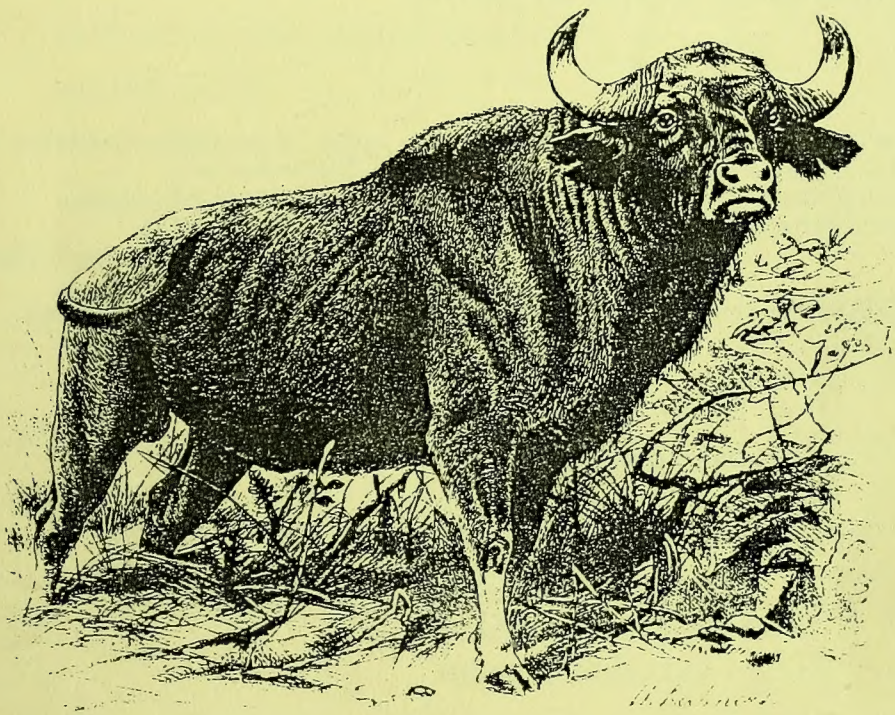
WILD CATTLE, BISON AND BUFFALOES

THEIR STATUS AND POTENTIAL VALUE



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The IUCN Conservation Monitoring Centre

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A contribution to the Global Environment Monitoring System

The IUCN Conservation Monitoring Centre is the division of IUCN that provides a data service to IUCN and to the conservation and development community. It is building an integrated and cross-referenced data-base on species of conservation concern and on ecosystems (principally protected areas so far). The CMC can produce a wide variety of specialist outputs and analyses from the data base, as well as major publications such the Red Data Books and Protected Areas Directories. The Conservation Monitoring Centre is based at Cambridge and Kew in the United Kingdom. It is supported by World Wildlife Fund and by UNEP, is a contribution to the UNEP Global Environment Monitoring System (GEMS) and provides services to CITES and UNESCO.

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INVENTORY REPORT FORM

THE IUCN/SSC WILD CATTLE SPECIALIST
GROUP MEMBERSHIP LIST

RED DATA BOOK CATEGORIES

EXTINCT (Ex).

Species not definitely located in the wild during the past 50 years (criterion as used by CITES).

ENDANGERED (E).

Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating.

Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that are possibly already extinct but have definitely been seen in the wild in the past 50 years.

VULNERABLE (V).

Taxa believed likely to move into the 'Endangered' category in the near future if the causal factors continue operating.

Included are taxa of which most or all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have been seriously depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range.

RARE (R).

Taxa with small world populations that are not at present 'Endangered' or 'Vulnerable', but are at risk.

These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

INDETERMINATE (I).

Taxa known to be 'Endangered', 'Vulnerable' or 'Rare' but where there is not enough information to say which of the three categories is appropriate.

OUT OF DANGER (O).

Taxa formerly included in one of the above categories, but which are now considered relatively secure because effective conservation measures have been taken or the previous threat to their survival has been removed.

INSUFFICIENTLY KNOWN (K).

Taxa that are suspected but not definitely known to belong to any of the above categories, because of lack of information.

N.B. In practice, 'Endangered' and 'Vulnerable' categories may include, temporarily, taxa whose populations are beginning to recover as a result of remedial action, but whose recovery is insufficient to justify their transfer to another category.

THE WILD BOVINAE

		WORLD STATUS
KOUPREY	*Bos sauveli*	Endangered
GAUR	*Bos gaurus*	Vulnerable
BANTENG	*Bos javanicus*	Vulnerable
WILD YAK	*Bos grunniens*	Endangered
WILD WATER BUFFALO	*Bubalus bubalis*	Endangered
TAMARAW	*Bubalus mindorensis*	Endangered
MOUNTAIN ANOA	*Bubalus quarlesi*	Insufficiently Known
LOWLAND ANOA	*Bubalus depressicornis*	Insufficiently Known
EUROPEAN BISON	*Bison bonasus*	Out of Danger
AMERICAN BISON	*Bison bison*	Not threatened
AFRICAN BUFFALO	*Syncerus caffer*	Not threatened

Resolution 15/10. IUCN General Assembly,
Christchurch, New Zealand,
11-23 October 1981

15/10. GENETIC RESOURCES

RECOGNIZING that genetic material forms part of the natural heritage of mankind and should therefore remain available to all nations;

AWARE that the conservation of genetic material is essential for the maintenance and development of animal and plant resources for a large number of present and future beneficial uses;

CONSIDERING that States have a duty of stewardship towards the conservation of genetic resources;

FURTHER CONSIDERING that States using these resources should contribute to their conservation;

RECALLING Recommendations No. 39 of the 1972 United Nations Conference on the Human Environment and the work of FAO, UNEP and Unesco/MAB for the conservation and utilization of genetic resources;

The General Assembly of IUCN, at its 15th session in Christchurch, New Zealand, 11-23 October 1981:

RECOMMENDS that all countries maintain maximum genetic diversity by means of both in situ and ex situ conservation measures;

FURTHER RECOMMENDS that national inventories be made of genetic resources whether under public or private control, in gene banks, in protected areas and in traditional cultivation, and that all such resources should in principle be available to potential users, provided that such usage does not permanently impair or destroy genetic resources;

CALLS UPON States using the genetic resources of another country to contribute to their inventory and conservation; and

INSTRUCTS the IUCN Secretariat to undertake an analysis of the technical, legal, and economic and financial matters relating to the conservation, accessibility and use of these resources with a view to providing the basis for an international arrangement and for rules to implement it.

INTRODUCTION

> The preservation of genetic diversity is both a matter of insurance and investment - necessary to sustain and improve agricultural, forestry and fisheries production, to keep open future options, as a buffer against harmful environmental change, and as the raw material for much scientific and industrial innovation - and a matter of moral principle.
>
> World Conservation Strategy, 1980

Although the problem of the disappearance of potentially valuable, but currently unfashionable, breeds of domestic livestock has been topical for some time and the issue of rare breeds is increasingly being addressed by national and international organizations, less widely considered is the plight of the wild relatives of domestic stock. However in 1980 a joint FAO/UNEP meeting on Animal Genetic Resources held in Rome 'urged all governments to give full consideration to ways and means of conserving viable populations of wild animal species, including avian, which are the ancestors or close relatives of domestic species, and recommended that FAO and UNEP expand their programmes in support of the establishment and improved management of national parks and reserves'. The list which followed included more than 35 species of extant wild animals and birds which are the wild relatives of domestic species. Examples from those included are the camel, the wild horse, the wild ass, the elephant, the vicuna, plus the various species of wild cattle and wild buffaloes. That so many wild relatives of domestic stock still survive tends to be little-known.

The botanical community has long recognized the importance of the preservation and utilization of wild plant genetic resources, but the conservation of wild animal genetic resources lags far behind. For plants there exist such bodies as the International Board for Plant Genetic Resources (IBPGR) and the International Rice Research Institute (IRRI) to coordinate collection of wild specimens and to undertake the subsequent research which has led to improvements in, for instance, crop yields and disease and pest resistance. However, for animals no such organizations exist and as yet there have been very few examples of the use of wild relatives to improve modern domestic stock. Indeed the potential value of such wild genetic resources is only just beginning to be appreciated.

A group of animals whose value in this context must be explored are the wild Bovinae - the wild cattle, bison and buffaloes - since many of them are the ancestors or the close relatives of domestic livestock. In addition, other members of the group offer the possibility for future domestication, whilst others the possibility for direct utilization by cropping schemes. The aim of this report is to heighten awareness of the potential value of the wild Bovinae, of the perilous status of many of them, and thus of the need for urgent conservation action.

More than one species of wild bovine has been domesticated, and the wild relatives of some of these still exist. The common domestic cattle of Europe, Bos taurus, and the humped cattle or Zebu of Africa and Asia, Bos indicus, are all descended from a single wild species, Bos primigenius, the Wild Ox or Aurochs which became extinct in the early 1600s. However, in Asia wild forms of domestic bovines do still survive: the Wild Water Buffalo, Bubalus bubalis, is the wild relative of the 130 million domestic Water Buffalo which are the principal draught animals for much of South-east Asian agriculture; the Wild Yak, Bos grunniens, has at least 10 million domestic relatives which are used as pack animals, for human transport and for meat and milk in the highlands of Central Asia; and

the Banteng, Bos javanicus, is the wild form of the domestic Bali cattle whose population numbers at least 1.5 million and constitutes 20% of Indonesia's domestic cattle population. Another Asian bovine, the Gaur, is probably the progenitor of the Mithan, a ceremonial ox of the hill tribes of Assam, Bangladesh, Bhutan and Burma. Breeding of the domesticate with the wild animal is encouraged whenever possible in the traditional belief that a better quality animal results. Hybridization between a wild species (or its domestic counterpart) and a different species further increases the potential value of the utilization of the wild genetic diversity. For example the domestic Banteng (Bali cattle) is crossbred with the Zebu (Bos indicus) to produce the Madura, a breed native to the island of the same name. The breed reportedly exhibits a better growth rate than the pure Banteng, performs better under extremes of heat and poor nutrition, and has superior meat and hides. Similarly, domestic Yaks are interbred with Zebu to produce the dzo, an animal which has a greater milk yield and is preferred for ploughing; and the Mithan is crossed with the Siri cow (Bos taurus) from India to produce a prized milk animal and a superior draught animal. Thus wild bovine species are potentially highly important sources of genetic material for their domestic counterparts and should be included in any genetic resources programmes involving the conservation of domestic rare breeds. All too often the wild relatives issue is unknown to the livestock fraternity and not addressed by the conservation community, and it deserves high priority action from both.

The four other species of wild bovine which occur in Asia - the Kouprey, the two Anoas, and the Tamaraw - are thought never to have been domesticated (though this is questionable for the Kouprey). These species may possess characteristics, such as disease resistance which would be desirable in domestic stock; for instance the Kouprey is believed to be resistant to rinderpest, the killer disease of domestic cattle. Furthermore these species may be possible candidates for domestication; the meat of both Anoas and the Tamaraw is highly regarded by local peoples.

A bovine that can reasonably be described as undergoing domestication at the present time is the North American Bison, Bison bison. From near extinction at the turn of the century it now numbers over 100,000 animals, at least 60,000 of which occur on private land for commercial production of meat and hides. Although the initial costs for Buffalo ranching are higher than for cattle, the returns are higher; meat prices for both in the U.S.A. are comparable but additional revenue can be earned from Buffalo by the sale of heads, hides, wool, hair, skulls and horns. Buffalo meat is low in fat and high in protein which makes it particularly acceptable to dieters and natural food advocates. Buffalo have the advantage of being productive under range conditions that are not optimal for cattle; they adapt well to climate extremes, need little care, and have few calving problems. Hybridisation experments with Bos taurus to produce the Beefalo or Cattalo have not as yet been very successful, the hybrids being apparently less productive than their pure parents. National Buffalo Associations exist in both the U.S.A. and Canada to promote and coordinate the industry. The European Bison, Bison bonasus, remains an animal of semi-captive conditions and as yet has not been exploited; the potential exists for it to become a commercial animal like its North American counterpart.

The African Buffalo, Syncerus caffer, provides a different example of exploitation: wild herds are being exploited directly through cropping schemes for meat and hides. In Mozambique, for example, over 13,000 Buffalo were cropped in the Zambezi Valley Delta between 1976 and 1982, providing cheap meat for local people as well as employment. Buffalo numbers have remained the same as cropping has been sustainable, and it is reported that local people now consider wildlife to be as important as domestic cattle. A scheme in Zimbabwe is attempting to train the species to the yoke.

Unfortunately six of the eleven extant species of wild Bovinae are threatened: four are considered 'Endangered' (the Kouprey, Wild Yak, Wild Water Buffalo, and Tamaraw); two are 'Vulnerable' (the Gaur and Banteng); two are 'Insufficiently Known' (the Anoas); two are 'Out of Danger' (the American and European Bison); and one, the African Buffalo, is 'Not Threatened'. Thus all four of the existing Asian bovines that are the wild relatives

of domestic stock are threatened, the Wild Yak and the Wild Water Buffalo being greatly so. Principal threat is loss of habitat to an ever-expanding human population, though over-exploitation and contact with domestic livestock are also severe problems. Indeed for the Wild Water Buffalo genetic swamping is the greatest threat. Trade either in live animals or parts and derivatives is not a problem.

What can be done? There are two basic ways of conserving the genetic diversity exhibited by the wild bovines:

1) 'In situ' conservation, in which the stock is preserved by protecting the ecosystem in which it occurs naturally, by the establishment and maintenance of national parks and reserves.

2) 'Ex situ' conservation,
   a) Of the whole animal: by the maintenance of captive populations in zoos (although this is undoubtedly expensive and could lead to problems of inbreeding).
   b) Of part of the animal: by modern techniques enabling the storage of embryos and sperm.

Ideally all three measures should be taken, however in practise this may not be possible.

All Bovinae, except the Kouprey and Wild Yak, occur in at least one national park or reserve, some such as the Gaur occur in many. Others although occurring in protected areas are not protected by them, for example, the Wild Water Buffalo is suffering genetic swamping from domestic Buffalo which roam freely in the various parks and reserves in which it is supposedly safe. Thus there is a need for management of protected areas with reference to preserving the genetic diversity of species within them. Such a requirement is implicit in the 'biosphere reserves' concept coordinated by UNESCO (the United Nations Educational, Scientific and Cultural Organization). Biosphere reserves should supposedly be a network of areas which conserve representative and unique examples of the biological diversity of the Earth. The idea of conserving the genetic variation within the species fits easily within such a concept.

There remains the question of how to make animals available for utilization in genetic resources programmes. In practice it is likely that captive herds will provide the animals, these being supplemented from time to time with wild specimens. All Bovinae, except the Kouprey, the Wild Water Buffalo and the Wild Yak have captive populations; clearly since all three have great potential value as wild genetic resources this situation needs amending. Within zoos there is also the need to be more aware of the importance of maintaining the genetic variation of the captive stock. This will only come about with increased genetical monitoring of captive populations and sophisticated breeding programmes. The livestock industry already has great expertise in this area and a pooling of skills would be highly beneficial.

Similarly the livestock industry could advise on the modern techniques of embryo storage and transfer, and sperm storage and insemination. These methods have already been employed for one bovine species: in 1980 the New York Zoological Society successfully bred a Gaur calf from an embryo transfer between a Gaur and a Holstein cow. Clearly the potential for increasing the captive stock of the species is now greatly enhanced.

In summary, the preservation and utilization of the genetic resources of the Wild Bovinae require the joint endeavours of both the conservation community and the livestock industry; the conservation community by heightening awareness of their potential and by focussing on in situ conservation, whilst the livestock industry can provide expertise in storage and utilization of these genetic resources. In view of the importance of this group of animals they merit high priority consideration in the determination of conservation actions.

Acknowledgements

Thanks must be extended to Mohd. Khan b. Momin Khan, Chairman of the IUCN/SSC Wild Cattle Specialist Group who so speedily provided access to the Group's files; and to Brian Groombridge, Richard Luxmoore, Jo Taylor, Lissie Wright and Suzanne Vernon of the IUCN Conservation Monitoring Centre for their suggestions and assistance.

DATA SHEET SUMMARIES

Bos sauveli — KOUPREY

Distribution centre is Democratic Kampuchea but range overlaps into southern Laos, eastern Thailand and probably western Vietnam. Not known to western science until 1937; estimates of total number have never exceeded 1000 animals. Prior to the Indochinese war of the 1970s the Kouprey was considered highly endangered and it was feared hostilities might have exterminated it. However a possible sighting occurred in July 1982 in eastern Thailand near the Kampuchean border, and subsequent investigations, whilst not definitely confirming the sighting, do strongly suggest that Kouprey inhabit the area. Investigations in 1974/75/76 also received reliable reports of sightings in southern Laos, northern Kampuchea and the Dongrak Mountain range in eastern Thailand. The IUCN/SSC Wild Cattle Specialist Group has made recommendations for the conservation of the Kouprey; these generally encourage that a capture programme for a breeding stock be continued. It has been suggested that Kouprey may have been domesticated during the Khmer culture, 400-800 years ago, and that perhaps domestic Kouprey can still be found in Indochina today. The species is believed to be resistant to rinderpest, the killer disease of domestic cattle and its conservation could therefore be of tremendous importance for genetically improving domestic breeds.

Bos gaurus — GAUR

Ranges eastwards from India to southern China and south to peninsular Malaysia. Certainly numbers in the thousands but has undoubtedly declined because of extensive habitat loss, indiscriminate hunting, and diseases caught from domestic stock. Now survives only in isolated and fragmented populations. Occurs in many protected areas. The Gaur is believed to be the wild progenitor of the domestic Mithan, a ceremonial ox of the hill tribes of Assam, Bhutan, Bangladesh and Burma. The Mithan interbreeds freely not only with Gaur, but also with Banteng, Yak, and cattle of both the taurus and zebu types. The cross between a Mithan and a Siri cow from India produces a prized milk cow and a male that is a powerful draught animal. Conservation of the Gaur could thus be of value to cattle husbandry in the tropics.

Bos javanicus — BANTENG

A South-east Asian bovine. Certainly numbers in the thousands but believed to be decreasing. Warfare and insurgency must have seriously affected its status; also threatened by habitat loss, increased hunting pressure from increasing human populations, disease, and hybridization with domestic cattle. Protected by law in much of its range but enforcement is difficult. Occurs in many national parks and reserves. Banteng are the wild relatives of the domestic Bali cattle and crossbreed with zebus to produce the 'Madura' breed; they thus constitute a valuable source of genetic material for the livestock industry.

Bos grunniens — WILD YAK

Inhabits remote areas of the Tibetan plateau and adjacent highlands. Numbers are greatly reduced primarily due to uncontrolled hunting. Necessary conservation measures include surveys to locate viable populations, legal protection and the establishment of reserves. The Yak has been domesticated and used as pack animal, for human transport, and for meat and milk in Central Asia as far back as there is any knowledge of people in this area. Since Wild Yak are the wild relatives of the domestic Yak they constitute a potentially valuable source of genetic material for the improvement of the domestic stock.

Bubalus bubalis — WILD ASIATIC BUFFALO or WILD WATER BUFFALO

This species is highly endangered in the wild and will become extinct unless drastic, rapid action is taken. Herds traditionally considered to be the 'true' Wild Water Buffalo occur only in Nepal and India. However it now seems likely that these animals interbreed extensively with free-roaming domestic Water Buffalo, thus they can no longer be regarded as solely of wild stock. Those in the rest of South-east Asia are considered feral. The species has suffered a dramatic decline in distribution and numbers, and probably fewer than 2000 animals now survive. Populations in peninsular India appear doomed by hydroelectric schemes and those in Assam by diseases such as rinderpest transmitted by domestic stock. All populations are suffering genetic swamping by interbreeding with domestic Buffalo. The decline of the animal was however due to over-exploitation and to habitat loss - its riverine habitat being much favoured for cultivation. Protected by law and occurs in a number of reserves, however, habitat protection is not enough. Protection from the adverse effects of domestic Buffalo and stock, needs to be enforced if this animal is to have any future. As a genetic resource for the domestic Buffalo population this species demands some priority in conservation choices.

Bubalus mindorensis — TAMARAW

A small buffalo endemic to the Island of Mindoro in the Philippines. Seriously depleted by hunting and habitat loss the species is now thought to be increasing in numbers due to an effective conservation programme launched at the end of the 1970s. Three reserves have been set aside for its protection, and hunting has been virtually eliminated. A 1983 official estimate was 250 animals; unofficial estimates place the figure at 300-400. Conservation of the species is coordinated by the 'Presidential Committee for the Conservation of the Tamaraw' (PCCT) created in 1979 by President Marcos. The species has not been domesticated but is perhaps a possible candidate; its meat is highly regarded by local people.

Bubalus quarlesi
Bubalus depressicornis — ANOAS

Anoas are buffaloes endemic to the Indonesian island of Sulawesi (formerly Celebes). Numbers are unknown but they are believed possibly to be declining because of hunting and loss of forest habitat. Two species are usually described, the Mountain Anoa, B. quarlesi, and the Lowland Anoa, B. depressicornis; however

in the field it has been difficult to distinguish between them and much of the literature refers simply to Anoa without specifying the species. The validity of distinguishing two separate species is also increasingly questioned. Anoas are protected by law and occur in many of the large reserves established in recent years; adequate protection of these reserves should be sufficient to ensure their survival. Anoas have never been domesticated but their potential for domestication should be explored; on Sulawesi they are prized for their hide, horns and meat.

Bison bonasus — EUROPEAN BISON or WISENT

Survives only in captive and semi-wild herds, the latter in parts of its original range in Poland and the U.S.S.R. Largest herd is in the Bialowieza Forest which straddles the border between the two countries; in 1980 Bison in the Forest numbered 411 animals. By the beginning of the 20th century the species still survived in the wild but only in the Bialowieza Forest (B. b. bonasus) and in the Caucasus (B. b. caucasicus). The last Bison in Bialowieza was poached in early spring 1919 and the last in the Caucasus died in 1927. The only surviving animals were those in zoological gardens and those belonging to private owners. Furthermore, only one animal, a bull, of the B. b. caucasicus subspecies had survived in captivity; it died in 1925. This bull did sire calves from B. b. bonasus cows, and most of the existing herds are in fact bonasus/caucasicus hybrids. By the 1980s, as a result of successful breeding programmes the species numbered over 2000 animals, and 24 herds had been re-established in the wild. Continued protection and breeding programmes are essential for the survival of the species; additional reintroductions to suitable habitat would always be valuable.

Bison bison — NORTH AMERICAN BISON

The 'Buffalo' of the Great Plains of North America numbered in the tens of millions when the Europeans arrived in the continent but by the 1890s had been reduced to only a few hundred. A century later their numbers have increased to about 100,000. Two subspecies are usually recognised: the Plains Bison, B. b. bison, and the Wood Bison, B. b. athabascae. The latter numbers only about 900 animals, principally in two herds, and is of conservation concern; it is however the subject of a detailed conservation programme and its survival is probably assured. Some free-roaming Plains Bison herds occur in refuges but the majority exist on private land for commercial production of meat and hides. In the U.S.A. there exists the National Buffalo Association, and in Canada the Canadian Buffalo Association, to promote and propagate the species.

Syncerus caffer — AFRICAN BUFFALO

Inhabits an extensive range in Africa south of 15°N, occupying a great variety of habitats providing food and water are available and human densities are low. Undoubtedly numbers in the millions and although in some areas, such as parts of South Africa and West Africa, its range is becoming fragmented, it cannot be considered a threatened species. Wild Buffalo are being exploited in various countries in cropping schemes for meat and hides, and in Zimbabwe there is an experiment attempting to train Buffalo to the yoke.

Table 1 World Distribution of Bovines Excluding the African Buffalo

	Bos javanicus	Bos gaurus	Bos sauveli	Bos grunniens	Bubalus bubalis	Bubalus depressicornis	Bubalus quarlesi	Bubalus mindorensis	Bison bison	Bison bonasus
India	Ex	x		x	x c					
Nepal		x			x c					
Bhutan		x		x?						
Burma	x	x								
Thailand	x	x	x							
Malaysia	x b	x e								
Kampuchea	x	x	x							
Laos	x	x	x							
Vietnam	x	x	x							
China		x g		x f						
Indonesia	x a					x d	x d			
Brunei	Ex									
Philippines (Mindoro)							x			
Canada									x	
U.S.A.									x	
Poland										x
U.S.S.R.										x

a Bali, Java, Kalimantan. b Sabah. c Translocated or feral occur in rest of S.E. Asia, Brazil, Philippines, Timor, Sri Lanka, Algeria, Egypt, Tunisia etc. d Sulawesi. e Peninsular Malaysia. f Tibet. g Yunnan.

KOUPREY ENDANGERED

Bos sauveli (Urbain, 1937)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY Distribution centre is Democratic Kampuchea but range overlaps into southern Laos, eastern Thailand and probably western Vietnam. Not known to western science until 1937; estimates of total number have never exceeded 1000 animals. Prior to the Indochinese war of the 1970s the Kouprey was considered highly endangered and it was feared hostilities might have exterminated it. However a possible sighting occurred in July 1982 in eastern Thailand near the Kampuchean border, and subsequent investigations, whilst not definitely confirming the sighting, do strongly suggest that Kouprey inhabit the area. Investigations in 1974/75/76 also received reliable reports of sightings in southern Laos, northern Kampuchea and the Dongrak Mountain range in eastern Thailand. The IUCN/SSC Wild Cattle Specialist Group has made recommendations for the conservation of the Kouprey; these generally encourage that a capture programme for a breeding stock be continued. It has been suggested that Kouprey may have been domesticated during the Khmer culture, 400-800 years ago, and that perhaps domestic Kouprey can still be found in Indochina today. The species is believed to be resistant to rinderpest, the killer disease of domestic cattle and its conservation could therefore be of tremendous importance for genetically improving domestic breeds.

DISTRIBUTION Northern and eastern Democratic Kampuchea, southern Laos, eastern Thailand and western Vietnam.

Although there were fears that the Kouprey might have been exterminated during the Indochinese war of the 1970s, a small herd was sighted on July 23 1982 in eastern Thailand in the Province of Sisaket on the border with Kampuchea (13,14,15), although definite confirmation is lacking. A further sighting on July 30 was reported by local inhabitants. A 1980 report also suggested that a few survived in Vietnam in the Truong Son Mountains of Thua Thien Province in the central part of the country (16) (although a 1971/72 visit found that the Vietnamese scientists were not familiar with the species (18)). In 1983 Sayer visited Laos and noted that several members of the Forest Department believed that the species still occurred in the Attopeu/Champassak area; however records are based on hearsay and usually refer only to sightings or tracks, it is possible therefore that identity is confused with other wild cattle species (25). Investigations in 1974/75/76 received what were considered reliable reports from hunters of the Kouprey's continued existence in southern Laos, northern Kampuchea, and in the Dongrak Mountain Range in Sisaket Province, eastern Thailand (3,6,7,8,10).

In 1969, prior to the war, the Kouprey was known to occur in three areas in Kampuchea: the Koulen-Promtep Reserve in the north, the Lomphat Reserve and the Phnom Prich Reserve (9). Sauvel who studied the animal in 1949 knew of only two areas about 250 km apart in Kampuchea where Kouprey had been seen (11). Fraisse in 1955 noted the existence of the species between Kontoum and Ben Mei Thuot in Vietnam (4).

POPULATION Numbers unknown but almost certain to be extremely low. The most recent sightings were in July 1982. Prior to hostilities the Kouprey was considered highly endangered; its status must have deteriorated further as its main areas of occurrence have been within a war zone occupied by well-armed factions and civil disturbance continues.

Kampuchea No recent information. The 1970 estimate was of only 30-70 (6); in 1957 the estimate was 500 (12). Harvey Neese investigating the status of the species in 1974 on behalf of the New York Zoological Society was told by local hunters in southern Laos that Kouprey still survived in Kampuchea, with the area south and west of Kompong Sra Lau (just north of the Laotian border) having the greatest number (7,8). Pfeffer (1974) received reports of Kouprey in the Chep-Melouprey area (10).

Laos 1983 reports suggest the species may still survive in Laos (25). Neese during his 1974 investigations received hunters' reports that Kouprey were still extant in southern Laos although extremely rare; a hunter reported shooting one at a mineral lick in June 1974 and another hunter reported seeing a herd comprised of one bull, ten cows, and several calves during the same month but at a different salt lick (7,8). Pfeffer (1974) also received reliable reports from the Champassak region on the border with Kampuchea (10).

Thailand Sporadic sightings occur, none of which have been definitely confirmed although experts are of the opinion that tracks found are indeed those of Kouprey. The most recent sighting was on 23 July 1982 of a small herd of one bull, two cows and two calves (13,14,15,21), another possible sighting on July 30 was of two males and three females (21). In 1975 a herd of about 20 were reported to have been sighted by a hunter, again in eastern Thailand. Two follow-up expeditions by FAO in April and August 1976 failed to sight any but received numerous reports from hunters which seemed to confirm that Kouprey had been present the previous year. However the second expedition found that subsequently a timber road had been constructed in the area causing many disruptive changes due to the uncontrolled influx of lumbermen, settlers, hunters and collectors of forest produce (3). The previous sighting was in 1949 (5). In the early part of the century Kouprey were said to be numerous north of the Dongrak range (6).

Vietnam Information received by Arthur and Carol Westing during an August 1980 trip to Vietnam suggested a possibility of about ten animals remaining in Thua Tnien Province (16).

HABITAT AND ECOLOGY Low rolling hills covered by open plains interspersed with dense deciduous forest, open forest and monsoon forest, preferably in areas where the soil is sandy and salt licks are plentiful. Although Kouprey generally graze in the open areas, the forest patches are essential to their existence, giving them shelter from the hot sun, refuge from predators, and food when the grasslands are dry. Kouprey have been found in herds of twenty or more with a mixed composition often including several adult males. The herds were usually led by an old female and frequently split or coalesced into larger or smaller groups. Mating is reported to occur in April with the young born in December and January, the season when fires set by man burn off the old dry grass and the tender new shoots appear. Wharton has shown that Kouprey habitat is to a great extent dependent on the slash-and-burn agriculture which has been practiced in South-east Asia for thousands of years (6,12). Longevity of Kouprey is unknown.

THREATS TO SURVIVAL A naturally low reproductive rate, uncontrolled hunting (the species is a prime target for meat-hungry people, and a demand exists for its beautifully shaped horns), and the succession of wars within its range have been the main causes of decline. Early in 1970, the three Kampuchean Kouprey reserves were overrun by military forces and it is considered unlikely that any Kouprey remained in either Lomphat or Phnom-Prich, although a few might remain in Koulen-Promtep. The war did at least put a stop to motorized poaching by government officials (2,9,10,11).

Trade There is no international or national trade in the species.

CONSERVATION MEASURES Until individuals of this species are actually located no conservation measures can be enacted. However it is suggested that investigations be carried out to locate Kouprey populations and if possible of capturing animals for a breeding programme. Also the feasibility of establishing a protected area should be explored although at present local conditions do not favour such an action.

Following the July 1982 possible sighting a rescue team comprised of Dr Boonsong Lekagul and personnel from the Thai Wildlife and Conservation Division attempted to capture the animals alive. However the team was working in remote and dangerous country and after a guide was injured by a land-mine the rescue bid was abandoned; no Kouprey were sighted (13,15,21). A second capture was planned for September 1982 by the Wildlife Division, however again no Kouprey were sighted during the 10 days of field work although fresh tracks were found in at least three different locations close to the Kampuchean border (21).

Learning from the experience of the two capture attempts, the SSC Wild Cattle Specialist Group at a meeting in Kuala Lumpar in October 1983 made various recommendations which are to be forwarded to the Wildlife Section of the Royal Forestry Department of Thailand for its consideration and action. In general these recommendations encourage that the capture programme for a breeding stock of Kouprey be continued with the involvement of the best available expertise in order to ensure its success (20,21,22). WWF/IUCN Project 509 holds funds earmarked for immediate release should any action become necessary.

Kampuchea Prior to the war Kouprey were legally protected and three reserves had been established for their protection: the Koulen-Promtep Reserve, the Lomphat Reserve and the Phnom-Prich Reserve (9); the present situation in the country is unknown.

Laos No data located.

Thailand The species is classified as a 'Thai Reserved Wild Animal', it is therefore forbidden to hunt, capture, export or keep it in captivity except under very special exemption (6,23). The 1976 FAO Kouprey expedition to Thailand strongly recommended that the Dongrak Mountain Range in Thailand should be made a national reserve to protect not only Kouprey but other wildlife, and also to preserve the area as an important watershed area. However it will also be necessary to secure the protection of adjoining game lands in Kampuchea (3). At present (1983), two wildlife sanctuaries: Yot Dom and Khao Phanom Dong Rak, exist near the border with Kampuchea (23).

Vietnam In 1980 reported to be strictly protected by law although this was unenforced (16).

The Kouprey is listed (as Novibos (=Bos) sauveli) on Appendix I of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, trade in it or its products is therefore subject to strict regulation by ratifying nations, and trade for primarily commercial purposes is banned.

CAPTIVE BREEDING There are none in captivity.

DOMESTICATION Although it is generally believed that the Kouprey has not been domesticated it may in fact have been so temporarily during the Khmer culture, 400-800 years ago (12,24). Furthermore Vietmeyer reports that both Vietnam and Laos have cattle breeds that resemble Kouprey, and a Kouprey bull reported to be a domestic animal of the Stieng tribe was exhibited in the Paris

menagerie in the mid-nineteenth century. Vietmeyer even speculates that it is possible that there are domestic Kouprey in parts of Indochina today (24). The species is apparently believed to be resistant to rinderpest, a killer disease of domestic cattle; effective conservation of the species could thus perhaps contribute significantly to the genetic upgrading of domestic cattle (24). There have been suggestions that the Kouprey is one of the ancestors of the humped zebu cattle; this however requires investigation.

REMARKS For description of animal see (1,6,7). The Kouprey was one of the most recent large mammals to become known to western science. The generic name Novibos is sometimes used instead of Bos (1,12).

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GAUR VULNERABLE

Bos gaurus (H. Smith, 1827)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY Ranges eastwards from India to southern China and south to peninsular Malaysia. Certainly numbers in the thousands but has undoubtedly declined because of extensive habitat loss, indiscriminate hunting, and diseases caught from domestic stock. Now survives only in isolated and fragmented populations. Occurs in many protected areas. Gaur are believed to be the wild progenitor of the domestic Mithan, a ceremonial ox of the hill tribes of Assam, Bhutan, Bangladesh and Burma. The Mithan interbreeds freely not only with Gaur, but also with Banteng, Yak, and cattle of both the taurus and zebu types. The cross between a Mithan and a Siri cow from India produces a prized milk cow and a male that is a powerful draught animal. Conservation of the Gaur could thus be of value to cattle husbandry in the tropics.

DISTRIBUTION India through Nepal and Bhutan to Burma, Thailand, Laos, Kampuchea, Vietnam and southern China (southern Yunnan), and south to the Malaysian peninsular (1,5,8,9,11). Throughout its range the Gaur has become restricted to remote and isolated forest regions. Three intergrading subspecies are usually recognized: B. g. gaurus from India and Nepal; B. g. readii from Burma, Thailand, Laos, Kampuchea, Vietnam and southern China; and the Seladang, B. g. hubbacki, from Thailand south of the Isthmus of Kra, and the Malaysian peninsular (1,3,5,9,11,19). The species is reported to have occurred in Sri Lanka, but to have become extinct there about 300 years ago (2).

India Its range encompasses three widely separated geographical areas that correspond to the major mountain systems: the Western Ghats, the central Indian highlands, and the foothills of the Himalayas, including the hills south of the Brahmaputra River. Within each of these major areas there are typically several more or less isolated populations (7,17). Schaller (1967) and Krishnan (1972) give detailed descriptions of distribution (7,17).

Nepal Found in the terai (32).

Bhutan Little data located; known to occur in Manas (40).

Burma In 1983 reported to be widespread throughout the forested hill system; surviving in the hills of Tenasserim, south, west, and central Burma, but absent from the central dry zone and the densely settled valleys of the major rivers, coastal plains and islands. Limit of range to the north is unknown (34,48).

Thailand Once found throughout the country but by 1977 was reported 'least uncommon' in Khao Yai National Park, the remote forested regions of the Tenasserim, and the forests of the south (9).

Laos Sayer who visited the country in 1983 received reports that it occurred in forested areas throughout the country (51).

Kampuchea No data located.

Vietnam A 1973 paper mentions that Gaur occur mainly south of Tanh Hoa in the Provinces of Nghe An, Ha Tinh and Quang Binh (41).

China Confined to the extreme south of Yunnan, itself the most southerly of the

Chinese provinces (42,43,45,46,49).

Malaysia Once found throughout the country, now occurs only in isolated populations principally in the States of Pahang, Johore, Trengganu, Kelantan and Perak (24)

POPULATION Certainly numbers in the thousands; believed to be declining.

India Total numbers unknown although probably several thousands. David in 1982 reported that after declines, many populations appeared to be increasing.

Nepal No recent data on numbers or trend.

Bhutan No information on numbers or trend. However the Gaur in Manas Wildlife Sanctuary in India (estimated in 1982 to number 1000) move into Bhutan during the summer and monsoon (40).

Burma At a guess Slater (1983) estimated the total population at about 5000 animals (48). Although surveys at the beginning of the 1980s indicated that Gaur were 'reasonably common in some areas' they were believed to be declining in number because of widespread hunting (48). The slopes of the western Arakan Yoma were reported to be an important stronghold (48).

Thailand In 1977 the total was estimated at less than 500 and continuing to decrease (9). The area of most abundance is Khao Yai National Park and the contiguous Huai Kha Khaeng and Thung Yai Wildlife Sanctuaries (36).

Laos Sayer (1983) noted that the species was 'very well known' to local people in all areas he visited and that horns were seen in many towns and villages (51), possibly indicating that it was still fairly abundant.

Kampuchea No data located.

Vietnam A 1973 estimate was of '220-250, not more' (41).

China Survives in 'small populations' in various protected areas (49).

Malaysia In 1981 the total was estimated at about 470 (35); the species occurring in appreciable numbers only in localized areas in the west (25,35). The largest herds are in the Taman Negara National Park, in the State of Perak, and in the Lepar River Valley in Pahang (24,25,35). Estimates since the late 1930s have all been in the mid-hundreds (3,5,6,11,21).

HABITAT AND ECOLOGY Evergreen, deciduous and semi-deciduous forests interspersed with clearings -- either natural or man-made (often abandoned cultivation sites) where grazing is available (3,6,7,11,16,18,36,48). Gregarious, associating in herds of two to twenty or more; lone bulls are not unusual (3,6,7,9,11,16,17,19,48). A grazer and browser, feeding on a variety of grasses, herbs, shrubs, and the foliage of some trees and climbers (3,7,9,11,16,17). In Malaysia, has been known to actively seek such cultivated crops as rice, banana, pineapple, tapioca and rubber leaves (19). When not disturbed by man is largely diurnal; when subject to disturbance becomes mainly nocturnal (3,7,9,11,13). There is no evidence of seasonal breeding; one young is born after a gestation period of about nine months (3,7,11,17,19). Longevity is thought to be at least 30 years (7).

THREATS TO SURVIVAL There are three main causes of decline and threat: habitat destruction (6,7,9,16,17,48), indiscriminate hunting (6,7,8,9,16,17,48), and diseases such as rinderpest, foot and mouth, and anthrax transmitted by domestic

stock (3,7,9,16,17,48). Gaur are extremely sensitive to disturbance and will not survive in country continually invaded by man (3). In India rinderpest seriously affected herds in the Mudumalai and Bandipur Sanctuaries in August 1968 and from 300 to 500 animals of all ages are thought to have died (7). In Thailand, during the Second World War, Gaur were also greatly affected by disease, usually carried by domestic animals such as Water Buffalo which grazed in the forests. Shortly after the war, hunting became a major factor in their continued decline, and poaching of Gaur continues in all forests where they still exist, even in Khao Yai National Park (8,9). In Burma anthrax was a major cause of their disappearance from many areas in the north and centre, and surveys in the early 1980s found poaching and agricultural encroachment to be widespread and detrimental to the species (48).

Trade There is virtually no international or national trade in Gaur.

CONSERVATION MEASURES Adequate protection in parks, reserves and forest areas is necessary wherever the Gaur still persists.

India Listed in Schedule 2 of the Wild life (Protection) Act 1972; cannot be hunted except under license and in accordance with conditions specified. Occurs in many national parks, wildlife sanctuaries and reserved forests (26); the national parks being Kaziranga, Bandipur, Bandhavgarh, Panch, Tadoba, Bannarghatta, Eravikulam Rajmallay, and Kanha (26,27). In 1982 WWF (India) initiated a project to study the social behaviour of the species in southern India (35).

Nepal Not known whether protected by law. Occurs in the Royal Chitwan National Park (31,32).

Bhutan Not known whether protected by law. Occurs in the Goley Game Reserve, the Manas Wildlife Sanctuary (29,30), the Mochu Reserved Forest, the Pochu Reserved Forest, and the Khaling Reserved Forest (29).

Burma Gaur are 'protected game' under the Wildlife Protection Act, 1936 (48) and may not be killed without a game license; cows and immature bulls are completely protected (18). In 1983 the species was reported to occur in many areas which had been surveyed as potential parks and reserves (34,48). Occurs in the Shwesettaw Wildlife Sanctuary, and possibly in the Pidaung, Shwe-U-Daung, Kahilu, Mulayit and Tamanthi Wildlife Sanctuaries although it is not known whether these populations are still viable (48).

Thailand Listed on Schedule 2 protected species, hunting only being allowed under license (no licenses have been issued in recent years (9)). Significant populations occur in the following protected areas: Khao Yai N.P. (altnough a 1982 report mentions only a few having been seen there in recent years (35)), Nam Nao N.P., Khao Chamao-Khao Wong N.P., Khao Kitchakut N.P. and the contiguous Khao Soi Dao W.S., Erawan N.P., Huai Kha Khaeng W.S., Thung Yai W.S., Phu Luang W.S., Phu Khieo W.S., Kaeng Krachan N.P., Om Koi and Mae Tuen W.S. (36). Small populations exist in other protected areas such as Tham Than Lot N.P. and Salak Phra W.S. but have declined greatly since the beginning of the 1970s (36).

Laos and Kampuchea No data located.

Vietnam Protected from hunting since 1963 (41).

China Listed in the first category of the protected wildlife list (49). Occurs in the Mengluen Nature Reserve, the Mengyang N.R. and the Mengla N.R. (44). Effective protection of its habitat is the most important conservation measure (49).

Malaysia Protected by law (35). Occurs in Taman Negara National Park, Krau Game Reserve, Sunggai Dusun Game Reserve and others (35). Has been the subject of studies (24) and within the Department of Wildlife and National Parks there is a Seladang Unit which carries out regular monitoring of populations (35). Two young Seladang were captured in 1982 with the aim of establishing a breeding stock in captivity (35).

The Gaur is listed in Appendix I of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, trade in it or its products therefore being subject to strict regulation by ratifying nations, and trade for primarily commercial purposes is banned.

CAPTIVE BREEDING In 1981 there were 41 males and 42 females (most captive bred) held in 17 zoological collections. In 1980 the New York Zoological Society successfully bred a Gaur calf from an embryo transfer experiment whereby a Gaur embryo was implanted in a Holstein cow (33). Such a technique will greatly increase the potential of breeding the species in captivity. The studbook keeper is Prof. Dr. H.-G. Klös, Director, Zoologischer Garten Berlin, 1000 Berlin 30, Hardenbergplatz 8, West Germany.

DOMESTICATION The Gaur is not a domestic animal, but a domesticated form, the Mithan, Bos frontalis, is thought probably to have been derived from it (39,47). Simoons and Simoons (1968) have published a 323 page monograph describing the Mithan in nature, culture and history (47). The name 'Gayal' is occasionally used as a synonym of Mithan (47). Although the Mithan is a domestic animal it has a curious role among the hill peoples; according to the Simoons;

> "it is a free-ranging animal, used for sacrifice on festive occasions, intimately involved in ritual and religious belief and in the prestige structure; figuring in the exchange system and used in payment of political, legal, and social obligations - yet having a minimal role in the realms of traction and dairying, for which common cattle are so valued among Hindu Indians. It is true that domestic animals much alike in form and temperament often play widely divergent roles among the world's peoples. Nevertheless, that a bovine animal should be kept for purposes so distinctive and under a system of husbandry so different from its relatives in nearby areas makes it seem worthwhile to reexamine the widely held view that bovines were domesticated for their flesh, their milk, and for traction, and that in the earliest days of domestication they were confined and herded" (47).

The Mithan has a two-pronged distribution in the hill country of Burma, Bangladesh, north-east India and Bhutan. One prong extends from the Arakan Hills and Chin Hills of Burma north through the Chittagong Hill tracts of Bangladesh, the Lushai (Mizoram) Hills, Manipur, the Naga Hills of India and possibly into the Patkoi range. The other prong extends from the northern hills of Burma through Arunachal Pradesh westward to Bhutan (47). For maps see (39,47). The animal may also occur in northern Yunnan in the Gungshan Drung-Nu Autonomous Country where it is called the Drung (Dulong) Ox (50). In appearance the Mithan is smaller than the Gaur; coloration of both is similar although horn shape differs strikingly (47).

In India, according to Vietmeyer (1983) there are some 50,000 head of Mithan in the jungles of Arunachal Pradesh and in Bhutan there are some 60,000 head of Mithan-cattle hybrids (39). Mithan are fully fertile amongst themselves but will interbreed freely not only with Gaur, but also with Banteng (Bos javanicus), Yak (Bos grunniens) and cattle of both the taurus and zebu types. The Naga hill tribes encourage interbreeding with Gaur, regarding it as an improvement of the breed (39). Crosses between Mithan and Zebu are also encouraged in certain districts (39). For example, in Bhutan, Mithan bulls have been mated with siri cows (Bos taurus) from India. This cross produces an animal with a high milk production; the

milk is rich in total solids and produces exceptional yields of cheese and butter. In addition to the female being a prized milk cow, the male is a powerful draft animal (3).

In Bhutan the government has established two Mithan herds by purchasing animals from Arunachal Pradesh and is breeding them on government farms and distributing males to private breeders (39).

REMARKS For description of animal see (2,3,6,7,8,9,10,11,14,15,17,18,19,37).

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BANTENG VULNERABLE

Bos javanicus (d'Alton, 1832)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY A South-east Asian bovine. Certainly numbers in the thousands but believed to be decreasing. Warfare and insurgency must have seriously affected its status; also threatened by habitat loss, increased hunting pressure from increasing human populations, disease, and hybridization with domestic cattle. Protected by law in much of its range but enforcement is difficult. Occurs in many national parks and reserves. Banteng are the wild relatives of the domestic Bali cattle and crossbreed with zebus to produce the 'Madura' breed; they thus constitute a valuable source of genetic material for the livestock industry.

DISTRIBUTION Formerly ranged from Manipur in India through Burma and Thailand to central southern Indochina and south to northern peninsular Malaysia (Perlis, Kedah and Perak); also on the islands of Borneo, Java and Bali. Three subspecies are usually recognised: the mainland B. j. birmanicus; B. j. lowi on Borneo; and B. j. javanicus on Java and Bali.

India Occurred in Manipur and possibly eastward of Chittagong at the turn of the century, and was still seen in Manipur in the late 1930s (21,22), however recent texts do not mention Banteng as occurring in India (23).

Burma Questionnaire surveys by the Forest Department during 1960-61 and 1980-81, plus field surveys in 1982/83 indicated that the species was widespread, tending to occur in the more sparsely inhabited dry zone and to be absent from the areas of higher rainfall in the west (25,35). Its range is reported to be increasingly fragmented (35).

Thailand In 1983 the most important sites were reported to be the contiguous Huai Kha Khaeng and Thung Yai Wildlife Sanctuaries (in Kanchanaburi and Uthai Thani Provinces) and probably the contiguous Om Koi and Mae Tuen Wildlife Sanctuaries in the north-west. Geng Krachan was also perhaps an important area for Banteng. The only area in the Petchabun mountain range thought to still harbour significant numbers was Nam Nao National Park (7).

Indochina Recent distribution is unknown; in the mid-1970s Banteng were thought to survive in some areas of former concentration such as the Luang Prabang range (Laos); the Khammouane plateau and south of Samneua (Laos); along the Laos/Kampuchea border; on the Kampuchean side of the Dongrak range (on the Thai border); in the rolling country south of Lomphat (eastern Kampuchea); in Angkor Wat National Park (Kampuchea); and possibly elsewhere (6,7). In Vietnam they reportedly still occurred south of Thanh Hoa at the beginning of the 1970s (41).

Malaysia On the Peninsular B. j. birmanicus is believed extinct, although may possibly still occur in Sungei Muda (Kedah), possibly extending to parts of Kelantan (8). The Bornean B. j. lowi is considered extinct in Sarawak though still survives in Sabah where a 1979-81 faunal survey found it to occur mainly in parts of the eastern lowlands, although small numbers were scattered throughout the more hilly central areas. In the western hill ranges evidence of their presence was located in only one area (15).

Brunei Extinct.

Indonesia On Borneo B. j. lowi occurs in parts of Kalimantan (27,30). On Java the nominate B. j. javanicus is still present in several localities, the largest known population being in the Ujung Kulon National Park (1,30), smaller populations also occur in the west in Cikamurang, Cimapag, Cikepuh, Leuweung Sancang, Cibanteng, Bojong Larang, Jayanti and Tegalwaru Reserves (13,31). Some of these herds are introduced, e.g. those at Cikepuh (31). Banteng also occur at the eastern end of Java in the Baluran National Park and the Banyuwangi Selatan (or Blambangan-Purwo) Game Reserve and elsewhere (13,31). Distribution on the island was formerly much greater (22). On Bali small numbers occur in the Bali Barat Reserve (13,18).

POPULATION Total is certainly in the thousands. B. j. birmanicus: the mainland race numbers in the thousands. B. j. lowi: numbers of the Bornean race are thought to be considerably less than that of the mainland race; several thousand are believed perhaps to occur in Kalimantan (30); in Sabah a 1981 estimate was of 300-550 (15); the subspecies is extinct in Sarawak and Brunei. B. j. javanicus: almost 2000 occur on Java, and about 30-40 on Bali (30,31).

India (Manipur) Believed extinct.

Burma Guess-estimates at the beginning of the 1980s put the total at 'a few thousand' (35). Data gathered during 1982/83 FAO surveys suggested that populations had greatly decreased over all but the most inaccessible parts of the range (35). The species was considered common in Burma in the 1930s but even then was disappearing from the more accessible and settled areas (35).

Thailand No recent information. In 1977 considered to number less than 500 (5); in 1983 it was thought probable that only 200 or less remained along the Burmese border and at Huai Kha Khaeng (24).

Vietnam A 1980 report mentioned that the species had continued to decline in recent years, however the source of the data was not mentioned (16).

Kampuchea and Laos Status unknown.

Malaysia On the Peninsular B. j. birmanicus is thought possibly to be extinct. The Bornean B. j. lowi is considered extinct in Sarawak but in Sabah a faunal survey of the country from 1979 to 1981 estimated a total of 300-550 (15); herds of at least 30-40 were seen at Kretam, Bukit Kumbaun, and between the Paitan and Sugut Rivers (15), equally large concentrations were thought probably to occur in the Labian and Kinabatangan lowlands and between the middle reaches of the Tingkayo and Kalumpang Rivers (15).

Brunei Extinct.

Indonesia On Borneo numbers and trend of B. j. lowi in Kalimantan are unknown, though in 1982 MacKinnon thought it might number several thousand (30). Reportedly abundant in the Kutai Reserve (27). On Java B. j. javanicus numbers almost 2000 (30,31). In 1977 the estimated total was of about 500 'pure' specimens (U. Halder 1977, In litt.). MacKinnon (1982) noted that the population in Ujung Kulon had risen in recent years to about 1000 (in 1976 it was about 200 (30)) possibly as a result of the loss of tiger from the reserve (30). Numbers in the Baluran Reserve have however dwindled as water sources have dried up due to loss of forest; the 1977 estimate was of 150 or more (14). In 1977 40 or more occurred in the Leuweung Sancang Reserve (13), and estimates (1981 and 1974) for Banyuwangi Selatan Reserve were of 25-30 (4). Bali: A 1982 report indicated that 30-40 wild Banteng occurred in the Bali Barat National Park (18).

Indonesia Protected by law (30,31). The conservation of the Banteng in Indonesia has greatly benefitted (and will continue to do so) from the establishment of an extensive system of reserves. Management of these areas for the maintenance of some open grazing areas will be advantageous to the species (30,31). In Kalimantan it is known to occur in a number of protected areas, including the S. Kayan - S. Mentarang Nature Reserve in the east (20), and the Kutai Reserve (2,27,30) which is said to have a good population of Banteng (27). On Java it occurs in the Ujung Kulon National Park where the recent increase of Banteng has resulted in a few groups beginning to disturb ladang or village ricefields around the Gunung Honje boundary and planned buffer zone (26); management practises in the park have been maintaining grazing areas especially for Banteng (24). Also occurs in the Baluran National Park (19), the Meru Betiri Game Reserve, the Malaeng Reserve (30), the Cikepuh Game Reserve, and the Leuweung Sancang National Reserve (13,31). Now believed virtually extinct in the Pananjung-Pangandaran Reserve (30), where they were introduced (31). Other reserves which harbour the species are listed in the DISTRIBUTION section. Banteng on Java have been the subject of studies by U. Halder (3), E. Sumardja (11) and others (26). On Bali it occurs in the Bali Barat National Park (13,18).

CAPTIVE BREEDING In 1981, 76 males and 106 females were held in 30 zoological collections, most captive bred (9).

DOMESTICATION Domestic Banteng known as Bali cattle are found in parts of South-east Asia, principally Indonesia. They are particularly important on the islands of Bali, Kalimantan, Lombok, Sulawesi, Sumbawa and Timor (33). There is no historical or archaeological evidence to indicate the date at which wild Banteng were first tamed (29) but on Bali and Sumbawa, where they are virtually 'uncontaminated' by crossbreeding with other cattle, they are thought to have been domesticated many, many centuries ago (33). Small numbers of domestic Banteng have also been introduced to Sumatra, Malaysia, and northern Australia, and there are experimental herds in Texas, U.S.A., and New South Wales, Australia (33). Domesticated Banteng are reported to account for about 20 per cent of Indonesia's total population of 'cattle'. The Banteng population increased from 1.1 million in 1967 to 1.4 million in 1975, and by the 1980s was estimated to be more than 1.5 million (33).

The domestic Banteng differs little from the wild Banteng although it is smaller in size (1,33). They are apparently docile, if reared, as in Indonesia, with frequent human contact but cannot be handled as roughly as other domestic cattle (33). They are excellent draft animals and are widely used for this purpose (1,32). They also have a reputation as a superior beef animal in South-east Asia and are exported to Hong Kong, Singapore, Malaysia and Japan for the gourmet market (1,32,33).

Banteng will also crossbreed with domestic cattle. A particularly successful cross is that between a Banteng and a Zebu to produce the Madura (1,32,33). This breed, native to the island of Madura probably came into being some 1500 years ago, when Indian invaders brought zebus of the Sinhala (or Ceylonese) type to Madura and crossbred them with Banteng (33). Virtually all of the 575,000 cattle on this island are Maduras (33). The breed is smaller in stature and has smaller horns than the domestic Banteng, but is similar in most other characteristics (1). It reportedly shows a better growth rate than the pure Banteng; is thrifty, hardy, and able to perform well under extremes of heat and poor nutrition (33). Both its meat and hide are said to be of superior quality (33). Though a hybrid in origin, both sexes are fully fertile (33). On Madura at the end of the rice harvest there is an age-old festival which centres around a bull race (1,33). The racing bulls are bred from selected Madura stock and are specially fed and trained (1); they are supposedly the fastest-running bovines (33).

HABITAT AND ECOLOGY Forested areas with glades and clearings for grazing (2,3,5,30,31,35). Mineral licks are also important (15,35), and where unavailable Banteng will occasionally drink seawater (5,15,30). Often found in hill country up to 2000m, since lusher valley bottoms are usually occupied by human settlement (2,31). In high rainfall areas such as the Annamite Mtns of Indochina, Banteng may be wholly dependent on fallow areas of slash-and-burn cultivation (2). Similarly in Sabah it is said that Banteng benefitted from shifting cultivation which increased food supply (15). In northern Kampuchea they also utilize savannas; in eastern Java natural or more permanent grasslands (2); and in Thailand and Burma they are primarily associated with deciduous dry dipterocarp forests and mixed deciduous forests (7,35). Banteng seem to depend more on grazing and less on browsing than the closely related Gaur (Bos gaurus) and where both occur Banteng tend to occupy more open and often drier habitats (2,3,5,11). Furthermore they appear to live in larger groups, and to be more mobile than Gaur (25). Herds vary in size from 2 to 25 or more with usually only one adult male per herd (5,15). Diurnal except when subject to hunting pressure, in response to which they become nocturnal and retreat into dense forest (3,5). One or two calves are born after a gestation period of 9.5 to 10 months (3,5). Longevity is 20-25 years (5).

THREATS TO SURVIVAL Loss of habitat to an ever increasing human population; greater hunting pressure for meat and trophies; military operations in much of its range; hybridization with domestic cattle, which may have affected the genetic purity of some stocks, and mortality from diseases such as rinderpest caught from domestic cattle (3,5,8,15,35). Also if Banteng are forced to rely too heavily on a small area of pasture, casualties often result from an overload of parasites combined with malnutrition (10). In Sabah, reasons for decline are reported to be the widespread use of guns, particularly during and after World War 2, probably coupled with a decrease in the practise of shifting cultivation (15).

Trade: There is no international or national trade in Banteng.

CONSERVATION MEASURES Basic needs are protection of suitable areas of habitat and complete protection of Banteng populations within these.

Burma Listed as a protected species under the Wildlife Protection Act, 1936. Occurs in the Shwesettaw and Kyatthin Wildlife Sanctuaries and the proposed Alaungdaw Kathapa National Park; may still occur in Pidaung and Shwe-U-Daung Wildlife Sanctuaries, but there is no recent confirmation (35).

Thailand Protected by the Wild Animals Preservation and Protection Act of B.E. 2503 (1961) as amended by Announcement of the Revolutionary Party No. 228, B.E. 2515 (1972). Occurs in the Huai Kha Khaeng and Thung Yai Wildlife Sanctuaries, the Nam Nao National Park, the Om Koi and Mae Tuen Wildlife Sanctuaries (7) as well as in several other protected areas.

Indochina Conservation measures are largely unknown. For Vietnam the Westings (1980) mention that a national park has been proposed on the plateau of the central highlands between Ban Me Thuot and Kontum and that it contains Banteng (16).

Malaysia Totally protected by the Fauna Conservation Ordinance (1963) and amendments (15). Does not as yet occur in any protected area. The 1979-81 faunal survey of Sabah study proposed various new conservation areas, of which the following harboured Banteng; Kumambu, Silabukan, Tanjung Linsang and Danum Valley (15). The Banteng is being considered for domestication in Sabah (15).

Crossbreeds between Banteng and European cattle have only been attempted in small programmes in the U.S.A. and Australia (33). For example, researchers in Texas are producing a cross that is one-eighth Banteng and seven-eighths Charolais. They believe it will result in a beef animal able to grow well in warm, humid conditions (33). In Australia, Banteng bulls have been mated to Brahman-Shorthorn cows. Calves that are one-fourth Banteng three-fourths Brahman Shorthorn have since been produced (33).

REMARKS For description of animal see (3,5,8,12). The name Bos sondaicus has been used in the past.

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WILD YAK ENDANGERED

Bos grunniens Linnaeus,1766

Order ARTIODACTYLA Family BOVIDAE

SUMMARY Inhabits remote areas of the Tibetan plateau and adjacent highlands. Numbers are greatly reduced primarily due to uncontrolled hunting. Necessary conservation measures include surveys to locate viable populations, legal protection and the establishment of reserves. The Yak has been domesticated and used as pack animal, for human transport, and for meat and milk in Central Asia as far back as there is any knowledge of people in this area. Since Wild Yak are the wild relatives of the domestic Yak they constitute a potentially valuable source of genetic material for the improvement of the domestic stock.

DISTRIBUTION China (1,2,3,19), India (7,8), and possibly Bhutan (12).

China: A 1984 report notes that the species is confined chiefly to the Qinghai-Xizang (Chinhai-Tibetan) Plateau: in the plateau steppe area at the head of the Yarlung-Zangbo-Jiang River and north-western Xizang (Tibet); in the Kunlun-Shan Mountains and the Aljin-Shan Mountains on the extreme southern border of Xinjiang (Sinkiang); and in the Qilian-Shan Mountain range at the juncture of Qinghai and Gansu Provinces (26).

India: There is some debate whether the species still persists. It definitely occurred there in the 1970s (in the Changchenmo Valley in the Ladakh region of Kashmir, occasionally straying as far as the head of the Sutlej Valley and near the Milan and Lipule Passes in east Kumaun (7,12)). Some reports note that it has not been seen there for a number of years and that none were seen in 1983 (8), however a paper given at the centenary seminar of the Bombay Natural History Society in 1983 by Brig. Moti Dar reported that herds did indeed still survive in the more remote areas of Kashmir (27).

Bhutan No information located.

The Yak supposedly occurs wild in Nepal though is rarely seen; it is thought to have been introduced from Tibet centuries ago (4). Historically its range extended from the Karakorums in north-east Ladakh, along the Kunlun Mountains in China to the Nan Shan range of extreme western China (Gansu Province) (1,3); and according to Sayer also probably in the Pamirs of Afghanistan (11).

POPULATION No population estimates exist but the species perhaps numbers only in the low hundreds.

China Sightings made during surveys by Academia Sinica in 1973-76 totalled approximately 800 animals in north-western Xizang (26). Recent reports from travellers in Tibet suggest that wildlife in the country has drastically declined and that the Wild Yak has been 'decimated' (15).

India Although believed extinct, evidence in 1983 suggested that it still survived and in some numbers (27).

Bhutan No information located.

The 1934-36 Dolan expedition to China remarked that the range of the Wild Yak seemed to have steadily shrunk during the recent preceding years, that skulls and

bones littered the steppes of the Upper Yellow River, and that as far as could be determined the Yak had been uncommon there for a decade or so. Yak were sighted only 3-4 times in the course of six weeks' travel on the steppes of the Upper Yellow River and the Yangtse (2). Lydekker (1898) reported Yak to be comparatively few in Ladakh (India) but to exist in China in great numbers (3).

HABITAT AND ECOLOGY The Tibetan plateau of alpine tundra and ice desert between 14,000-17,000ft (4270-5185m) or higher (2,5). During the 1973-76 surveys Yaks were usually seen in small groups of 3-5, the occasional lone bull being seen in summer; larger herds sometimes numbering more than 200 individuals were also encountered (26). Similarly the Dolan expedition reported cows and calves together in herds during the summer; mature and older bulls perhaps occurring in small bands or alone (2). Lydekker reported herds numbering from ten to a hundred head or more, the old bulls being for the most part solitary or occurring in small bands of 3-4. Feeding occurred chiefly in the early mornings and evenings (3). Gestation period is about 8-9 months (5).

THREATS TO SURVIVAL This century, Yak populations have suffered a marked reduction as a result of uncontrolled hunting. The remaining herds have become scattered and isolated in the most remote areas of their former range (2,13,15,26, E. Schäfer 1963, Pers. comm.).

Trade There is no international or national trade in Wild Yak.

CONSERVATION MEASURES Information is needed on the whereabouts of viable populations before effective conservation measures can be suggested. However effective protection from hunting is a necessary measure, as is the establishment of adequately protected areas (10).

China The species has been protected in China since 1962 (9,26), though this is difficult to enforce in remote mountainous areas (26). Feng Zuo-jian recommends that reserves be established in north-western Xizang and other appropriate areas to conserve the Wild Yak and other alpine wildlife. He also suggests the need for a conservation education programme (26).

India Partially protected by law under the Wildlife (Protection) Act of 1972, although may be hunted on licence at the discretion of the Chief Wildlife Warden.

Bhutan Unknown.

Bos mutus (including the synonym Bos grunniens) is listed in Appendix 1 of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, trade in it or its products between ratifying nations is therefore subject to strict regulation and trade for primarily commercial purposes is banned.

CAPTIVE BREEDING There are no Wild Yaks in captivity.

DOMESTICATION It is not known when Yak were first domesticated but it is considered likely that there has been a close interaction between man and Yak ever since the first human immigrations into the high mountains of Asia (17). Certainly the Yak was known by repute to the classical Greeks who called it 'poiphagos', the eater of grass (17). The domesticated Yak differs little in appearance from the wild animal except that it is smaller, has shorter and thinner horns, and may be variable in colour (17). It is found in the mountains and plateaus of Tibet and western China (Quinghai, Sichuan, Gansu, Xinjiang and Yunnan) (20), and in northern Afghanistan, Pakistan, India, Nepal, Bhutan, Mongolia and the Soviet Union (16,18,24). Vietmeyer suggests that there are more than one million domestic Yaks in the world (16) although he does not cite the

source. A 1982 article about Yaks in 'China Pictorial' mentions however that 'ten million Yaks' live in the far western provinces of China (20), and a 1979 Chinese Press Release mentions 12.3 million Yaks in China's Qinghai-Tibet plateau (22).

Domestic Yaks are reputedly docile and easily managed. They are excellent pack and riding animals and can carry loads of up to 150 kg (17,18,24). At high altitudes (up to 6000m) an animal can carry a pack, or a man, at a steady pace for days at a time and still remain in good condition (17,24). In some regions the Yak is the only pack animal available whilst in others it is used as common cattle are, being milked and occasionally slaughtered for meat. The milk has a very high fat content and in some areas Yak butter is used in great quantities both as a staple food and as a lighting fuel (17,21,23,24). The Yaks long, thick, silky hair is used for textiles (20,24).

In all the lower regions where Yak are found they are interbred with common cattle, either the humpless cattle of Tibet and Mongolia or the Zebu. The sires are usually cattle and the dams Yaks; the hybrid is commonly known as a dzo. Like the mule, the hybrid offspring of cattle and Yak surpass their parents in strength and vigour; the females are fertile but the males are sterile. Hybrids are intermediate in appearance between the parents, having a shorter coat with much less downy undercoat than the pure Yak whilst the females yield larger quantities of milk than the Yak cow. The hybrids are preferred for ploughing in Tibet because the Yak is said to be too stubborn (17,24).

In India the government is establishing national research centres to investigate rare, economically important species, including the domestic Yak (14); such research should include an examination of the beneficial role of the Wild Yak in future Yak husbandry. In China a Yak Research Group was established in 1979 in Xining, capital of Ginghai Province (21,22).

REMARKS For description of animal see (1,2,4,6,13,16).

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WILD ASIATIC BUFFALO
or WILD WATER BUFFALO

ENDANGERED

Bubalus bubalis (Linnaeus, 1758)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY This species is highly endangered in the wild and will become extinct unless drastic, rapid action is taken. Herds traditionally considered to be the 'true' Wild Water Buffalo occur only in Nepal and India. However it now seems likely that these animals interbreed extensively with free-roaming domestic Water Buffalo, thus they can no longer be regarded as solely of wild stock. Those in the rest of South-east Asia are considered feral. The species has suffered a dramatic decline in distribution and numbers, and probably fewer than 2000 animals now survive. Populations in peninsular India appear doomed by hydroelectric schemes and those in Assam by diseases such as rinderpest transmitted by domestic stock. All populations are suffering genetic swamping by interbreeding with domestic Buffalo. The decline of the animal was however due to over-exploitation and to habitat loss - its riverine habitat being much favoured for cultivation. Protected by law and occurs in a number of reserves, however, habitat protection is not enough. Protection from the adverse effects of domestic Buffalo and stock, needs to be enforced if this animal is to have any future. As a genetic resource for the domestic Buffalo population this species demands some priority in conservation choices.

DISTRIBUTION India (mainly Assam and Madhya Pradesh) and south-eastern Nepal are the only countries where Buffalo traditionally believed be of truly wild stock occur. Throughout the rest of southern Asia the Wild Buffalo are considered feral. In addition, translocated or feral animals occur in Australia, Brazil, the Philippines, Timor and Sri Lanka. The domestic form is found throughout the Old World (7).

India Wild Water Buffalo were once widely distributed over the grass jungles and riverine forests of north-east India from the Gangetic and Brahmaputra plains in Assam, west to Uttar Pradesh, and southwards through eastern peninsular India to the Godavari River (1,16). Throughout most of this range they have now been exterminated and by the 1980s were confined chiefly to Assam (where populations are now believed to be much interbred with domestic Buffalo) and Madhya Pradesh.

In Assam they occur only in sanctuaries, the two largest concentrations being in the Kaziranga National Park and the Manas Wildlife Sanctuary. Elsewhere in Assam small herds also still survive - in the Sankosh valley just west of Manas, in the Sonairupa, Orang and Laokhowa (Lakhawa) Wildlife Sanctuaries in central Assam, and in the Pabha (or Milroy Buffalo Reserve), and Lakhimpur in eastern Assam (1,16). Reports by Forest Officers in 1983 also mentioned herds in Meghalaya - in the Rewak Reserve Forest on the border with Bangladesh and in June and July also in the Songsak Reserve Forest on the northern slope of the Garo Hills (24). Ranjitsinh (1982) mentioned that a few stragglers remained in adjacent Arunachal Pradesh (19).

In peninsular India the Buffalo has almost vanished, only a few populations remain, principally in the region north of the Godavari River (1). The main stronghold is in the State of Madhya Pradesh where by the 1980s only four viable populations survived (38): three in Bastar District on the left bank of the Indravati River - in the Indravati National Park, the Bhairamgarh Forest Range, and two herds in the Pamed Forest Range (both forests have been declared sanctuaries) (24,26,38). The

fourth population occurs in Deobagh Tahsil in Raipur District (10,19,38). In Orissa by 1983 the species was all but extinct; its last place of occurrence, in the Balimela and Kondakamberu area of Malakanagiri sub-division of Koraput District had been opened up by 'reclamations' and the Buffaloes had reportely moved to the Chitrakunda dam area towards Kondakamberu (24,27). The species has vanished from Maharashtra State (15,24,25) where it occurred in the mid-1970s in the Chandrapur District an area adjoining Bastar (15). There are also reports that small groups of Wild Buffalo have been sighted along the border of Andhra Pradesh with Madhya Pradesh and Orissa (19,24) but confirmation is needed (24).

Nepal By the 1970s Wild Buffalo could be found only in the Koshi Tappu Wildlife Reserve on the floodplain of the Sapta-Koshi River in south-eastern Nepal (5). Prior to 1950 the species range was much greater. After this time malaria eradication programmes followed by settlement and cultivation of the terai, plus an uncontrolled influx of settlers resulted in a drastic contraction of the species range (5).

POPULATION By the 1980s the total population was probably only 1000-1500 and probably very few of these could be considered of 'pure' wild stock. In the 1960s the estimate was about 2000 (18).

India By the 1980s the total number was probably not much greater than 1000 animals, the vast majority occurring in Assam where genetic swamping by domestic Buffalo was greatest. Assam: At the beginning of the 1980s the number was probably 800 to 1000 Wild Buffalo. According to Divekar a census by the Forest Department in 1978 estimated 660 Buffalo in Kaziranga (14); a 1981 publication on 'Wildlife in India' published by the Ministry of Agriculture mentions about 500 in Kaziranga and 300 to 400 in Manas (9). However populations in both these ares are now well interbred with domestic Buffalo. Madhya Pradesh: Numbers in Indravati National Park in 1983/4 were about 190 (38); a June 1982 census gave a total of 167 (24,26) compared to 163 in 1981, 147 in 1980 and 123 in 1979 (10). Divekar surveyed the region from 18th March to 26th March 1975 and estimated that 'probably not more than 50 occurred including those in the adjoining Chandrapur district of Maharashtra' (13); Daniel and Grubh had estimated 200 to 250 ten years earlier (1). 1983/84 estimates for Bhairamgarh were 20, for Pamed about 43, and for Deobagh Tahsil approximately 35 (38). Surveys by Divekar and others in Maharashtra at various times in 1978 and 1979 concluded that the species had disappeared (15). No information has been located on numbers in the Balimela area of Orissa. Whether the species still occurs in Andhra Pradesh needs confirmation.

In the 1800s in India the species was abundant and reportedly seen in hundreds along the great rivers of the east (1). In peninsular India they were equally abundant (1).

Nepal The number in Koshi Tappu in 1980 was reported to be about 60 animals, indicating a stable trend over the previous few years - in July 1976 the population was estimated to have been at least 65 individuals (5).

HABITAT AND ECOLOGY The marshes, grass jungles and reed brakes in the vicinity of rivers and lakes provide the ideal habitat, offering both food and shelter, pools of water to lie in, and mud wallows to roll in (22). Such areas of ample water and grass are capable of supporting quite dense populations and Buffalo herds have been known to number many individuals (21). Such habitat occurs in the riverine flats of Assam and Nepal. Further south however the species lives in a drier habitat scattered with trees. Buffalo feed chiefly on grass, grazing in the mornings and evenings, and sometimes at night, lying up by day in high grass or dense patches of cover, or submerged in a marsh or pool (22). In recent times they have taken to crop raiding (5,21,22). They usually associate in

small herds which may combine to form large assemblages (22). In Nepal, Dahmer (1978) who studied the species noted three distinct social groupings - mixed herds, bachelor herds, and lone bulls; the mixed herds had one adult bull which accompanied the herd during all seasons (5).

THREATS TO SURVIVAL Principal reason for the dramatic reduction in the range and numbers of the Wild Asiatic Buffalo has been the loss of its riverine habitat to human settlement and cultivation (1,10,16,18). The species has also been subject to increasing competition for forage from domestic stock, to interbreeding with domestic buffalo, and is vulnerable to disease transmitted by domestic cattle and buffaloes (1,10,16,18). In Kaziranga National Park, where large herds of semi-wild domestic buffalo, called Kachhar, graze in the sanctuary, mating of wild bulls with domestic cows is common (10,16) and this is becoming a major threat to the genetic integrity of the Wild Buffalo in the park (10,16). (Whether the interbreeding occurs the other way round which would in fact be more detrimental to the wild stock is not mentioned). Also in Kaziranga, in the first part of 1981 112 Wild Buffaloes were reported to have died of rinderpest (10).

In peninsular India the surviving Buffalo are threatened mainly by irrigation projects such as the Balimela Dam in Orissa which has all but inundated the last remaining habitat of the species in the state (16). Similarly the Bhopalpatnam Irrigation Project and the Bodhghat Hydro-electric Project, both on the Indravati River in West Bastar will adversely affect the species habitat (10). The Hydel Project in Deobhog Tahsil in Raipur District (10) threatened the Udyanti herd but according to Ranjitsinh (1984) is now no longer a threat (38).

Trade The U.S.A. report to CITES for 1979 recorded the import into the United States from Nepal of '20 carvings' of Bubalus bubalis, whether these were from domestic or wild Water Buffalo was not stated (39).

CONSERVATION MEASURES The Wild Water Buffalo is highly endangered and will become extinct unless concerted efforts are made to conserve the last viable populations. Such measures principally involve the protection of their habitat, and segregation from domestic Buffalo which transmit diseases, and which by interbreeding swamp the genetic purity of the wild stock. As yet the various protected areas have not provided the necessary protection.

India Listed in Schedule 1 of the Wildlife Protection Act, 1972; any form of hunting is totally prohibited (10). Additionally protected by law in Madhya Pradesh (17). Occurs in the following protected areas: in Assam in the Kaziranga National Park, and the Wildlife Sanctuaries of Manas (390 sq. km), Sonairupa (175 sq. km), Orang (73 sq. km), Laokhowa (Lakhawa) (70 sq. km), and in Pabha or Milroy Buffalo Reserve (491 sq. km); and in Madhya Pradesh in the Indravati National Park (1258 sq. km) which incorporates the Kutru Wild Buffalo Sanctuary, and which is to become a 'Project Tiger Reserve' (24).

Nepal Included on the list of fully protected animals (11), and occurs in the Koshi Tappu Wildlife Reserve (65 sq. km) established on 19 July 1976 (5,8). A reintroduction into Chitwan National Park was planned with animals from Koshi Tappu but was indefinitely postponed because of fiscal considerations (5). Such a translocation is recommended as a necessary conservation measure in case of a disaster in the Koshi Tappu Reserve. Thomas Dahmer studied this animal in the reserve from May 1975 through July 1976 (5).

CAPTIVE BREEDING There are no Wild Water Buffalo in captivity.

DOMESTICATION The domestic Water Buffalo numbers at least 130 million, one-ninth the number of cattle in the world (7). Two general types are recognised

- the Swamp Buffalo and the River Buffalo (7). Swamp Buffalo are found in the eastern half of Asia from the Philippines west to India. They wallow in any water or mud puddle they can find or make. Primarily exploited as a work animal they are also used for meat but almost never for milk production (7). River Buffalo occur in the western half of Asia, from India to Egypt and Europe. They prefer to wallow in clean water. They are the dairy type of Water Buffalo producing much more milk than Swamp Buffalo. In India they make up only 35 per cent of the milk animals but produce almost 70 per cent of the milk. Buffalo butterfat is the major source of cooking oil in some Asian countries, including India and Pakistan (7).

Parts of Asia and even Europe have depended on Water Buffaloes for centuries. They are represented on seals struck 5000 years ago in the Indus Valley, suggesting they had already been domesticated in India and Pakistan (7). They were in use in China 4000 years ago but seemingly were unknown to the ancient Egyptians, Greeks and Romans. It was not until about 600 A.D. that Arabs brought the animal from Mesopotamia to the Middle East. Water Buffaloes were later introduced to Europe by pilgrims and crusaders returning from the Middle East in the Middle Ages. Buffaloes became established in Italy, Hungary, Romania, Yugoslavia, Albania, Greece and Bulgaria and have remained there ever since (7). Egypt began to use them in the Middle Ages and the species has since become the most important domestic animal in the country (7).

Other areas of the world have begun to use Water Buffalo only in recent times. For instance Brazil first imported a small number of animals at the beginning of the 20th century; they now total about 400,000 head and Buffalo meat and milk are sold widely in Amazonian towns and villages. Other countries now utilizing Water Buffalo include Trinidad, Venezuela, Colombia, Guyana, Suriname, Costa Rica, Panama, Papua New Guinea and Australia (7). Buffalo meat has a reputation of being tough, however it is lean and tender when the animals are raised primarily for meat production; taste-wise it compares favourably with beef. The milk is rich, having a higher content of both butterfat and nonfat solids than cow's milk. In Europe, Buffalo milk is used to make the sought-after Mozzarella cheese. As a work animal the Buffalo is the principal powerhouse for Asian agriculture. It is adaptable, versatile, widely used to plough, level land, plant crops, puddle rice fields, cultivate field crops, pump water, haul carts, sleds, and shallow-draft boats, carry people, thresh grain, press sugar cane, haul logs as well as countless other tasks. For millions of peasants in the Far East, Middle East, and Near East it is the only method of farming food crops. Even in areas where the tractor has replaced the Water Buffalo the animal is now making a comeback as fuel becomes scarce and expensive (7). Furthermore the Buffalo offers free fertilizer!

There is increasingly more interest in the vast potential offered by the Water Buffalo especially since the promises offered by mechanization to many of the peoples of developing countries appears increasingly to be unattainable. Not only has the increase in the cost of fuel been a factor but frequently the infrastructure to maintain machinery is not available. Furthermore tractors usually require at least four hectares for economical operation, which precludes their use on most peasant farms (7). It is to be hoped that governments and international aid agencies will foster research on the domestic Water Buffalo. The importance of conserving the wild genetic stock gains importance and must deserve some priority in conservation decisions. Recently (1981) a highly useful book on the species was produced: 'The Water Buffalo: New prospects for an underutilized animal' (7). Some additional useful references are listed (28,29,30,31,32,33,34,35,36,37).

REMARKS For description of animal see (1,22).

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TAMARAW ENDANGERED

Bubalus mindorensis (Heude, 1888)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY A small buffalo endemic to the Island of Mindoro in the Philippines. Seriously depleted by hunting and habitat loss the species is now thought to be increasing in numbers due to an effective conservation programme launched at the end of the 1970s. Three reserves have been set aside for its protection, and hunting has been virtually eliminated. A 1983 official estimate was 250 animals; unofficial estimates place the figure at 300-400. Conservation of the species is coordinated by the 'Presidential Committee for the Conservation of the Tamaraw' (PCCT) created in 1979 by President Marcos. The species has not been domesticated but is perhaps a possible candidate; its meat is highly regarded by local people.

DISTRIBUTION The Philippines. Endemic to the Island of Mindoro where by 1983 it occurred only in isolated pockets throughout the island (19). Principal stronghold is the Mt Iglit/Baco National Park (19); the species also occurs in the Mt Mitchell- F.B. Harrisson area, and on Mt Calavite. At the turn of the century Tamaraw were found throughout Mindoro (1,2,4,6,9,10,11,12,15), and during the Pleistocene also occurred on nearby Luzon Island (3).

POPULATION The 1983 official count was of 250 Tamaraw (19,20), of which about 135 occurred in the Mt Iglit/Baco National Park (19); the unofficial estimate was of 300-400 (20). Owing to effective conservation measures numbers have been increasing (20). The majority of animals occur in protected areas although small groups can still be found outside the parks (20).

It has been estimated that 10,000 Tamaraw occurred on Mindoro in 1900 (7); by 1949 numbers had dwindled to about 1000 and by 1953 to fewer than 250 (12). In 1969 a field survey could only locate three small populations totalling about 100 animals (6,7). The 1973-74 estimate was of 150-200 (2,4) of which 70-80 or more occurred in the Mt Iglit area (8,9,10).

HABITAT AND ECOLOGY Preferred habitat is reported to be a mosaic of thick forest (for cover) and open grazing areas (1,10,12). A study on Mt Iglit found that Tamaraw cows usually occurred in the interspersion of forest, talahib (Saccharum spontaneum) grassland, and cogon (Imperata clylindrica) grassland, but because mature bulls were intolerant of other bulls, many adults and most juvenile bulls were forced to utilize ranges without forest cover (8,10). Adult Tamaraw are largely solitary although groups of juveniles may persist for a year or more (9). The breeding season is in the early part of the six month dry season, so cows bear their single calves in the rainy season when the forage is lush and the weather cool (9). Once reputediy placid and diurnal, persecution has caused Tamaraw to become largely nocturnal and elusive. However since the virtual elimination of hunting, Tamaraw have once again been seen grazing openly during the day (1,14,15).

THREATS TO SURVIVAL Hunting has been the main cause of decline, for trophies and for its meat which is said to be delicious. Since the early 1900s the increase in human numbers, timber operations, farming, cattle ranching, availability of firearms and hunting combined with lack of effective enforcement of hunting laws nas greatly restricted the species' nabitat and very greatly reduced its numbers. Farmers have eradicated it from the fertile lowlands, and ranchers want every spot of suitable land in the foothills for domestic cattle. The

latter is perhaps the greatest future threat to the Tamaraw's recovery (1,6,7,8,9,10,12,14,15).

Trade There is no national or international trade involving Tamaraw.

CONSERVATION MEASURES The Commonwealth Act No.73 of 1936 (amended by the Republic Act 1086) penalizes the killing, hunting, wounding or taking away of Tamaraw. The species occurs in the 77,445 ha Mt Iglit/Baco National Park (established 1961) which is excellently protected (19), the 15,000 ha Mt Calavite Game Reserve (established 1920), and the 44,500 ha Mt Mitchell - F.B. Harrisson Game Refuge (2,4,10,12,15). In 1969, as a result of a field survey by Tom Harrisson, efforts by Charles Lindbergh, Sixto Roxas, Manuel Elizalde, Sr., Manuel Elizalde, Jr., Jesus Alvarez, Luis Yulo, and others, plus support by President Marcos, a Tamaraw Conservation Programme was launched by the President (2,20) (for full details see Alvarez 1973) (2). Although the programme resulted in the protection of a small herd of about 100 Tamaraw on Mt Iglit, the status of the species remained precarious. A survey in 1978 by Ian C. Player and David A. Parkinson recommended that a more intensive conservation effort was required. In response President Marcos created the 'Presidential Committee for the Conservation of the Tamaraw' (PCCT) under Executive Order No. 544 (20). All conservation action has subsequently been coordinated by the Committee (which includes Minister Manuel Elizalde, Jr., Assemblyman Luis Yulo and Jesus Alvarez, Assistant Director of the Bureau of Forest Development) (20).

Since the PCCT took over responsibility of conserving the Tamaraw, numbers have increased (20). The Committee has four main activities: 1) A 400 ha enclosure (called the 'gene pool') has been fenced within the lower elevations of the Mt Iglit/Baco National Park (13,18,19,20). By September 1983 it held 5 male and one female Tamaraw (20); capture of more animals is ongoing outside reserves in areas where the species is threatened and where there is no hope of protection (19,20). 2) Enforcement of protection of the Tamaraw has been increased, and in 1982 a case was brought against poachers (20). Also 'minority tribes' have been enlisted into the overall programme (20). 3) Scientific studies have been initiated both in Mt Iglit/Baco National Park and in the 'gene pool' and there are plans to undertake radio telemetry work (20). 4) A national education campaign is ongoing involving press, radio and television (1,2,4,8,10,13,18,20).

The Tamaraw is listed in Appendix I of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, trade in it or its products is therefore subject to strict regulation by ratifying nations, and trade for primarily commercial purposes is banned.

CAPTIVE BREEDING Aside from the captive nerd of six Tamaraw (5 males, one female) in the PCCT 'gene pool', there is only one other Tamaraw known to be in captivity: a female at the Manila Zoo (20).

DOMESTICATION The Tamaraw has never been domesticated. Vietmeyer believes that the species has potential for domestication. Its meat and hide are apparently highly regarded by local peoples, cattlemen, and visiting hunters. Furthermore because of its close relationship to the Water Buffalo, Bubalus bubalis, it may have genetic material relevant to an improvement of this important domestic bovine (17).

REMARKS For description of animal see (1,11,12,16). The species is frequently considered to be closely related to the Anoas of Sulawesi (Celebes), all three often being placed in the genus Bubalus subgenus Anoa. Groves however, in a 1969 study of the systematics of this trio concluded that the Tamaraw is more closely related to the Asiatic Buffalo, Bubalus bubalis, and that it should be named Bubalus mindorensis in the subgenus Bubalus (5).

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ANOAS

INSUFFICIENTLY KNOWN

Bubalus quarlesi (Ouwens, 1910) Mountain Anoa

Bubalus depressicornis (H. Smith, 1827) Lowland Anoa

Order ARTIODACTYLA Family BOVIDAE

SUMMARY Anoas are buffaloes endemic to the Indonesian island of Sulawesi (formerly Celebes). Numbers are unknown but they are believed possibly to be declining because of hunting and loss of forest habitat. Two species are usually described, the Mountain Anoa, B. quarlesi, and the Lowland Anoa, B. depressicornis; however in the field it has been difficult to distinguish between them and much of the literature refers simply to Anoa without specifying the species. The validity of distinguishing two separate species is also increasingly questioned. Anoas are protected by law and occur in many of the large reserves established in recent years. Adequate protection of these reserves should be sufficient to ensure their survival. Anoas have never been domesticated but their potential for domestication should be explored.

DISTRIBUTION The Indonesian island of Sulawesi (formerly Celebes). Although traditionally Anoas have been divided into 'Lowland' (depressicornis) and 'Highland' (quarlesi) species, the validity of this distinction is increasingly being questioned (12,13). MacKinnon who has done fieldwork on Sulawesi reports that within any region there tends to be only one type of Anoa and although it is generally true that in the most mountainous regions this tends to be quarlesi, within a quarlesi region this highland form will range right down to sea level (as in the Dumoga valley). Conversely in depressicornis areas, depressicornis will range right up to the highest peaks in mossy, montane forest, as for example, in Gn Tangkoko and Gn Ambang (1500 m) (12). Similarly Watling who has also worked on Sulawesi also questions the validity of the accepted distinctions and remarks that whether there is merely a cline, and whether distinction is altitudinal or geographical, is unknown (13).

The more traditional view is best summarized by Groves. He reports the Lowland Anoa, B. depressicornis, to have historically ranged throughout Sulawesi but to be restricted to the lowlands (3). He summarized the locality records as: a) Northern peninsula: Minahassa, Menado, Bambulan, Gorontalo Likupang, Lempias, coast near Limbe, forest between Langowan and Pangku, Paybi, Tolitoli; b) Central Sulawesi; Donggala; c) South-eastern peninsula: north slope of Boro Boro Mountains, Kampung Mowita, Malili, Kolaka (3). The Mountain Anoa, B. quarlesi, was thought (naturally enough) to inhabit the mountainous regions. Groves cites the following historical locality records: a) Northern peninsula: Besoa, Menado; b) Central Sulawesi: Lake Lindu, Tuwulu; c) South-western peninsula: Latimodjong, Watampone, Madjene, mountains inland from Macassar at 2000 m, Toradja, Upper Binuwang, Palopa, Mandar Mtns, Bola Batu, Tjani (3). Van Bemmel reporting in 1963 said 'so far as is known the Anoa still survives on the Peak of Bonthian (near the tip of the south-western peninsula), the Toradja Highlands and the central mountains of Celebes' (7).

At the turn of the century the Anoa was described as 'retreating before advancing culture more and more into the interior of the land, abandoning coastal areas where it was previously common' (5). In 1936 Anoa species (unspecified) were still abundant on islands south of Sulawesi (5).

POPULATION No censuses have been carried out and numbers are unknown. At a guess MacKinnon in 1982 thought it probable that each species numbered a few

thousand (1). Both Watling and MacKinnon reported Anoas to be widespread though thinly distributed and in undisturbed areas of favourable habitat still to be locally common, occurring in all remaining forest blocks that had been surveyed (12,13). Trend is believed to be downward because of hunting and habitat loss; however this remains only an impression (9). In 1979 MacKinnon reported the Lowland Anoa to have disappeared or reached low numbers in many places particularly near towns and villages where it was heavily hunted and snared, but that healthy populations still occurred in large forest blocks (9). The Mountain Anoa he reported to be very rare (9).

Robin Hanbury-Tenison who visited Sulawesi in 1974, reported that Anoas were 'quite numerous' in the eastern peninsula between Luwuk and Poso (4). In the past the species has been described as verging on extinction (2,11) but there appears to be little data available. Harper (1945) quotes a letter from F. N. Chasen in 1937 in which the latter describes the Anoa as 'less numerous than formerly' and 'certainly worth a place in your list' (of extinct and vanishing mammals). Most of the other sources quoted by Harper (pre-1940) describe the Anoa as locally numerous though decreasing (5).

HABITAT AND ECOLOGY All forest types from sea-level to the moss forests in the highlands (12). Usually solitary or in pairs (12,13), occasionally in small parties but never in large herds (12). Feeds in natural clearings on wild ginger, ferns, grass, shrubs and various fruits especially Ficus variegatus (12).

THREATS TO SURVIVAL Anoas are heavily hunted and snared (9,12,13) and will soon leave an area if disturbed (13). Their forest habitat is also disappearing due to human influx and increased logging for export (9,12). Watling reports that though they are disturbed by logging Anoas probably benefit from the regeneration of vegetation; they are certainly known to use selectively logged forest (13).

Trade: There is virtually no national or international trade in Anoas, although in 1976 an animal trader in South-east Asia was offering one pair of Lowland Anoa for US $3000 each (15).

CONSERVATION MEASURES Fully protected by law in Indonesia and included in a number of large reserves (1,12): Dumoga-Bone National Park (mostly Mountain Anoa) (12), Lore Lindu National Park (Mountain Anoa) (8,12) where in 1981 it was stated to be 'common' (8), Morowali National Park (12), Tangkoko Batuangus Reserve (Lowland Anoa) (12), Gn Ambang Reserve (12), Panua Reserve (1), Gn Manembo-nembo (1). No specfic conservation project has been carried out on the species but its conservation has greatly benefitted from the establishment in recent years of an extensive system of large reserves (1,12). MacKinnon suggests that because of this no specific conservation project is required for Anoas (1), however, scientific studies to investigate the distribution of the two Anoa types and to more fully understand their degree of distinctiveness would be interesting.

Both Lowland and Mountain Anoa are listed in Appendix I of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, trade in them or their products is therefore subject to strict regulation by ratifying nations, and trade for primarily commercial purposes is banned.

CAPTIVE BREEDING In 1981, the International Zoo Yearbook recorded that of the Lowland form there were 13 males and 13 females (18 captive bred) held in eight zoological collections, and of the Mountain form 7 males and 5 females (7 captive bred) held in 5 collections (7).

DOMESTICATION Anoas have never been domesticated. Vietmeyer notes that on Sulawesi they are prized for their hide, horns and meat. The flesh, especially that

of the calves, is apparently tender and well flavoured (16).

REMARKS For description of animal see (3). The two supposedly distinct types of Anoa are a large form, the Lowland Anoa, with white legs, long tail and rugged horns, and a small type, the Mountain Anoa, with legs mainly the same colour as the body, a short tail and conical horns. Some authors have regarded both types as subspecies of B. depressicornis (7) but according to Groves there is no evidence of intergradation and they should be classed as two distinct species (3).

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EUROPEAN BISON or WISENT OUT OF DANGER

Bison bonasus (Linnaeus, 1758)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY Survives only in captive and semi-wild herds, the latter in parts of its original range in Poland and the U.S.S.R. Largest herd is in the Bialowieza Forest which straddles the border between the two countries; in 1980 Bison in the Forest numbered 411 animals. By the beginning of the 20th century the species still survived in the wild but only in the Bialowieza Forest (B. b. bonasus) and in the Caucasus (B. b. caucasicus). The last Bison in Bialowieza was poached in early spring 1919 and the last in the Caucasus died in 1927. The only surviving animals were those in zoological gardens and those belonging to private owners. Furthermore, only one animal, a bull, of the B. b. caucasicus subspecies had survived in captivity; it died in 1925. This bull did sire calves from B. b. bonasus cows, and most of the existing herds are in fact bonasus/caucasicus hybrids. By the 1980s, as a result of successful breeding programmes the species numbered over 2000 animals, and 24 herds had been re-established in the wild. Continued protection and breeding programmes are essential for the survival of the species; additional reintroductions to suitable habitat would always be valuable.

DISTRIBUTION U.S.S.R. and Poland. Extinct in the truly wild state although semi-wild herds have been re-established. Largest herd occurs in the Bialowieza Forest which straddles the border between Poland and the U.S.S.R. In the U.S.S.R. (as of 1978) there were also 18 other semi-wild herds: in the Carpathians, in Polyesye, on the Volyno-Podolsky Heights, in the Caucasus, and in Tyan-Shan (1). In Poland there were four additional semi-wild herds, besides that in the Bialowieza Forest (19).

Formerly the Bison ranged throughout western and southern Europe as far east as the Caucasus, and northward as far as the Lena River in Siberia (10). However by the beginning of the 20th century the only surviving wild herds were in the Bialowieza Forest (B. b. bonasus) and in the Caucasus Mountains (B. b. caucasicus). The Bialowieza herd had been maintained for the personal use of Polish Kings and later the Russian Imperial Family (11,13) and had been protected since 1532 (18). According to the 1914 census, the number of animals was 727 (19). However World War I was disastrous for the species and by 1919 not a single specimen survived in the Bialowieza Forest, and by 1927 all in the Caucasus had been killed (the Caucasian race thus becoming extinct) (19). The only remaining animals were the 54 specimens which had been distributed among various zoological gardens of Europe, and a small herd in the Pszczyna Forest Reserve on the Duke of Hochberg's estate in south-western Upper Silesia. (Furthermore the only surviving representative of B. b. caucasicus was a bull (named Kaukasus) which belonged to a Hamburg animal dealer. The bull sired a number of calves but all were from B. b. bonasus females. The bull died in 1925. Most herds in both the U.S.S.R. and Poland thus in fact contain genes of both subspecies). The Pszczyna Forest Reserve had been established as a breeding centre in 1865 with a bull and three cows from Bialowieza presented by Tsar Alexander II (13). By 1918 the Pszczyna herd numbered more than 74, but by December 1922 only three animals, a cow and two bulls, survived (4,13,19); numbers subsequently increased (11). Animals from Pszczyna plus some from various zoological gardens were collected together in Poland to form a breeding nucleus (4); they were kept under semi-captive conditions in a special fenced enclosure of 507 acres in part of the Bialowieza Forest, of which 74 acres were cleared and sown to pasture grasses. By the end of 1939 there were 16 Bison in the Reserve: 1 bull and 6 cows of the bonasus line and 3 bulls and 6 cows of the bonasus/caucasicus line. By 1950 however all hybrids had been removed from the Polish section of the reserve and a

few years later also from the Russian section (19). In 1952 animals from this enclosure were released to live in a semi-wild state in the Bialowieza Forest (4,11,12,13,14,18). Subsequently other free-ranging herds have been established and by the end of 1980 numbered more than 24 (18).

There is a herd in the Caucasus National Park which contains an admixture of American Bison (Bison bison) genes (4,12,13,14).

POPULATION In 1978 the number of European Bison exceeded 2000 (3,5,18), of these about 800-900 existed in semi-free herds, the rest in captivity (3). About 800 occurred in the U.S.S.R, almost 600 in Poland, and the rest in zoological gardens around the world (18). By the end of 1980 the number of semi-free herds was 24: 5 in Poland and 19 in the U.S.S.R., these contained more than 40% of the total number of animals. 17 herds were comprised of 10 or more animals, and the largest semi-free herd in the Bialowieza totalled 411: 242 in the Polish section and 169 in the Russian (18).

U.S.S.R Total at the beginning of the 1980s was about 800. Almost all these animals are the offspring of 8 females (5 of bonasus type, and 3 of bonasus/caucasicus type) which were introduced into the U.S.S.R from Poland between 1946-1951 (16). 19 semi-free herds existed: 3 herds are of pure bonasus type, and 16 of bonasus/caucasicus (18). The number in the Russian section of the Bialowieza Forest was 169 at the end of 1980 (18). The Russian Red Data Book reports that pure European Bison (as opposed to hybrids with American Bison) are reared in two nurseries: the Prioksko-Terrasny Nat. Prot. Reserve (established 1948), and the Okski Reserve (established 1959). In 1973 there were 100 Bison in the nurseries (1,15).

Poland At the end of 1980 the total population numbered 561 animals. Semi-free herds of pure bonasus were located in four areas - Walcz Forest, Borki Forest, Knyszyn Forest and Bialowieza Forest (18). The number free-living in Bialowieza was 242 (19); another 26 were held in enclosures (19). There is also a bonasus/caucasicus herd living semi-wild in the Carpathian mountains (18).

HABITAT AND ECOLOGY Forests and woodlands (14) where it feeds on grasses, ferns, leaves and the bark of certain broad-leaved trees; in the autumn it subsists almost entirely on acorns. Both sexes reach sexual maturity at about two years of age (1), females produce one young usually every 2 or 3 years (16).

THREATS TO SURVIVAL The depletion and, eventually the almost total eradication of the forests of Europe was the main cause of the near demise of the Bison; hunting and wars took their toll of the remainder (4,11,12,13,14). The extinction of the Bison in the Caucasus was also accelerated by an outbreak of epizootic foot-and-mouth disease and anthrax caught from domestic livestock in the mountains (1).

CONSERVATION MEASURES The species has recovered because of the effectiveness of a conservation programme begun in the 1920s. Continued protection of herds is needed and reintroductions should be ventured wherever suitable areas are available within its historic range.

U.S.S.R.: Protected by law since 1923, and in 1924 was declared a 'nature monument' (16). In 1968 a special Commission for European Bison Protection was attached to the Research-Technical Council of the Main Board of Nature Conservation, Natural Reserves and Game Management of the U.S.S.R Ministry of Agriculture (15,16). Occurs in the Bialowieza Forest Reserve adjoining the Polish Reserve of the same name. Prior to its demise the Caucasian subspecies occurred in the Caucasus Reserve established in 1924 to protect it (1). The bonasus blood lines and the bonasus/caucasicus bloodlines are bred separately, the former for

restocking the lowlands, and the latter for restocking the southern, mountainous regions (Carpathians, Kodry, Crimea and Caucasus). In the Caucasus appropriate measures have had to be taken to prevent the mixing of the bonasus/caucasicus Bison in the Teberdinsky Reserve, the Assinsky Reserve and the Tseisky State Hunting Reserve with the herds of American-European Bison hybrids in the Caucasus and the Nalchik forest and hunting reserves (1). The Russian Red Data Book reports that it would be valuable to extend the Arkhyzsky part of the Teberdinsky Reserve (1).

Poland: Protected by law. Occurs in the Bialowieza Forest Reserve, as well as three other reserves (6). There is an ongoing conservation programme for the species.

After the demise of the Bialowieza herd during World War I a uniting force to effect the survival of the European Bison was the proposal by the Polish zoologist Jan Sztolcman in 1923 that led to the founding of the International Society for the Protection of the European Bison. The Society, with headquarters in Frankfurt, made a significant contribution to the rehabilitation of the species (4,14). Among other matters, it was responsible for compiling a studbook - the result of work by Dr Erna Mohr, Dr Jan Zabinski and others - containing particulars of all living pure-bred specimens. The studbook still continues.

CAPTIVE BREEDING All 2000+ animals are essentially captive bred. The 'European Bison Pedigree Book' is maintained at the National Council for Nature Protection, ul Wawelska 52/54, 00-922 Warszawa, Poland (8).

DOMESTICATION The European Bison has never been domesticated, however there is perhaps potential for commercial production for meat and hides as is carried out with the congeneric American Bison.

REMARKS For description of animal see (10,17). The European Bison will interbreed freely with the American Bison and produce fertile offspring. It is therefore becoming generally accepted to treat the two forms as conspecific under the name Bison bison (7,9).

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NORTH AMERICAN BISON NOT THREATENED

Bison bison (Linnaeus, 1758)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY The 'Buffalo' of the Great Plains of North America numbered in the tens of millions when the Europeans arrived in the continent but by the 1890s had been reduced to only a few hundred. A century later their numbers have increased to about 100,000. Two subspecies are usually recognised: the Plains Bison, B. b. bison, and the Wood Bison, B. b. athabascae. The latter numbers only about 900 animals, principally in two herds, and is of conservation concern; it is however the subject of a detailed conservation programme and its survival is probably assured. Some free-roaming Plains Bison herds occur in refuges but the majority exist on private land for commercial production of meat and hides. In the U.S.A. there exists the National Buffalo Association, and in Canada the Canadian Buffalo Association, to promote and propagate the species.

DISTRIBUTION U.S.A. and north-west Canada; extinct in Mexico. Two subspecies are usually recognised: the Wood Bison, B. b. athabascae, now restricted to Canada, and the Plains Bison, B. b. bison, from the U.S.A. and Canada.

B. b. athabascae: Confined to Canada. By the 1980s only two herds of Wood Bison survived: one wild in the Mackenzie Bison Sanctuary located along the north-west shore of Great Slave Lake, North West Territories (sometimes called the Fort Providence herd), and the other in semi-captivity in the Isolation Area of Elk Island National Park east of Edmonton, Alberta. No other herds of 'pure' Wood Bison exist in such numbers, although small numbers have been distributed to various zoological parks (8). The small herd in Wood Buffalo National Park is now considered interbred with Plains Bison.

During the great demise of the Plains Bison in North America from 1840 through the turn of the century, the Wood Bison also declined in numbers (3,4). By the 1920s most (if not all) of the surviving Wood Bison occurred in Wood Buffalo National Park, established in 1922 for their protection; Bison in the park then numbered about 1500-2000 (3,5). However in 1925 another major impediment to the survival of the subspecies occurred when the Federal Government decided to introduce excess Plains Bison from Wainwright Park, Alberta, into Wood Buffalo Park. Between 1925-1928, 6673 Plains Bison were released into range occupied by Wood Bison. Immediate herd mixing occurred resulting in hybrid crosses as Wood Bison were greatly outnumbered by the introduced Plains Bison. Tuberculosis and brucellosis were also unfortunately introduced with the Plains Bison. Bison numbers increased to an estimated 12,000 by 1934 (3,6) and it was generally believed that by 1940 pure Wood Bison had become extinct (3). However during an aerial survey in 1957, Dr. N.S. Novakowski of the Canadian Wildlife Service discovered an isolated herd of Bison in the north-west corner of Wood Buffalo National Park. Subsequent investigations including the collection of five specimens indicated that these were pure Wood Bison (3,7). In August 1963 eighteen animals were taken from the rediscovered herd and transferred to an area north-east of Fort Providence in the North West Territories, now known as the Mackenzie Bison Sanctuary. In 1965, another group of 23 animals were moved to an enclosed area in Elk Island National Park near Edmonton, Alberta, and it was hoped to establish this as a source breeding herd for future transplants; since 1971 this herd has been classified as disease-free (3).

Historically, the Wood Bison's range included most of the boreal regions of British Columbia, Alberta, Saskatchewan, North West Territories, and Yukon Territory

and along the eastern slopes of the Rocky Mountains to Colorado in the United States (9).

B. b. bison: Occurs in the U.S.A. and Canada. The north-eastern boundary for the historic range of Plains Bison is roughly outlined by a line extending from north central Saskatchewan in a southeastward direction to the southern shore of the Great Lakes. The northern boundary in central Canada is also approximated by this line. The eastern boundary was that of the Allegheny Mountains in the U.S.A. extending south through the States of Maryland, Virginia, North Carolina and South Carolina. In the south the range extended from Alabama across southern Mississippi and Louisiana westward along the south-eastern coast of Texas and into Mexico. The western boundary generally extended northward from north-central Mexico and merged with the historic range for Wood Bison along the eastern foothills of the Rocky Mountains. In Alberta, Canada, the western and northern boundaries of the Plains Bison range approximated the boundary of the ecotone between grassland and forest habitat. To the north of this interface lies boreal forest and the historic range of Wood Bison (9).

POPULATION By the 1980s the number of Bison in North America was probably in the region of 100,000, i.e. about 75,000 in the U.S.A. and 25,000 in Canada (13). Numbers in both countries are increasing and the species is considered not threatened. The Wood Bison, B. b. athabascae, is however of conservation concern and by the 1980s numbered only about 900 animals; this however is a great increase since the 1940s when this subspecies was considered extinct (3,4,9). Of the 900, about 750 were in the Mackenzie Bison Sanctuary and about 120 in the Elk Island herd (9).

When Europeans first arrived in North America Bison certainly numbered in the tens of millions (estimates vary between 30 million and 75 million (9)) however by the 1890s they had been reduced to a few hundred. Since that time they have steadily increased in number and range though few herds are free-roaming.

HABITAT AND ECOLOGY Historically the species occupied widely varying habitats throughout its immense range which varied climatically from tropical and semi-desert conditions to sub-arctic. Although the species is traditionally associated with the prairies, it also occurred extensively in mountainous areas, open forests, and semi-desert areas (9). Primarily a grazer, with grasses and sedges being of most importance, it will also browse (9). Bison are gregarious; three basic groups exist: matriarchal groups of adult females and their young up to three years of age; bull groups or solitary bulls; and breeding groups. Mating occurs from July to September (9,14); gestation averages 285 days and one calf is the norm (14). Both sexes seem to reach maturity at between 2 and 4 years of age. Wild individuals are known to have lived about 20 years and maximum potential longevity may be as much as 40 years (14).

THREATS TO SURVIVAL The decline of the great Bison herds began almost as soon as European explorers arrived in North America. The Bison were hunted commercially and for subsistence both for their meat and skins. They were also shot to protect agricultural interests and to help subdue the Indians of the Great Plains. From many millions they were reduced to probably fewer than 1000 individuals in the entire continent by the 1890s (14). The final collapse of the Wood Bison population in the 1920/30s was caused by hybridization with the Plains Bison introduced to their only remaining sanctuaries (9,19,20). Today there are no great threats to the survival of the species.

CONSERVATION MEASURES The species has recovered as a consequence of private and governmental conservation efforts and provided these continue, especially in respect to the Wood Bison, the species will continue to thrive. Today Bison management practices vary considerably depending on the objectives of the

individuals and agencies controlling the animals. Bison have been managed in order to preserve the species and subspecies, for commercial meat and hide production, as a game species, as tourist attractions, and for their historical significance (9).

B. b. athabascae is protected by law in Canada and is listed as an 'Endangered Species' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) - a federal/provincial group (8). This subspecies is also listed in Appendix I of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, trade in it or its products therefore being subject to strict regulation by ratifying nations, and trade for primarily commercial purposes being banned.

It occurs in the Mackenzie Bison Sanctuary where it was introduced in 1963, and in Elk Island National Park where it was introduced in 1965. After the 'rediscovery' in 1957 a 'Wood Bison Rehabilitation Program' was begun in 1959 when plans were formulated to trap, test for disease, and transplant a herd out of the only known site in Wood Buffalo National Park, to prevent them from hybridizing with the introduced Plains Bison in the south part of the park, and to isolate them from an anthrax outbreak in the Bison along the Slave River(9). Trapping began in 1963 and 18 animals were transferred to the area now known as the Mackenzie Bison Sanctuary. Continuing concern regarding anthrax led to a second transfer in 1965 of 23 animals to an isolation area in Elk Island National Park, to save the subspecies from extinction and to establish a source breeding herd for future transplants (9). During the first few years at Elk Island, disease was a problem. Since 1971, however, this population has been classified as disease free (9).

Since 1973, representatives of the Canadian Wildlife Service, Parks Canada, and territorial and provincial wildlife agencies from western Canada have met annually to develop criteria for management of Wood Bison. It is in this context that the present Wood Bison project commenced in 1975 (3,9). The primary objective is the establishment of three geographically isolated and self-perpetuating herds within the historic range (3), the second is to protect and preserve the Wood Bison gene pool by dispersing small breeding herds to zoological parks and gardens. Successful and unsuccessful attempts to reestablish Wood Bison have resulted from current programme activities. The first transfer, during summer of 1978 from the source herd at Elk Island National Park to the wilds of Jasper National Park was unsuccessful because the Bison left the Park (3,9). Another transfer to the wild took place in June 1980 when 28 animals were released near Nahanni Butte, N.W.T. - their progress is being monitored (9). Successful transfers have now been made to more than seven institutions (3,9).

As of 1980 priorities for the programme were to continue with transplants to the wild and to captivity with emphasis on the establishment of two more free-roaming populations as soon as feasible. Negotiations were also underway for a second transfer to the North West Territories and for potential transfers to the Yukon and Alberta (3). A proposal recommending that a permanent herd of Wood Bison (200-250) be maintained at Elk Island National Park has also been approved (9) as has a suggestion that Plains Bison in display herds held in Banff, Waterton Lakes, Prince Albert and Riding Mountain National Parks be exchanged for Wood Bison (3).

B. b. bison: About 15,000 Bison occur on public and private refuges. In the U.S.A. a National Buffalo Association exists to promote the Buffalo Industry (P.O. Box 706, Custer, South Dakota 57730, U.S.A.), similarly there exists the Canadian Buffalo Association (Box 10, Beaubier, Saskatchewan, SOC OHO, Canada). As long as ranching the species remains a commercial enterprise no conservation measures are necessary.

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AFRICAN BUFFALO NOT THREATENED

Syncerus caffer (Sparrman, 1779)

Order ARTIODACTYLA Family BOVIDAE

SUMMARY Inhabits an extensive range in Africa south of 15°N, occupying a great variety of habitats providing food and water are available and human densities are low. Undoubtedly numbers in the millions and although in some areas, such as parts of South Africa and West Africa, its range is becoming fragmented, it cannot be considered a threatened species. Wild Buffalo are being exploited in various countries in cropping schemes for meat and hides, and in Zimbabwe there is an experiment attempting to train Buffalo to the yoke.

DISTRIBUTION One of the most widely distributed ungulates in Africa south of the Sahara, it occurs south of latitude 15°N (2). The species varies considerably in appearance over its wide range and this has given rise to a plethora of specific and subspecific names (see Ansell, 1971 for a comprehensive survey (1)). At present it is fashionable to describe two main types: the large black Buffalo (caffer) from southern Africa to Ethiopia and Somalia, and the small red type (nanus) which occurs in the west of the range south through Gabon and Congo, probably to northern Angola (1).

The species can be found in the following countries: eastern Gambia where vagrants occasionally still occur (2); Senegal (12); eastern Guinea-Bissau; Sierra Leone (2); sparsely in Liberia (29); Ivory Coast (11); Upper Volta (2,10); Mali (13); Niger (14); Ghana (18); Togo (2); Benin (2,6); Nigeria; Cameroun; south-western and north-eastern Central African Republic; southern and eastern parts of Sudan; Ethiopia; Kenya excluding parts of the central and north-east; south-western Somalia; Uganda; Rwanda (17); Burundi (15); Zaire (19); Congo (Brazzaville) (16); Tanzania from sea-level to over 4000 m on Kilimanjaro; Angola except the south-west; Zambia excluding the extreme west; Malawi; Mozambique; Zimbabwe though absent from the central plateau; Nambia from the extreme north-east along the eastern border south to about 20°S; Botswana in the north, the Okavango delta, and the north-east south to near Lake Ngami and the Makgadikgadi Pan (2); South Africa, in the eastern Transvaal south to Swaziland; and in Natal in large populations in the Hluhluwe and Umfolozi Game Reserves and their immediate vicinity. A relict population survives in the Addo National Park in Cape Province, representing the last remnants of what was once a much wider distribution. From this population, which has grown in numbers with protection, they have been reintroduced to other parts of the Province (2).

POPULATION Almost certainly numbers in the millions and is not threatened as a species. Has declined in parts of its range, e.g. large areas of South Africa and parts of West Africa, and in other areas numbers fluctuate depending on such factors as hunting pressure, rinderpest outbreaks etc.

HABITAT AND ECOLOGY The species can be found in a great variety of habitats ranging from rainforest and swamp, woodland and bush, to open savannah (5). It is mainly a grazer, but occasionally browses on leaves (7). Sinclair (1977) has reported population densities of about 3 to 18 individuals per sq. km. and herd ranges of about 10 to 300 sq. km. Generally, density is greatest, and range smallest, in areas with the highest rainfall. Mean herd size varies - it is only about 20 individuals, probably all closely related, in the forests of Zaire but on the Serengeti Plains herd size was observed to range from about 50 to 1500 and averaged 350. These herds appeared to be fairly stable each occupying a largely separate range. Herds were permanently composed of units consisting of a female and her young of the previous two birth seasons. There seemed to be no overall

social hierarchy. Most mature males lived with the herds for the rainy half of the year, but split off during the dry season, then forming bachelor groups of usually 3 or 4 animals. Some males, especially very old ones, lived permanently apart from the herds. Male groups had a dominance hierarchy established by agonistic displays and fighting, and individuals competed for oestrous females. Reproduction occurs throughout the year in some areas, but there are seasonal peaks associated with rainfall. Gestation is 340 days (7). Sexual maturity is reached between 3.5 to 5 years of age. Wild individuals up to 18 years old have been found in the Serengeti. A captive specimen was known to have lived 29 years 6 months (7).

THREATS TO SURVIVAL Buffalo are particularly susceptible to rinderpest, which has affected numbers in various parts of Africa (1,22). In urban and agricultural areas the species has vanished (1).

CONSERVATION MEASURES Syncerus caffer is listed in Class B of the African Convention (1969), i.e., it may be hunted or collected only under special authorization granted by the competent authority. It is protected in many countries as a game animal and occurs in numerous national parks and game reserves. It has also been the subject of studies; Sinclair (1977) has produced a monograph on the species.

CAPTIVE BREEDING Numerous in zoos and breeds well (20).

DOMESTICATION The species has not been domesticated although there is currently a scheme in Zimbabwe attempting to train Buffalo to the yoke (21).

Wild Buffalo are being exploited in various countries in cropping schemes for meat and hides. For example, in Mozambique the south bank of the Zambezi River delta has been proclaimed a 'Wildlife Utilization Area' and permanent staff have been based there. Between 1976 and 1982 over 13,000 Buffalo were cropped and all products sold. Buffalo numbers have not declined. The scheme (which includes the cropping of other ungulates) has been considered successful; the economic value of wildlife as a meat producer is believed proven; and apparently the government as well as a large percentage of the people now consider wildlife to be as important as domestic cattle (23).

REMARKS For description of animal see (1,2,3,4,5,7,8).

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INVENTORY REPORT FORM

Report to be mailed to Jane Thornback, SCMU, 219(c) Huntingdon Rd, Cambridge, CB3 ODL, U.K.

1. Country 2. Date

3. Reporter

   Name: Address:

4. Taxon

   Scientific Name: Common Name:

5. Distribution

   Present: Former:

   If possible, please include a map. Is present range preferred or enforced habitat?

6. Population

   Estimated numbers in the wild. Indicate date of estimate and describe method of estimation. Are numbers increasing, decreasing or stable?

7. Habitat and Ecology

   Biome type. Elevation range. Brief notes about social structure, feeding habits and diet, reproduction (gestation, breeding season, number of young, age of sexual maturation), longevity etc.

8. Threats to Survival

   Eg. habitat destruction, over-exploitation, hybridization, natural disasters, competition for food.

9. Conservation Measures Taken

   Legal measures (international conventions, national laws); is law enforced? Protected areas - does it occur in national parks, reserves etc.? If so, please list. Management programmes or research programmes in progress.

10. Conservation Measures Proposed

    Same as for 9, but measures that are needed for the conservation of the taxon.

11. Captive Breeding

    Numbers in captivity. Does it breed readily in captivity?
    Where and when?

12. Remarks

Reference citations for description of animal. Comments about related taxa. If the above information concerns a subspecies then brief information should be given about the distribution and status of the species as a whole. Special acknowledgements etc.

13. References

Can be published papers, unpublished manuscripts, or references to correspondence (cited as In litt.).

Wild Cattle Specialist Group

The Species Survival Commission (SSC), established in 1949, is one of six commissions of IUCN. It is concerned primarily with action to prevent the extinction of species, and to preserve viable wild populations in their native habitats. To aid it in its tasks it has over the years amassed a global network of wildlife experts who voluntarily assist in providing information on the status of species and in suggesting and vetting relevant projects. These experts are mainly organized into Specialist Groups which focus on one or more species groupings. The following are members of the Wild Cattle Specialist Group:

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