diet consists of a wide variety of vegetation including leaves, fruits, twigs and bark. They are especially fond of wild mangoes, bamboo and figs. These rhinos get their minerals (mainly sodium and calcium) from visiting salt licks and drinking from salt springs. The daily food consumption in adults averages about 50 kilograms.

The Sumatran rhino is a solitary species. It is very sensitive to all forms of disturbances and is driven away by the slightest sign of intrusion. Males are more nomadic and wander along streambeds and game trails. It feeds before dawn and sunset and moves mostly by night. The rhino spends much of the day in mud wallows or rainwater ponds usually created by the animal themselves, with the surrounding 10 - 35m kept clear. Wallowing is thought to be a cooling mechanism or to provide protection against insects. In some areas, the Sumatran rhino exhibits seasonal

movements, staying in the hills when lowlands are flooded and descending when the weather has become cool near the end of the rains. It can climb steep hills and swim well. The species is an inexhaustible walker and early writers have commented on the fact that it is excessively sly and it has incredible endurance when moving about. It is able to reach a great speed in a short time.

Due to their private habits, little is known about their reproductive behavior. But it is known that most births, in their present range, occur from October to May during the months when there is heavy rainfall. Both the males and females sexually mature at 7 - 8 years of age. The gestation period is estimated to be 12 - 16 months; interbirth interval of 1 calf every 3 - 4 years and weaning takes place at 16 - 17 months. During the first few days after birth, the young calf is hidden in dense vegetation near salt licks while the mother grazes but after two months, it can be found wandering with its mother. Females accompany their calves for a long period of time before they eventually become solitary.

The species are rather adaptable and can live in a variety of habitats.. Their typical habitats are tropical rainforests and montane moss forests. Other habitats include forest margins, areas with dense vegetation and costal swamps. Each individual rhino has a permanent and well-defined home range that includes a salt lick, but males defend a larger territory than females.

3.2.2. Javan/Lesser One-horned Rhinoceros

3.2.2.1. Past Distribution

Until the middle of the 20th century, the Javan rhino was widespread and often abundant from Bangladesh east through Myanmar and southwest China to Vietnam and south through Thailand, Laos, Cambodia and Malaysia to Sumatra and Java.

The last known specimens of the Javan rhino were shot in Myanmar in 1920 and in Malaysia in 1932, and it is known to have survived in Sumatra at least until 1959

(Simon & Geroudet 1970). In Java it was confined to the Ujung Kulong National Park by the 1930's due to expanding human populations (Java is a densely settled island with a population of more than 100 million people).

In the past it was found in the Sundarbans (Duncan, 1883; Sterndale, 1884; Beddard, 1902; Rookmaaker, 1983, Salter, 1984, Khan, 1983). From old documents (District Gazetteers) and hunters story it is also mentioned that the species occurred in the Ganges-Brahmaputra-Teesta Floodplains where there exists plenty of reed lands. Herbaceous growth was very dense in the floodplains. The northern parts of the Sundarbans and the adjacent Gorai river basin were very suitable habitat for rhinos.

In 1950, it was still present in the Sundarbans, the Brahmaputra Valley, in the CTG Hills and several other localities, but by 1960 it was extinct. Until recently, there was speculation that it might exist in other locations outside Bangladesh, besides Java, such as the Myanmar/Thailand border, southern Laos, the Loeser Reserve in Sumatra, Cambodia and Vietnam. However, only rhinos from a population in Vietnam's Cat Tien National Park have recently been photographed using photo trapping (WWF Global Network 1999).

3.2.2.2. Present Distribution and Status

The total population of Javan Rhinos has declined dramatically over the last 150 years, resulting in a low during the 1960s of an estimated 20 to 30 individuals within Ujong Kulong National Park on Java. Strict protection by the Indonesian Authorities has allowed the recovery of this population to an estimated 50 individuals. Ujong Kulong has an estimated carrying capacity of 80 rhinoceros, based on home size range and habitat condition.

Status of Population of Javan Rhinoceros in the Wild

Year	Numbers	Source
1960	24-48	Talbot (1960)
1964	24	Ziswiler (1961)
1967	25	Khan (1989)
1975	45-54	Thornback (1978)
1981	54-60	Sajudin (1982)
1984	50-54	Khan (1989)
1990	<60	Cumming <i>et. al</i> (1990)
1991	50-70	Santiapillai <i>et al.</i> (1991)
1994	<100	Anon (1994)
1995	<70	Foose and Van Strien (1995)
1997	<75	WCMC/WWF (1997n)
1998	<85	Focus (1998)
1999	55-68	WWF Global Network (1999)

3.2.2.3. Reintroduction Attempts

Several attempts were undertaken to breed species in captivity by IUCN/SSC/CBSG in Southeast Asian range countries (Foose and van Strien, 1997). But information on its reintroduction is not available.

3.2.2.4. Biology and Ecology

The Javan (Lesser One-horned) Rhinoceros is considered to be the rarest large mammal species in the world. The Rhino is a dusky grey colour with a single horn; the skin has a number of loose folds giving the appearance of armour plating. This species is very similar in appearance to the closely related Indian Rhinoceros, but is slightly smaller, with a much smaller head and less developed folds of skin on the neck. Recent evidence suggests that the horn may be absent in females.

The Javan rhino occurs in the Eastern Indochina Dry & Monsoon Forests Global 200 Eco region (Olson & Dinerstein 1998; Olson & Dinerstein 1999). The Javan rhino weighs 1500 - 2000 kg (3200 - 4400 lb). The gestation period of the species is 16 months. Breeding season in it's present range is at the end of February and the end of April. One calf is born at a time. The time between births is probably at least 3 years. The calf stays with the mother for about 2 years. They can live near about 21 years.

The Javan rhino browses on saplings and bushes, often breaking down saplings to feed on leaves and shoot ends. It also eats certain fruits. The Javan rhino remains near water and enjoys bathing and wallowing in mud. Mornings and evenings are the chief feeding periods.

The Javan rhino is generally solitary except for mating pairs and mothers with young. The Javan rhino prefers tall grass and reed beds in dense lowland rain forests with a good supply of water and plentiful mud wallows. It now occupies hilly areas up to 2000 m (6550'), but this may be a result of being driven into sub-optimal upland habitats due to the pressure of human settlement in lowland areas. In Vietnam it occurs on very steep hills covered with thick bamboo and rattan stands (WCMC et al. 2000, WWF Global Network 1999). The Javan rhino of Bangladesh habitat was mangrove forest and mixed evergreen forest.

The major reasons for its decline have been, hunting for its horn, which is still valued highly for use in Oriental medicine, and habitat loss due to clearing of lowland forest. Disease and shifts in the composition of vegetation in the Ujung Kulong National Park have also given rise to concern.

3.2.3. Indian / Greater One Horned Rhino (*Rhinoceros unicornis*)

3.2.3.1. Past Distribution

The Indian one-horned rhinoceros was originally distributed in the grassy jungles of alluvial plains in Northern India and Nepal, where it occurred from the middle Ganges to Assam. They were also found throughout the foothills of the Himalayas from north Pakistan, east through India and Nepal, to Assam and Bengal. They may also have occurred in Burma, Thailand, and other parts of Southeast Asia until the Middle age [Burton, 1987].

Duncan (1883) wrote in Cassel's Natural History that Great One Horned Rhino was recorded from Bengal, Shayam and Cochin China. While Sterndale (1884) mentioned that the species was found in the Terai of Himalayas, middle of Nepal down to Assam Valley. By quoting Jordon, Sterndale (1884) wrote this animal once roamed in the Indus Valley. They seemed to prefer grasslands, only in few occasion venturing into the high forests. This animal was seen in the Eastern foothills of the Himalayas. They were also found in the grasslands along the rivers. Rao (1957) said the Indian Rhino once occurred in the Indo-Gangetic plains and adjacent countries. Prater (1971) wrote about its wide distribution in the Gangetic Plains.

Husain (1974, 1981) mentioned about the occurrence and extinctions of this species from Bangladesh but without referring to the exact location of occurrence. Rookmaaker (1980) said that this species occurred in Assam, Nasirabad (Mymensingh), Sylhet and Kachar areas. Khan (1982) wrote that this species was distributed in the Sundarbans, Garo foothills, in the wetlands of Mymensingh and Sylhet Reedlands. They were also seen in the wetlands of Eastern hills. Based on reference of Mahara of Koch Bihar, 1908; Sengupta, 1969 and Asmat 2001 wrote that the Greater One Horned Rhinoceros was distributed in Rangpur, Rajshahi, Mymensingh and Sylhet areas. Also according to district gazetteers, Indian

Rhinoceros once roamed the districts of Mymensingh, Jamalpur, Netrokona, and Sherpur in the middle of the nineteenth century.

3.2.3.2. Present Distribution and Status

By the late 1950s a total of about 400 individuals survived, the majority in Kaziranga Sanctuary, Assam, with others in Bengal and Assam. Currently over 400 Indian rhinos are carefully guarded in Chitwan Park, and its numbers are increasing in Nepal. By the early 1980s the total was estimated at over 1000. Small numbers are maintained in about 30 zoos [Burton, 1987]. The dense human population of the areas restricts rhinos to parks though sometimes they can ravage farmers' fields. Some of the rhinos are currently being moved to Royal Bardia National Park, where they are doing well. The SSP is working with the International Rhino Foundation (IRF) to provide support selected in situ projects for both *Rhinoceros unicornis* and its co generic species *Rhinoceros sondaicus* (the Javan rhino). A probable project for the SSP next year is rendering support to the newly formed rhino protection units for Javan rhino in Ujong Kulong National Park, Indonesia.

Status of Population of Greater One Horned Rhinoceros in the Wild

Year	Numbers	Source
1952	350	Gee (1952)
1958	700	Gee (1959)
1963	600	Oryx (1964)
1964	625	Gee (1964)
1965	625	Oryx (1966)
1966	740	Oryx (1966)
1967	500	Schumacher (1967)
1968	680	Oryx (1968)
1971	630	Fitter (1974)
1983	1000	Nowak and Paradiso (1983)
1984	1500	Macdonald (1984)

1986	1711	Marten <i>et al</i> (1987)
1987	1700	Sale and Singh (1987)
1989	1959	Vigne and Martin (1991)
1990	1700	Foose (1990)
1994	1900	Anon (1994)
1995	2135	Martin and Vigne (1996)
1997	1550	Talukdar (1997)
1997	About 2095	WCMC/WWF (1997)
1998	Approx.2100	AZA (1998)

3.2.3.3. Reintroduction Attempts

Captive breeding programme has been patronized both in India and Nepal by the central government authority. In Nepal, rhinos have also been successfully reintroduced into Bardia National Park, through translocation of individuals from Chitwan.

Ex-situ Stock of *Rhinoceros unicornis* in Regional Zoos

	<i>Male</i>	<i>Female</i>	<i>Total</i>
1. Dhaka Zoo, Bangladesh (2001)	1	1	2
2. Central Zoo, Nepal (2001)	1	1	2
3. India, in 12 zoos (2000)	23	12	35
<i>Total</i>	25	14	39

Source: SAZARC, 2002

3.2.3.4. Biology and Ecology

This species of rhino is a forest dweller and is also an excellent swimmer that will cross wide rivers. It prefers to be near swamps and rivers since it needs to spend a great deal of time in water or mud to protect its skin. Using its prehensile upper lip, the Indian rhino feeds on grasses and twigs. Approximately 2,100 Indian rhinos remain in their natural habitat; however, this is up from a low of 900 in 1970. It is listed as

endangered by U.S Fish & Wildlife Service and the IUCN Red Data Book and is an Appendix I species under CITES. Their habitat in Bangladesh was deciduous forest. The food requirement (per day) of the Great Indian Rhinoceros, in captivity, is – about 150-200 Kg green grass and dry grass + 20-25 kg additional fruits + salt + nutrient pellet, in addition to 200 liter water for in the wallowing tank [Khan, 1998]. Poaching continues to be a problem in its range states. As with all rhinos, the species is poached for its horn. Its horn brings a higher price than African rhinos for medical purposes. Its habitat is now limited as well.

3.3. Swamp Deer

There are 3 subspecies of the Barasingha or Swamp Deer (*Cervus duvauceli*). They are (with the countries where they exist or have existed): *Cervus duvauceli duvauceli* (wetland barasingha) (India, Nepal); *C. d. branderi* (upland barasingha) (currently a single population in Madhya Pradesh, India); *C. d. ranjitsinhi* (currently a single population in Assam, northeast India, Bangladesh (extinct)) [Wemmer et al., 1998].

3.3.1. Past Distribution

In the 19th century it occurred along the base of the Himalayas from Upper Assam, in a few places in the Indo-Gangetic plain from the Eastern Sundarbans to Bahawalpur to Rohri in Upper Sind, and locally throughout the region between the Ganges and Godavari and as far east as Mandla, generally in areas covered by moist, deciduous forests (Sankaran 1989; Schaller 1967).

In the early 20th century it was found primarily in the marshes bordering the Himalayas and along some of the rivers in the Gangetic basin; in Assam, India it was common in the Brahmaputra River valley; in central India, it was found in scattered pockets mostly south of the Narmada River in what is now the state of Madhya Pradesh. By the middle 1960's, populations were small and isolated and declining rapidly. At that time it was found in greatest concentration in Uttar Pradesh and the

adjoining area of southwest Nepal; scattered small herds also occurred in northern Bengal, Assam and Madhya Pradesh.

In Bangladesh it was mostly abundant in the Sundarbans, Chittagong Hill Tracts and Sylhet Forest Divisions of Bangladesh. In the literature it was mentioned that the species also occurred in the districts of Bakerganj, Tangail, Dinajpur, Ponchagarh, Thakurgaon, Mymensingh, Jamalpur, Netrokona, Sherpur, Greater Dhaka, Noakhali and Kishoreganj [District gazetteers].

3.3.2. Present Distribution and Status

It became extinct from Bangladesh about four decades back [Hendrichs 1975; Khan 1984b]. Currently it is found in several localities in the terai of southern Nepal and adjacent districts of India, and in Assam and Madhya Pradesh, India (Wemmer et al. 1998). Limited to India; 3 subspecies are recognized: (a) the swamp dwelling *duvauceli* of the Terai, Uttar Pradesh, Assam, distinguished by its splayed hooves and larger skull, and (b) *branderi* found in the open ground of Madhya Pradesh with smaller well-knit hooves. It is also present in M. Pradesh of India. It lives in central and northeastern India & in Assam, in alluvial regions, dense jungles and at forest verges [Hanak and Mazak, 1992]. (c) *ranjitsinhi* found in Assam. It was this subspecies that was previously found in Bangladesh.

Present distribution of Swamp deer is much reduced and fragmented, with an estimated 5,000 remaining in the wild, mostly in protected areas. The barasingha is therefore considered a vulnerable species by the IUCN (1996). Only 200 of the central Indian race are believed to exist [Prater].

The common belief among wildlife conservationists is that the last stronghold of *C. d. duvauceli* in Uttar Pradesh is Dudhwa National Park and its adjoining Kishanpur and Katerniaghat wildlife sanctuaries. However, there are areas along the Ganga that support good populations of barasingha but are badly neglected by wildlife managers.

One such area is the Hastinapur Wildlife Sanctuary where barasingha exist but little is known about this population (Khan 1999).

3.3.3. Reintroduction Attempts

There are several reports of captive propagation of this species in some of the regional zoos. But no information is available on re-introduction.

Ex-situ Stock of *Cervus duvauceli* in Regional Zoos

	<i>Male</i>	<i>Female</i>	<i>Unknown</i>	<i>Total</i>
1. Central Zoo, Nepal (2001)	2	0	0	2
2. India, 8 zoos (2000)	33	45	2	80
<i>Total</i>	35	45	2	82

Source: SAZARC, 2002

3.3.4. Biology and Ecology

The coat is generally an orange to brown color, with males being slightly darker than females. During the summer, the pelage lightens, and some populations develop faint spots on the back and sides. The under parts, including the underside of the tail, are whitish. There is a dark dorsal stripe, on each side of which may be a row of light spots. The barasingha weighs 170 - 180 kg (370 - 400 lb).

The barasingha occupies a wide variety of forest types, including dry and moist deciduous forest, mangrove forest and evergreen forest, but its prime habitat in the past has been grasslands and reed beds bordering the major rivers in the northern part of its range. Regardless of the vegetation type, it prefers areas with water; flat to moderately hilly terrain; and open localities comprised of both marshes and grasslands or of woodlands with an understorey of grasses.

The altitudinal range of the barasingha is between 100 - 300 m (330 - 980'). It inhabits flooded tall grassland and open sal (*Shorea robusta*) forest with a grass understorey. The upland barasingha occupies drier habitat. (Wemmer et al. 1998)

The barasingha occurs in the Terai-Duar Savannas & Grasslands and the Eastern Indian Monsoon Forests Global 200 Ecoregions. (Olson & Dinerstein 1998, Olson & Dinerstein 1999)

The maturity age of the swamp deer is more than 2 years (females). The gestation period is 240-250 days. The mating season may extend from September to April. Births occur from August - November, with a peak in September - October (Kanha National Park, India) (Schaller 1967). They have one young per litter. The time between births is 1 year. The maximum age is 23 years (Captivity) (Nowak 1999).

The barasingha eats mainly grasses, but the wetland barasingha occasionally feeds on aquatic plants. Aquatic plants also contribute significantly to the diet of *C. d. ranjitsinhi* during the monsoon and winter. (Wemmer et al. 1998)

The barasingha can be active during the day or at night. It drinks at least twice a day during the hot season, traveling to a water hole soon after daylight and in the late afternoon.

Barasingha have social organization structures. In central India the majority of the barasingha were found in mixed herds for the first 8 months of the year, with the ratio of females to males being about 2:1. In three different areas the herds averaged 8, 8, and 13 - 19 animals respectively, with larger herds comprising 45 - 61 animals. For the remainder of the year the herds were smaller and many animals were solitary. During the peak of the rut the barasingha form breeding herds, numbering 30 - 50 individuals each, composed of a number of adult males, females, and young. Males establish a dominance hierarchy, with the highest-ranking male taking priority to any estrous female. The composition of the herd changes somewhat from day to day.

In Dudhwa National Park, India, mean group sizes during summer, monsoon, and winter were 32, 13 and 7 respectively. Congregations of up to 250 individuals have been seen. (Wemmer et al. 1998)

The ratios of adult males: adult females: fawns for several localities in India in the 1960's were as follows (the number of females has been set to 100 in all cases):

90:100:15 (January 1, 1964; total population ~ 82; Kanha National Park)

104:100:16 (January 1, 1965; total population ~ 55; Kanha National Park)

69:100:40 (February 25 - March 5; total population ~ 70 - 80; West Kheri Forest)

88:100:33 (April 30 - May 7; total population ~ 200 - 250; Kaziranga Sanctuary)
(Schaller 1967)

The density of the species is 0.2 individuals/sq km (0.6 individuals/sq mi) (total ~ 75 individuals; Kanha National Park, India); biomass ~ 37 kg/sq km (assuming average weight = 160 kg) (213 lb/sq mi (assuming average weight = 350 lb)). (Schaller 1967).

The causes of the barasingha's decline and present threats include destruction or modification of its habitat for wetland reclamation, grass and timber cutting, illegal gathering of fuelwood and other resources in reserves, and cultivation or tree plantations; poaching; and shooting for (allegedly) crop protection. Diseases introduced by cattle may also have been a factor.

3.4. Sambar Deer

The Sambar Deer is the most widespread deer species in the world, covering many countries in the Asian continent. It is also one of the larger members of the deer family.

3.4.1 Past Distribution

India, Bangladesh, Burma & Ceylon, extending through the Malay countries & eastwards to the Philippines and beyond. The typical race *C. u. unicolor* is from Ceylon. The Indian race *C. u. niger* is confined to India. The Malay race *C. u. equinus* extends from Assam eastwards [Prater]. It was a resident in India & Southeastern Asia, Southern & Southeastern China, the Malayan Peninsula, Sri Lanka, Sumatra, Borneo [Kalimantan], Hainan and Taiwan [Hanak and Mazak, 1992]

In Bangladesh, Sambar occurred in Sylhet, CTG, CHTs (Khagrachari, Bandarban & Rangamati), Dhaka, Jamalpur, Mymensing, Comilla, Noakhali, Netrokona, Sherpur, Kishoreganj, and Greater Dhaka [Khan 1985, district gazetteers].

3.4.2. Present Distribution and Status

In Bangladesh this species is now restricted to Sylhet, Chittagong and the Chittagong Hill Tracts. These populations are locally threatened with extinction.

Although the Sambar deer is found in almost every corner of India, some of the best parks to sight this animal in are Kanha, Corbett, Ranthambore, Bandhavgarh, Gir, Dudhwa, Manas, Kaziranga and Sariska. Sambar Deer (*Cervus unicolor*) are also found in Australia. They were introduced into this country in the latter part of last century from India, Sri Lanka and Malaysia.

Stock is available in all most all the zoos as well as in the wild in the region.

3.4.3. Reintroduction Attempts

All the zoos have adequate captive breed population but none is engaged in its reintroduction.

3.4.4. Biology and Ecology

The Sambar Deer is the most widely spread deer species in the world, covering many countries in the Asian continent. Their population is large and spread to almost every corner of India. They do not appear on the endangered list.

It is also one of the larger members of the deer family. Some males are known to weigh up to 300 kg. and can grow to a height ranging from 135 - 150 cm. at the shoulders. The specimens found in central India appear to be larger than those found in other regions. The male members of this species have antlers that can grow to a length of 90 - 95cms, with a record finding of one that measured 127cms! These animals have a life expectancy ranging between 16 - 20 years.

They are the favourite prey species of the tiger. A large sambar can feed a tiger for up to 4 days. Unlike the Spotted deer, which shouts an alarm and darts away at the sight of a predator, the sambar tends to alertly watch and keep giving alarm calls until the danger has passed. A reason due to which many of them fall prey to predators.

Food requirement of Sambar in captivity –is around 7-10 kg grass/vegetable + 2-3 kg additional fruits + salt + nutrient pellet + leaf of jackfruit tree or similar + nuts + 12 liter water [Khan, 1998]. Their natural diet consists of vegetation, mainly leaves.

Their breeding period is mainly during the months of November and December. The gestation period is 6 months. The males by this time have shed their antlers. A new pair starts growing almost immediately. It is during this period of their life cycles when

they are seen less frequently. The male's mostly lead solitary lives and are rarely seen associating with each other, except on some occasions during the rutting season. The sambar has extremely sharp senses of hearing and smell.

3.5. Hog Deer

3.5.1 Past distribution

The species is thought to be locally extinct [Khan 1982a; 1984b]. It was found in the district of Tangail, Mymensingh, Jamalpur, Netrokona, Sherpur, Sylhet, Greater Dhaka, Noakhali, Khulna, Rajshahi, Dinajpur and Kishoreganj [District gazetteers].

The last records of this species in Sylhet and Sundarbans are: Sylhet [extinct in 1971] and Sundarbans [Hendrichs, before 1970].

3.5.2. Present Distribution and Status

Hog deer is widely distributed throughout much of tropical Asia. It is found on the low alluvial grass plains of north India from Sind and the Punjab to Assam. Its range extends into Nepal, Bhutan, Burma, Southern Yunnan in China, Thailand, Indo-China, and on the Calamain islands in western Philippines. It was also introduced to Sri Lanka [Hanak and Mazak, 1992].

There are but few records of locally migratory populations in Bangladesh, in areas bordering Sylhet and Assam, Tripura and CHT. Possibly a few individuals are still surviving in the remotest forests of the Chittagong Hill Tracts

3.5.3. Reintroduction Attempts

In all most all of the major zoos in the region captive-bred individuals are available. There has been no attempt so far to reintroduce captive-bred animals in to natural areas.

3.5.4. Biology and Ecology

The name "Hog deer" arises from its habit of crashing through the undergrowth with its head down like a wild pig, rather than leaping over obstacles like other deer. Cover is taken as soon as it is feasible. During flight, the tail is held erect, showing the white underside. They are gregarious only when conditions are favorable and do not form a 'unit' at these times, fleeing in different directions rather than in a herd. When alarmed, they make a whistling vocalization or a warning bark.

Home ranges vary widely in size, but averages at above 70 hectares. Population densities may be as low as 0.1 animals per sq. km. in riverine valleys, raising to over 19 individuals per sq. km in grassy floodplains.

Main habitats of Hog deer are riverine forests, marshes, swamps, clearings, and grasslands. *Axis* deer are predominantly grazers; through they occasionally browse and will eat fallen flowers and fruits of forest trees. *Axis* deer in general take readily to water and are said to be good swimmers.

The coat is an ochre-brown colour, although adult males generally darken with age. The young are spotted with white freckles, and reminiscent faint spots may be visible in the summer coat of adults. There is a darker brand running down the spine. The hog deer has relatively short legs and a stocky figure, which is lower in the front than the back. The face is short and wedge-shaped. Males bear three-tined antlers, mounted on short pedicels on the forehead, which may grow up to 60cm/24 inches in length. Hog deer stand only about 28 inches high at the shoulder. Body length: 105-

115 cm/ 3.5-3.8 ft. Shoulder height: 60-75 cm/ 2-2.5 ft. Tail length: 20 cm/8 in, weight: 36-50 kg / 79-110 lb. A fully-grown adult mostly weigh in between 20-30kgs.

Hog deer have a gestation period of 8 months. Rutting takes places during the months of autumn and the antlers are shed in spring. Young per birth is 1, rarely 2. The mating season peaks from September to December depending on the region. It has a life expectancy of 20-30 years. about the young are weaned for about 6 months. Sexual maturity is reached in about 8-12 months. They are essentially solitary, although temporary groups of up to 40 animals have been seen in primary feeding areas. The main social group is a female and her fawn.

Males are aggressive, and may become territorial at low population densities, marking the boundaries with glandular secretion. During the rut, males gather in open meadows, pawing the ground during antagonistic encounters. Harems are not created, with males courting and defending a single female at any given time. Unlike many other deer species, hog deer do not have a rutting call.

Axis deer normally rest during the hotter part of the day and move about at dawn and dusk. They may become nocturnal in the summer, or when molested by people. One of the ways of identifying them is from the 'not long enough' appearance of their legs in comparison to their bodies. If alarmed by anybody or any suspicious movement or sound, they can also identify them from their long raised tails, which are white on the underside. However, this behavior is not unique to them among the deer species.

Where they are undisturbed they form small herds; otherwise they are mainly solitary. During the mating season, which ranges around the month of September, they can also be seen in pairs grazing in the alluvial grass plains.

3.6. Wild Water Buffalo

3.6.1 Past Distribution

The wild water buffalo originally ranged from eastern India and Nepal, east to Vietnam, and south to Malaysia. By 1963, it had been numerically substantially reduced and eliminated from the greater part of its former range. At that time it was thought to be restricted to three zones: the Brahmaputra Valley in Assam, India; the lower reaches of the Godavari River at the confluence of the borders of the states of Orissa, Madhya Pradesh and Andhra Pradesh, India; and the Saptkosi River, Nepal, close to the border with India. As of 1990, remnant populations were thought to occur in Assam and Orissa in India, in Nepal, and in two sanctuaries in Thailand.

In Bangladesh wild buffalo was found in the districts of Rajshahi, Natore, Nowgaon, Nobabganj, Jessore, Tangail, Dinajpur, Noakhali, Ponchagarh, Thakurgaon, Pabna, Sirajganj, Bogura, Ranjpur, Barishal, Vola, Pirozpur, Jhalkathi and Fariudpur, over 50 years ago [district gazetteers].

3.6.2 Present Distribution and Status

In 1980, wild buffalo was reported at Vandaria Beel of Bakerganj district. Presently there are no records of wild buffalo occurring in Bangladesh.

In 1998, wild buffalo were thought to occur in Bhutan, India, Nepal and Thailand. The global population currently is less than 4000. The available data suggest that the global wild buffalo population is in decline (Hedges, 1998).

No subpopulations of more than 500 wild buffalo are known, and there may even be only one subpopulation of more than 50 true wild buffalo (in Kosi Tappu Wildlife Reserve in Nepal). The assessment of wild buffalo numbers is hampered by the difficulty of distinguishing between free-ranging domestic buffalo, feral buffalo, and

truly wild buffalo, as well as hybrids between wild and other buffalo (IUCN 2002). *B. amee* is native to southern and southeastern Asia, from India & Nepal southeastwards including Sri Lanka and the Sunda islands. *B. bubalis* has been bred not only in northern Asia but also in Egypt, the Balkans, in the Asian islands, including the Philippines, & elsewhere [Hanak and Mazak, 1992].

Population Status of Wild Water Buffalo

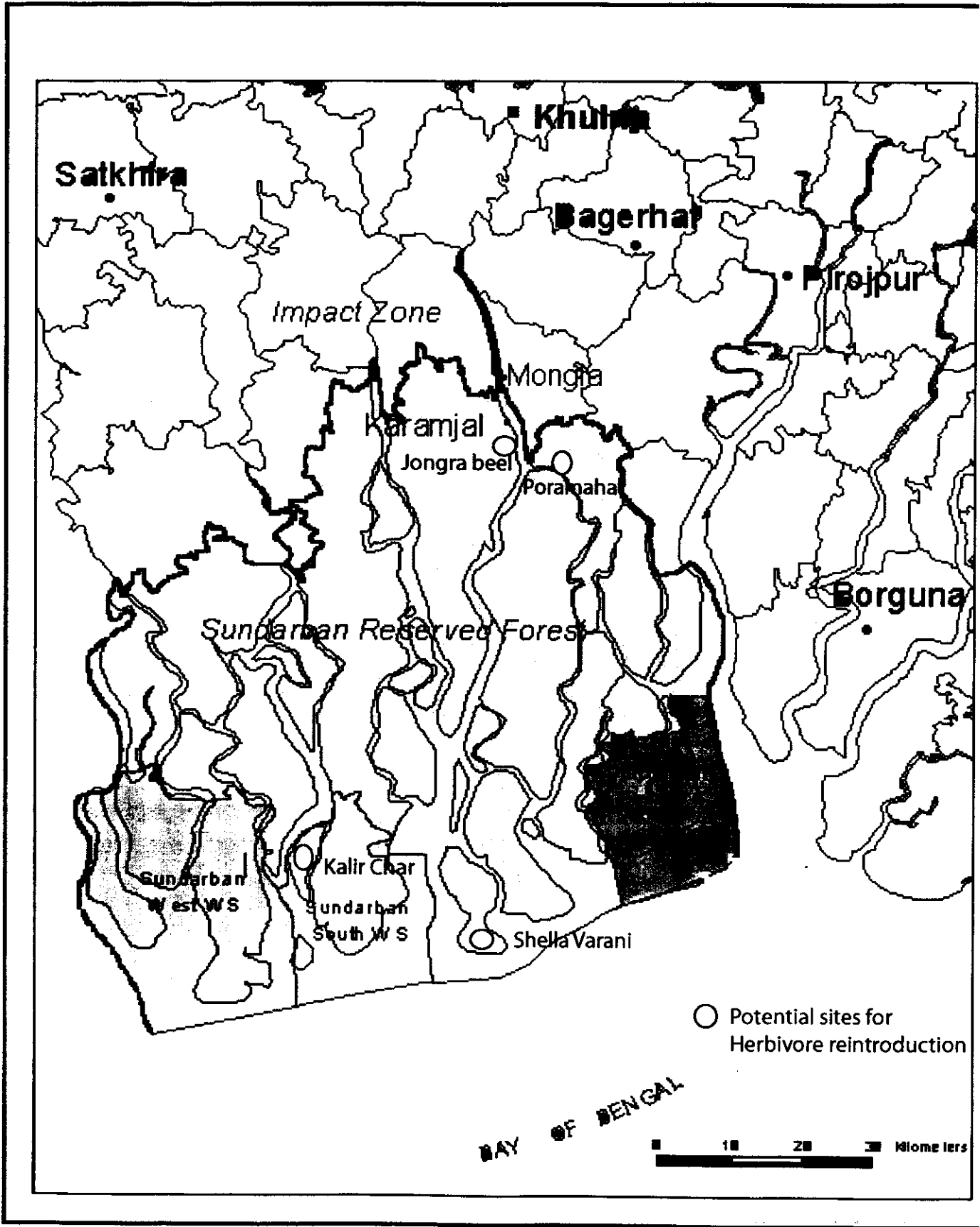
Region	Year	Number	Source
India	1966	<2000	IUCN (1967)
	1989	1000	Oryx (1989c)
	1994	3300-3500	Choudhury (1994)
Nepal	1966	100	IUCN (1967)
	1976	40	Oryx (1976)
Rest of the World	1966	<2000	IUCN (1967)
	1972	2000	Curry-Lindahl (1972)
	1990	<2000	Humphrey and Bain (1990)
	1998	<200	Hedges (1972)

3.6.3. Reintroduction Attempts

There is information available of some captive breeding in some regional zoos but no specific information is readily available on the reintroduction of wild water buffalo.

3.6.4. Biology and Ecology

The wild water buffalo weighs 800 - 1200 kg (1800 - 2600 lb). Puberty is reached at about 18 months. The gestation period of wild water buffalo is 300 - 340 days. Usually only 1 calf is born. The birth interval is usually about 2 years. Weaning occurs for 6 - 9 months. They can survive only 25 years in the wild, 29 years in captivity.



The wild water buffalo eats grass and vegetation growing in or beside rivers and lakes. The wild water buffalo is found in wet grasslands (especially elephant grass) and marshes, near pools and wallows, and near (and in) large rivers. Occasionally it utilizes woodland.

The wild buffalo is diurnal only in areas where it is well protected; where there is substantial human disturbance it is mainly nocturnal. The wild water buffalo lives in herds of females and their young. The males gather in separate bachelor herds outside the breeding season.

Reasons for its decline include interbreeding with domestic and feral buffalo (there are now thought to be nearly 150 million domestic buffalo in the world), loss of habitat due to cultivation, hunting, and competition with and disease from domestic cattle.

3.7. Preliminary Field Observations

The original habitat in the buffer of the Sundarbans has been encroached upon by various land uses other than the naturally evolved ecosystem. But several patches along the northern periphery of the Sundarbans still survive, and where the locally extirpated herbivores could possibly be reintroduced. All these sites were surveyed by the SBCP/TAG and an assessment was made on their potential to accommodate the wildlife to be reintroduced.

Potential sites for reintroduction were visited and data on the habitat situation were collected. These sites are: Jongra Beel, Shella Nadir Verani and Poramahal (See Map). These areas are open wet depressions, very rich in freshwater hydrophytes, especially species of grasses and reeds. *Tamarix*, *Melia grass*, *Phragmites* and several other species of reeds and grasses are the main vegetations of these wetlands. In addition another site was also visited and bio-physical conditions were assessed. The name of the site is Kalirchar.

Jongra Beel is an estuarine wetland dominated by reeds and grasses, surrounded by tree cover consisting of Sundri, Baen, Loha Jhao, Kakra and Bola. *Phragmites* and *Typha* are major species associated with Ajali grass and Singra. Adjacent to the reed lands are the common species Tiger fern, Phoenix palm, and Kalia Lata. A fresh tiger den /resting place was noticed at the outer edge grassland of Jongra beel. In the forest very old growth of Baen and Sundri trees was seen. Several patches of very dense Balla forest are virtually impenetrable. Epiphytes are common. Forest floors with old and rotten leaf litter were seen in abundance. The creeks within the reed lands are deeply muddy and very rich in fresh water fish species and turtles. Based on recent study conducted by SBCP it is revealed that approximately 85% of the area is covered with forest. The rest of the area is mainly open area partly dominated by grasses and partly by water. The open areas (beel) are found inside the forests at a certain distance from the canals in areas that are usually referred to as back swamp.

Shella Varani is located in Block 3 of Compartment 6 under Sharankhola forest range and the GPS location is N 21°43.449' - 21°46.401'; E 89°32.428 –89°35.970'.

The physio-chemical characteristics of the area are: located in the inter- and supra tidal zone; the soil is clay, silt, sand with soft and harder consistency; water is clean with pH 7.5 at 21°C and salinity 21‰.

This site is located opposite the northern most corner of Dublar char and is one of the potential sites of wildlife reintroduction in general and the water buffalo in particular. Areas around the distributaries of the river Shella is known as Shella Nadir Varani. Major vegetation composition of the site is: *Aponogeton sp.*, *Blumea sp.*, *Clemitis arborea*, *Clerodendron inerme*, *Cyperus javanicus*, *Dalbergia candenatensis*, *Dalbergia spinosa*, *Eriochloa procera*, *Flagellaria indica*, *Hmarthria sp.*, *Imperata cylindrical*, *Ipomoea bilobata*, *Mucuna monosoerma*, *Myristachya wightiana*, *Nypa fruticans*, *Oryza rffipogon*, *Pandanus foetidus*, *Phragmites karka*, *Pongamia pinnata*, *Portersia coarectata*, *Pseudoraphis*, *Saccharaum spontaneum*, *Typha elephantia* and *Acanthus ilicifolius*

It is noticed that the general succession pattern of vegetation in Shella varani, along the side of the canal starts with Dhanshi grass mixed with Horgoza followed by Keora forest.

The site in the northern edge is open wet depression, apparently rich in wetland biodiversity. The peripheries of this area have Tamarix, Melia, Phragmites grasses in abundance. On the other hand there are also littoral flats and healthy forest areas rich in undergrowth.

The biophysical features are very favorable for reintroductions of ungulates.

Poramahal is a very important habitat for fresh water fish, water birds and turtles. This wetland has a high density of Phragmites, Stranol, Dulfa, Bala, Jhana, Chirchira and Malia. Several creeks surround this beel. The creeks are Mrigamari, Sonamukhi, Poramahal, Badshar Bharani, and Baidder Bharani.. Open meadows and dense reed lands with freshwater makes this habitat important for a variety of wetland fauna and flora.

All these sites could be inhabited by large herbivores. These areas still have the favorable ecological conditions despite partial degradation of the habitat. There are changes in vegetation pattern and faunal composition within the sites. Reedlands and grasslands are now proliferant.

Kalir char and its adjacent areas are under the compartment 43 of Khulna Forest Range. Major habitat types are: tidal mudflats, grassland, swamp forest, creeks, mixed beach of sand and mud.

This is one of the largest islands with luxuriant undergrowth. This forest is dominated by Gewa and Goran trees having various species of grasses all around its periphery. Species of grasses are gregariously growing near the muddy bank of the creeks which

cris-cross the island. Tiger ferns are very common. Wide meadows inside the island extend the grazing ground for the ungulates. All most all wildlife fauna that are commonly seen in the Sundarbans are encountered here. In terms of vegetation this forest is in better health compared to others within the Sundarbans. Human disturbances are comparatively fewer mainly because of its remoteness. There exists a wildlife watch and monitoring station to look after the sites. In the FRMP as well as in the SBCP biodiversity studies recommended Kalir char as one of the key sites for biodiversity conservation. Considering all these criteria, this could be a potential site for wildlife reintroduction.

4. Scope for Reintroduction

Reintroduction decision tree question	S. Rhino	J. Rhino	I. Rhino	Swamp D.	Sambar	Buffalo	Hog D.
Q1 Biodiversity need and meeting key requirements	Yes, because there is a national need	Yes, because there is a national need.	Yes, because there is a national need but not feasible, not fulfill criteria	Yes, because there is a crying need to restore and enhance tiger prey base.	No, because the species was not the original inhabitant of the Sundarbans.	Yes, because there is a need and fulfill the key criteria.	Yes, because there is a need and feasible.
Q2 Institution and human resources	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q3 Quarantine and veterinary programme	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q4 Habitat suitability	No	No	No	Yes	Yes	Yes	Yes
Q5 Socioeconomic & legal requirements	No	No	No	Yes	Yes	Yes	Yes
Q6 Release-stock suitability	N/A at this stage as there exists no national stock at ex situ.	Do	Do	Yes	Yes	Yes	Yes
Q7 Logistic and release	No	No	No	No	No	No	No
Q8 Monitoring and follow-up capabilities	No	No	No	No	No	No	No

The above matrix reflects the questions and answers pertaining to the selection of candidate species for possible reintroduction. The basic questions of the decision tree for reintroduction are answered as yes when they passed in fulfilling the criterion and answer is no when it fails to fulfill the required needs.

5. Discussion and Conclusion

The first and foremost need for reintroducing locally extirpated herbivores in Bangladesh is to establish a formal institutional set up and mechanisms for implementing this type of long duration programme. The ongoing project-approach activity is not a sustainable one. The best example is the Dulahazara Deer Breeding Park, which was established during the period Bangladesh was East Pakistan. The second important need is for permanent and skilled human resources in the Forest Department, those who will look after this long-term reintroduction programme.

Three species may be considered as suitable candidates for reintroduction in the Sundarbans. These are: Wild Water Buffalo, Swamp Deer and Hog Deer. This consideration is based on the detailed review and evaluation of the species initially selected for screening through the IUCN reintroduction criteria. A general consensus is also built in support of this selection among the relevant stakeholders through a national technical workshop organized by the SBCP in late 2002.

A few places were identified as potential stock source based on literature review and meeting held with the experts of the region. At *ex-situ* source India is the country and the specific locations are mentioned in the list of contact person and center (see Annexes 4 and 5).

Favorable ecological conditions can be found in the Sundarbans. This has again been confirmed in a recent study by SBCP (Jongra-Andharia Area, Technical Reports-TR.No.15, 2002).

Reintroduction of large herbivores could add to the prey-base of the tiger. This could also add value to the education, research and tourism sector. One of the major constraints for re-introduction would be the given institutional and socio-economic aspect, which is not favorable for this type of expensive and long-term projects of species recovery or re-introduction.

Experiences of the recent re-introduction projects in Nepal India, Malaysia, Indonesia, UAE and Australia revealed that a long-term strategy is essential and sound scientific management plan is compulsory to achieve the mission of a reintroduction project.

Although the actual cause of local extinction of some of the large herbivores from the Sundarbans are not known, over hunting was identified as one of the major cause for the downfall. Therefore, to address this burning issue, a very pragmatic action programme to combat the hunting and poaching is an early requirement.

- A Population Habitat Viability Assessment (PHVA) will help in identifying significant environmental and population variables and assessing their potential interactions, which would guide long-term population management. There should be sufficient carrying capacity to sustain growth of the re-introduced population and support a viable population in long run.

- The site should be within historic range, the choice of release site and type should be done carefully.

- Identification and elimination, or reduction to a sufficient level, of previous causes of decline, that could include disease; over-hunting, over collection; pollution; poisoning; competition with other species or predation; habitat loss, competition with domestic livestock, etc. should be assessed before starting upon a reintroduction program.

- An assessment should be made of the taxonomic status of individuals to be re-introduced. They should preferably be of the same subspecies or race as those, which were extirpated, unless adequate numbers are not available

- Detailed studies should be conducted of the status and biology of wild populations to determine the species' critical needs. This might include descriptions of habitat preferences, intraspecific variation and adaptations to local ecological conditions, social behaviour, group requirements, foraging and feeding behaviour, predators and diseases.

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Annex-1

Meet Key Persons and Visit to Regional Reference Center

It was planned to visit Myanmar to meet the people and program related to conservation breeding and reintroduction. But unfortunately, this could not be achieved. Several communications were made with some key institutions and personals. The list is included in the report. Several key persons dealing in conservation breeding were consulted. Important among them are: Dr. Sally Walker IUCN/SSC/CBSG; Dr. Reza Khan, Director Dubai Zoo, UAE, IUCN/SSC member; Dr. Prithviraj Fernando, University of Columbia, USA; Dr. Jayanthi Alahakoon, Deputy Director, National Zoological Gardens, Sri Lanka; Ms. Uzma Khan, Zoological Gardens, Lahore Pakistan; Dr. Muhammed Masoor Kazi, Karachi Zoo, Pakistan; Dr. R.K. Shrestha, Kathmandu Central Zoo, Nepal; Dr. B.A. Daniel, Zoo Outreach Organization, IUCN/SSC/CBSG, India; Dr. Sanjay Molur, IUCN/SSC/CBSG; Dr. Bala Krishna, Head IUCN Asia Regional Biodiversity; Dr. Miranda Stevenson, Retd. Zoo Director, U.K and DR. R.K. Shahu, Zoo Superintendent, Kamala Nehuru Zoological Garden, Gujrat, India. All of them were consulted while they were present at one of the regional meetings of the SAZARC (South Asian Zoo Association for Regional Cooperation) convened at Dhaka. In addition the following experts were consulted:

- y/ ▪ Dr. S.C Dey, Secretary General Global Tiger Forum, New Delhi, India
- Dr. C.L Trishal, Director, Wetlands International- South Asia, A-127, Defence Colony, New Delhi-110024, Tel. +91-11-4629906, Fax: +91-11-4691557, e-mail wisaind@del12.vsnl.net.in
- Dr. Vivek Menon, Executive Director, Wildlife Trust of India, PO.Box 3150 New Delhi 110003 India, tel: +91-116326025-26, Fax.6326027, e-mail: vivek@wildlifetrustofindia.org
- Dr. Tariq Aziz, WWF-India, 172-B Lodhi Estate, New Delhi-110003, India, tel; +91-114698072, fax+91-114698072, e-mail areasindia@vsnl.net
- Dr. Dinoysius S.K. Sharma, Senior Head Animal Species Conservation Unit, WWF-Malaysia, 49, Jalan SS23/15, Taman SEA, 47400 Petaling Jaya, Selangor, Malaysia. Tel. ++9603) 7803,3772, Fax. ++ (603) 7803 5157, e-mail dionysisus@yahoo.com

They expressed their interest to cooperate with the Forest Department Initiative. Communication with Myanmar was failed due to some political reasons. This may be restored at a later stage or a trip to West Bengal (Garumara Sanctuary and Jaldapara Wildlife Sanctuary) Assam (Kaziranga Wildlife Sanctuary) could be organized.

Annex-2

The IUCN/SSC Re-introduction Specialist Group (RSG) is a disciplinary group (as opposed to most SSC Specialist Groups which deal with single taxonomic groups), covering a wide range of plant and animal species. The RSG has an extensive international network, a re-introduction projects database and re-introduction library. The RSG publishes a bi-annual newsletter

RE-INTRODUCTION NEWS.

Contact address for re-introduction practitioner or interested in re-introductions:

Mr. Pritpal S. Soorae
Senior Conservation Officer
IUCN/SSC Re-introduction Specialist Group (RSG)
Environmental Research & Wildlife Development Agency (ERWDA)
P.O. Box 45553
Abu Dhabi
United Arab Emirates (UAE)

Tel: (D/L) 971-2-693-4650 or general line: 693-4628
Fax: 971-2-681-7361
E-mail: PSoorae@erwda.gov.ae

IUCN/SSC Guidelines For Re-Introductions

Prepared by the SSC Re-introduction Specialist Group *
Approved by the 41st Meeting of the IUCN Council, Gland Switzerland, May 1995

INTRODUCTION

These policy guidelines have been drafted by the Re-introduction Specialist Group of the IUCN's Species Survival Commission (1), in response to the increasing occurrence of re-introduction projects worldwide, and consequently, to the growing need for specific policy guidelines to help ensure that the re-introductions achieve their intended conservation benefit, and do not cause adverse side-effects of greater impact. Although IUCN developed a Position Statement on the Translocation of Living Organisms in 1987, more detailed guidelines were felt to be essential in providing more comprehensive coverage of the various factors involved in re-introduction exercises.

These guidelines are intended to act as a guide for procedures useful to re-introduction programmes and do not represent an inflexible code of conduct. Many of the points are more relevant to re-introductions using captive-bred individuals than to translocations of wild species. Others are especially relevant to globally endangered

species with limited numbers of founders. Each re-introduction proposal should be rigorously reviewed on its individual merits. It should be noted that re-introduction is always a very lengthy, complex and expensive process.

Re-introductions or translocations of species for short-term, sporting or commercial purposes - where there is no intention to establish a viable population - are a different issue and beyond the scope of these guidelines. These include fishing and hunting activities.

This document has been written to encompass the full range of plant and animal taxa and is therefore general. It will be regularly revised. Handbooks for re-introducing individual groups of animals and plants will be developed in future.

CONTEXT

The increasing number of re-introductions and translocations led to the establishment of the IUCN/SSC Species Survival Commission's Re-introduction Specialist Group. A priority of the Group has been to update IUCN's 1987 Position Statement on the Translocation of Living Organisms, in consultation with IUCN's other commissions.

It is important that the Guidelines are implemented in the context of IUCN's broader policies pertaining to biodiversity conservation and sustainable management of natural resources. The philosophy for environmental conservation and management of IUCN and other conservation bodies is stated in key documents such as "Caring for the Earth" and "Global Biodiversity Strategy" which cover the broad themes of the need for approaches with community involvement and participation in sustainable natural resource conservation, an overall enhanced quality of human life and the need to conserve and, where necessary, restore ecosystems. With regards to the latter, the re-introduction of a species is one specific instance of restoration where, in general, only this species is missing. Full restoration of an array of plant and animal species has rarely been tried to date.

Restoration of single species of plants and animals is becoming more frequent around the world. Some succeed, many fail. As this form of ecological management is increasingly common, it is a priority for the Species Survival Commission's Re-introduction Specialist Group to develop guidelines so that re-introductions are both justifiable and likely to succeed, and that the conservation world can learn from each initiative, whether successful or not. It is hoped that these Guidelines, based on extensive review of case -

Histories and wide consultation across a range of disciplines will introduce more rigour into the concepts, design, feasibility and implementation of re-introductions despite the wide diversity of species and conditions involved.

Thus the priority has been to develop guidelines that are of direct, practical assistance to those planning, approving or carrying out re-introductions. The primary audience of these guidelines is, therefore, the practitioners (usually managers or scientists), rather

than decision makers in governments. Guidelines directed towards the latter group would inevitably have to go into greater depth on legal and policy issues.

1. DEFINITION OF TERMS

"Re-introduction": an attempt to establish a species(2) in an area which was once part of its historical range, but from which it has been extirpated or become extinct (3) ("Re-establishment" is a synonym, but implies that the re-introduction has been successful).

"Translocation": deliberate and mediated movement of wild individuals or populations from one part of their range to another.

"Re-inforcement/Supplementation": addition of individuals to an existing population of conspecifics.

"Conservation/Benign Introductions": an attempt to establish a species, for the purpose of conservation, outside its recorded distribution but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range.

2. AIMS AND OBJECTIVES OF RE-INTRODUCTION

a. Aims:

The principle aim of any re-introduction should be to establish a viable, free-ranging population in the wild, of a species, subspecies or race, which has become globally or locally extinct, or extirpated, in the wild. It should be re-introduced within the species' former natural habitat and range and should require minimal long-term management.

b. Objectives:

The objectives of a re-introduction may include: to enhance the long-term survival of a species; to re-establish a keystone species (in the ecological or cultural sense) in an ecosystem; to maintain and/or restore natural biodiversity; to provide long-term economic benefits to the local and/or national economy; to promote conservation awareness; or a combination of these.

Annex –3

Definition and basic Principles of Reintroduction

Re-Introduction

Re-introduction is defined as an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct

The principal aim of any reintroduction should be to establish a viable, free-ranging population in the wild, of a species, subspecies or race, which has become globally or locally extinct, or extirpated, in the wild. It should be reintroduced within the species' former natural habitat and range and should require minimal long-term management.

The objectives of a re-introduction may include: to establish a keystone species in an ecosystem; to maintain and/or restore natural biodiversity; to provide long-term economic benefits to the local and/ or national economy; to promote conservation awareness, or a combination of these.

Basic Principles

There are 12 basic principles. These are:

1. Identify the need for re-introduction and conduct a rapid overall assessment (determine if the key requirements-habitat, socio-economic, financial, legal, management, release-stock suitability, veterinary, post-release monitoring are likely be met)
 2. Define aims, objectives, and time frame
 3. Establish a multidisciplinary team
 4. Assess the proposed release-site habitat and determine suitability
 5. Review the socio-ecological and behavioural data on the taxon of interest
 6. Determine if the socioeconomic, financial, and legal requirements can be met in the short and long terms
 7. Assess the suitability of the release stock
 8. Evaluate the genetic status of the release stock
 9. Ensure release stock has been cleared for release by a qualified veterinary team
- basic principles

10. Develop strategy and time frame for transport and final release of animals
11. Establish and enact post-release monitoring and other follow-up activities
12. Document project outcomes on an ongoing basis

Annex-4

List of Zoos and Breeding Centers of South Asia

BANGLADESH

Dhaka Zoological Garden, Government of the People's Republic of Bangladesh, Department of Livestock Services, Mirpur, Dhaka

Rangpur Zoo (15-20 acres), C/o Deputy Curator, Head, Livestock Department, Government of the People's Republic of Bangladesh, run by Department of Livestock Service, Rangpur, Bangladesh:

Rajshahi Zoo, City Corporation, Government, run by Deputy Commissioner, Rajshahi, Rajshahi, Bangladesh

Comilla Zoo, Comilla: Government, run by Deputy Commissioner, District Authority, and Dist. Comilla

Jahanabad Zoo, Government, run by Army Administration, Jahanabad cantonment, Khulna.

Chittagong Zoo (about 35 acres), City Corporation, Chittagong, Bangladesh Government, run by Deputy Commissioner, Chittagong

BHUTAN

Breeding Centre, run by Wildlife In-charge, Department of Forestry Services Phuentsholing, Bhutan

INDIA

(India has 180 zoos. ¹¹Large Zoos only are listed here)

Indira Gandhi Zoological Park, Visakhapatnam 530 001 Andhra Pradesh, India

Nehru Zoological Park, Bahadurpura, Hyderabad 500 264 Andhra Pradesh

Assam State Zoo Cum Botanical Garden, R.G. Barua Road, Guwahati 781 005

Sanjay Gandhi Biological Park, Patna 800 001 Bihar, India

National Zoological Park, Mathura Road, New Delhi 110 003 India

Sakkarbaug Zoo, Outside Majejadi Gate, Junagadh 362 001 Gujarat, India

Kamala Nehru Zoological Garden, Kankaria, Ahmedabad 380 008 Gujarat, India

Sri. Chamarajendra Zoological Garden, Indira Nagar, Mysore 570 010
Karnataka

Veer mata Jijabai Bhosle Udyan Zoo, Byculla, Mumbai 400 027

Nandankanan Zoological Park, Janapath, Saheed Nagar, Bhubaneswar

M.C. Zoological Park-Clihat Bir, S.C.O. 839-40, Sector-22A, Chandigarh 19
April 2002

Arignar Anna Zoological Park, Vandalur 600 048 Chennai

Prince of Wales Zoological Gardens, PO: 448, Hazratganj, Lucknow 226 001

Kanpur Zoological Park, Allen Forest, Kanpur 208 002 Uttar Pradesh

Zoological Garden, Alipore, Alipore, Calcutta 700 027 West Bengal, India

NEPAL

Central Zoo, King Mahendra Trust for Nature, Jawalakhel, Post Box No.3712,
Katmandu, Nepal

Gharial Breeding Centre

Elephant Breeding Centre

Musk Deer Breeding Centre

PAKISTAN

Karachi Safari Park, Karachi Metropolitan Corporation, Karachi 3, Pakistan

Karachi Zoological Gardens, Karachi Metropolitan Corporation, Nishter Road,
Karachi 3, Pakistan

Margalla Hills Zoo, Marghar Zoo, City Development Authority, Islamabad,

Pakistan

Jungle Kingdom, Inside Ayub Park, G.T. Road, Rawalpindi, Pakistan

Lahore Zoo, Hahrah-e-Quaid-e-Azam, Lahore 54000, Pakistan

Bahawal Pur Zoological Gardens, Bahawal Pur, PAKISTAN

Clifton Aquarium, Karachi, Government

Jallore Park, Government

22 breeding centers, Government

Karachi L--dhi Korangi Zoo, Government

Jungle Kingdom, Rawalpindi, Private

3-6 private zoos in Sindh, Private

SRI LANKA

Colombo Zoo, National Zoological Gardens, Dehiwala, Colombo, Sri Lanka

Pinnewala Elephant Orphanage, Pinnewala, Sri Lanka Pinnewala Zoological Gardens, Pinnewala, Sri Lanka

Annex 5

List of Experts

Dr. Jayanthi Alahakoon
Deputy Director & Vety. Officer
National Zoological Gardens
Dehiwala, Colombo
Sri Lanka

Mr. Lyn de Alwis
Retd. Zoo Director & Sr. Forest Official
30 Hotel Road, Mount Lavinia
Sri Lanka

Mr. B. S. Bonal
Director, National Zoological Park
Secretary, IZDA
Mathura Road
New Delhi 110 003

Dr. Masood-ul-Haq Chaudhury
Curator
Bahawalpur Zoological Gardens
Bahawalpur, Pakistan

Dr. Abdul Aleem Chaudhury
Conservator of Forests
Monitoring & Evaluation
84,13-111, Johar Town
Lahore 546000, Pakistan

Dr. Ravi Chellam
Wildlife Institute of India
P.Box No. 18, Chandrabani
Delira Dun 248 001, Uttaranchal

Dr. Ganesli Kumar Dubey
Veterinary Officer, Maitri Baag Zoo
7A South Park Avenue, Sector 9
Bhilai 490 006, M.P.

Dr Madhav Ghimire
Vety. Officer, Central Zoo/KM~fNC
Jawalakhel P I3ox 3712
Kathmandu, Nepal

Mr. Mazhar Hussain
Director Environment
Capital Development Authority
Fatima Jinnah Park, Islamabad
Pakistan

Dr. Raja Muhammad Javed
Director, Lahore Zoo
Hahrah-e-Quaid-e-Azam
Lahore 54000 Pakistan

Mr. V. Kalaiarasan
Director, Chennai Snake Park Trust
Rajbhavan Post
Chennai 600 022, T.N. India

Dr. Anil Khaire
Nisargakavi Bahinabai Choudhury Prai
Sangrahalay
Sambhaji Nagar, G Block, Chinchwad
Pune411 019, MS

Ms. Uzma Khan
Lahore Zoo
Shahre Quaid e Azan
Lahore, Pakistan

Mr. Muhammad Salehuddin Khan
Curator, Dhaka Zoo
Mirpur, Dhaka 1216, Bangladesh

Mrs. Dammika Malasinghe
Assistant Director (General)
National Zoological Gardens
Dehiwal~, Colombo, Sri Lanka

Dr. F~. Narasunhuln, II~S, Director
Sri. Venkateswara Zoological Park
Tirupati 5 1 7 505, Pudipatla Post, A.P.

Dr. Abdul Mannan
Curator, Chittagong Zoo
City Corporation
Chittagong, Bangladesh
Mr. Adit Pal
92, Nilgiri Apartment
New Delhi 110 019, India

Brig H.A.N.T. Perera
Director, National Zoological Gardens
Dehiwala, Colombo, Sri Lanka

Dr. Mansoor Qazi
A-54, Block 14, Gulistan-e-Johar
Karachi, Pakistan

Dr. Arabinda Kumar Saha
Deputy Curator, Head
Rangpur Zoo, Livestock Department
Rangpur, Bangladesh

Dr. R. K. Sahu
Zoo Superintendent
Kamla Nehru Zoological Garden
Kankaria, Ahmedabad 380 008,
Gujarat, India

Dr. M. A. Salam
Asst. Director
Jawahar Lal Nehru Biological Park
Sector-4, Bokaro Steel City
Bokaro 827 004, Bihar, India

Mr. Zohare Ah Shariff
Chief Executive, Jungle Kingdom
Clo. House # 3, Street # 42
F-8/I, Islamabad, Pakistan

Dr. Vinod Kumar Sharma
Chief Warden, Zoos
President IZDA
S.C.O.No.169-70, Sector 8-C
Chandigarh, Punjab, India

Mr. Ang Phuri Sherpa
Project Manager, Kanchanjunga
Conservation Area Project
C/o. WWF-Nepal Program
P.Box 7660, Kathmandu, Nepal
Mr. R. K. Shreshta
Director, Central Zoo/KMTNC
Jawalakhel, P.Box 3712
Kathmandu, Nepal

Ms. Pratibha Singh
Director, Kanpur Zoological Park
Allen Forest
Kanpur 208 002, U.P., India

Mr. P.R. Sinha, Member Secretary,
Central Zoo Authority
Bikaner House, Barrack No.4
Shajahan Road, New Delhi 110 011

Dr. Arshad Haroon Toosey
Veterinary Officer
National Avian Research Centre
P.Box No.10000, Abu Dhabi UAE

Kinley Tshering
Wildlife Incharge
Department of Forestry Services
Phuentsholing, Bhutan

Ms. Sally Walker
Founder/Secretary
Zoo Outreach Organization
No.29/i, Bharathi Colony, Peelamedu
Coimbatore 641 004, T.N.

Mr. Sanjay Molur, Dy. Director
Zoo Outreach Organization
No.29/i, Bharathi Colony, Peelamedu
Coimbatore 641 004, T.N.

9/14

Dr. B.A. Daniel, Scientist
Zoo Outreach Organization
No.29/i, Bharathi Colony, Peelamedu
Coimbatore 641 004, T.N.

Ms. Geetha Shreshta
Central Zoo/KMTNC
Jawalakhel, P.Box 3712
Kathmandu, Nepal

Mr. Paul Pearce Kelly,
Curator, Invertebrate House
London Zoo, Regents Park
London, United Kingdom

Dr. U.S. Seal, Chairman
Conservation Breeding Specialist Group
12101 Johnnycake Ridge Road
Apple Valley, Minnesota 55124 USA