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REPORT ON
GLOBAL STATUS OF BIODIVERSITY
IN THE DRYLANDS

FOR THE
UN INTERGOVERNMENTAL NEGOTIATING COMMITTEE
FOR A CONVENTION TO COMBAT DESERTIFICATION

WCMC CONTRIBUTION TO
CHAPTER 1: INTRODUCTION

February 1994

WORLD CONSERVATION
MONITORING CENTRE

The mission of the
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Drylands of the World

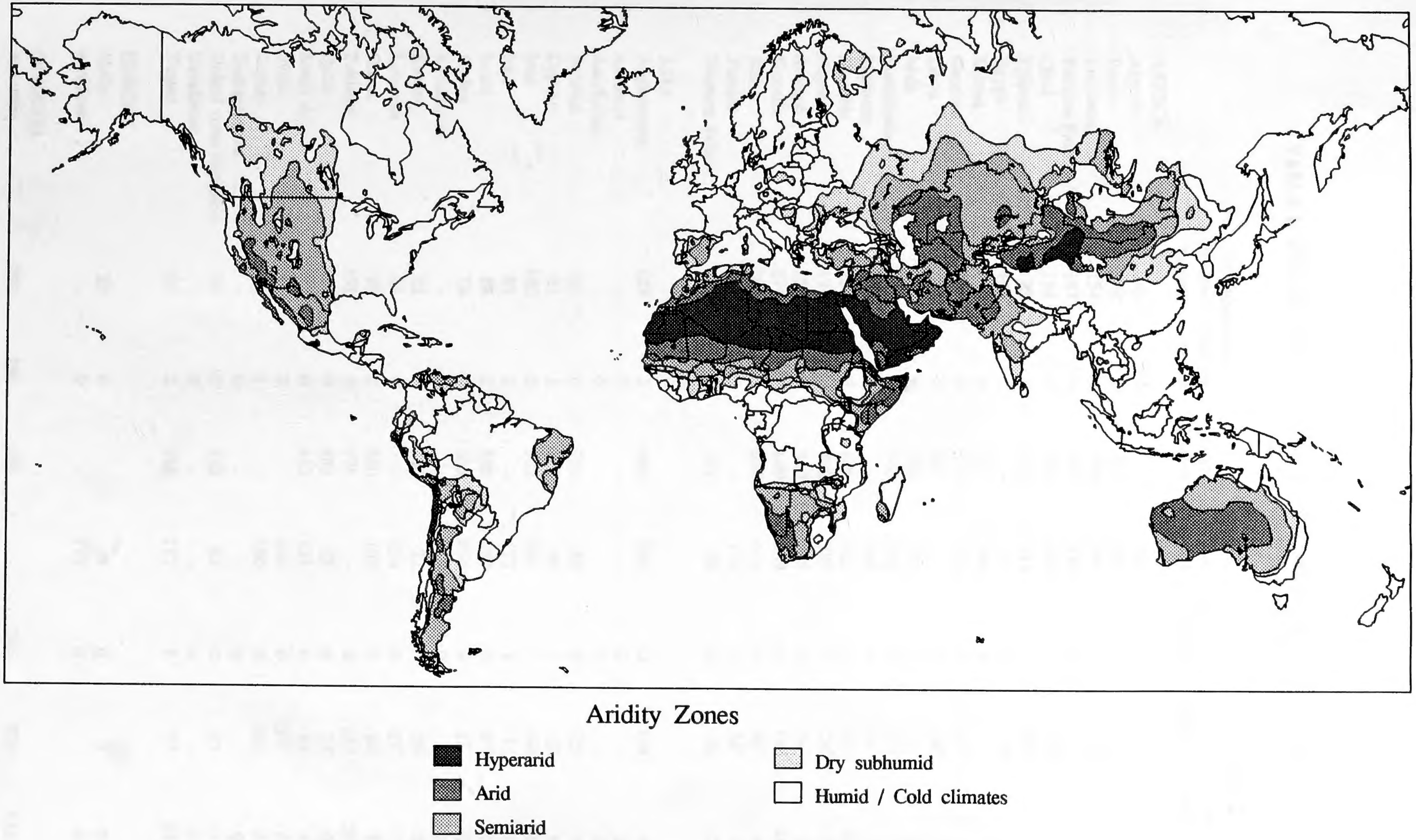

TABLE 1. SPECIES RICHNESS AND ENDEMISM IN DRYLAND COUNTRIES MAMMALS, BIRDS, AND REPTILES

	Mammals		Birds			Reptiles	
	Species known	Endemic species	Species known	Resident species	Endemic species	Species known	Endemic species
AFRICA							
Algeria	92	2	-	192	1	46*	3
Benin	188	0	423	302	0	34*	1
Botswana	154	0	550	386	0	143	2
Burkina Faso	147	0	453	316	0	15*	3
Chad	134	1	532	354	0	29*	1
Djibouti	22	0	326	118	1	10*	0
Egypt	102	7	-	132	0	83	0
Eritrea	-	0	537	306	0	-	0
Gambia	108	0	504	263	0	27*	1
Libya	76	5	317	-	0	26*	1
Mali	137	0	622	335	0	34*	2
Mauritania	61	1	541	196	0	33*	1
Morocco	105	4	-	209	0	68*	8
Namibia	154	3	609	423	1	152*	26
Niger	131	0	482	287	0	24*	0
Senegal	155	0	610	355	0	56*	1
Somalia	171	11	649	389	10	193	48
Sudan	267	11	937	616	0	92*	6
Tunisia	78	1	-	173	0	36*	1
Western Sahara	32	0	141	60	0	26	0
ASIA							
Afghanistan	123	1	460	235	0	103	4
Armenia	-	3	-	-	0	-	1
Azerbaijan	-	0	-	-	0	-	0
Bahrain	16	0	294	28	0	25	0
Cyprus	21	1	347	80	2	23	1
Iran	140	5	502	323	1	164	26
Iraq	81	1	-	172	1	81	1
Israel	89	3	500	180	0	80*	1
Jordan	71	0	363	154	0	17*	0
Kazakhstan	-	4	-	-	0	-	0
Kuwait	21	0	280	27	0	29	0
Lebanon	53	0	-	154	0	27*	2
Oman	55	2	430	107	0	64	9
Pakistan	151	3	476	-	0	143	23
Qatar	10	0	255	23	0	17	0
Saudi Arabia	77	0	413	155	0	84	4
Syria	61	2	-	204	0	34*	2
Turkey	116	1	-	290	0	102	4
Turkmenistan	-	0	-	-	0	-	0
United Arab Emirates	24	0	360	67	0	37	1
Uzbekistan	-	0	-	-	0	-	0
Yemen	65	2	358	117	8	77	31
EUROPE							
Malta	22	0		28	0	8	0
Moldova	-	0	-	175	0	-	0
OCEANIA							
Australia	282	198	656	-	355	700	616

NOTES

The table covers taxa of species rank only; subspecies are excluded, as are recently extirpated or introduced species. Marine cetaceans, sea turtles and sea snakes are excluded. Species known totals for birds include breeding species, non-breeding migrants, occasional visitors and vagrants. Resident species totals include known and probable breeding species.

The primary data source used was Global Biodiversity 1992 (WCMC, 1992) with additions as follows: Mammalian species totals for Arabian and Middle Eastern countries from Harrison and Bates (1991); for Djibouti from Stuart and Adam (1990). Bird species totals for most Arabian and Middle Eastern countries, Turkey and Moldova from BirdLife International (*in litt.* to WCMC). Bird species totals for sub-saharan African countries and Yemen from Dowsett and Dowsett-Lemaire (1993). Bird, mammal and reptile totals for Western Sahara from Valverde (1957).

* = preliminary reptile species totals from information held at WCMC; probably underestimates. Numbers of endemic species obtained from information held at WCMC.

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TABLE 2. SPECIES RICHNESS, ENDEMISM, AND THREATENED SPECIES IN DRYLAND COUNTRIES

	Mammals, Birds and Reptiles			Higher Plants		
	Species known	Endemic species	Threatened species	Species known	Endemic species	Threatened species
AFRICA						
Algeria	-	6	23	3,164	250	149
Benin	645	1	11	2,201	0	3
Botswana	847	2	14	2,000	17	4
Burkina Faso	615	3	11	1,100	0	1
Chad	695	2	20	1,600	-	13
Djibouti	358	1	9	641	2	3
Egypt	-	7	23	2,076	70	92
Eritrea	-	0	3	-	-	-
Gambia	619	1	7	974	43	0
Libya	419	6	16	1,825	134	58
Mali	793	2	20	1,741	11	17
Mauritania	635	2	19	1,100	-	3
Morocco	-	12	26	3,675	625	198
Namibia	915	30	24	3,174	-	-
Niger	637	0	17	1,178	0	1
Senegal	821	1	22	2,086	26	34
Somalia	1,013	69	27	3,028	500	56
Sudan	1,296	17	32	3,137	50	11
Tunisia	-	2	17	2,196	-	26
Western Sahara	199	0	8	330	-	0
ASIA						
Afghanistan	686	5	28	4,000	800	7
Armenia	-	4	12	-	-	-
Azerbaijan	-	0	16	-	-	-
Bahrain	335	0	5	248	0	0
Cyprus	391	4	8	1,682	88	45
Iran	806	32	39	8,000	1,400	2
Iraq	-	3	22	2,937	190	3
Israel	750	4	22	2,317	155	44
Jordan	451	0	12	2,100	150	12
Kazakhstan	-	4	29	-	-	-
Kuwait	330	0	8	282	0	1
Lebanon	-	2	10	3,000	330	7
Oman	549	11	15	1,200	73	4
Pakistan	770	26	48	4,950	372	16
Qatar	282	0	5	306	0	0
Saudi Arabia	574	4	18	2,028	34	6
Syria	-	4	13	3,000	330	14
Turkey	-	5	35	8,650	2,675	1,842
Turkmenistan	-	0	28	-	-	-
United Arab Emirates	421	1	7	347	0	0
Uzbekistan	-	0	24	-	-	-
Yemen	500	41	15	1,650	68	149
EUROPE						
Malta	-	0	4	914	5	20
Moldova	-	0	9	-	-	-
OCEANIA						
Australia	1,638	1,169	121	15,638	14,074	1,735

NOTES

For all columns except threatened higher plants the table covers taxa of species rank only; subspecies are excluded.

Mammals, birds and reptiles

Species known: country totals for known species of mammals, birds, and reptiles combined (see Table 1 for data sources). Migrant and vagrant birds are included; marine cetaceans, sea turtles and sea snakes are excluded. Recently extirpated or introduced species are excluded. - = data incomplete for one or more groups.

Endemic species: country totals for single-country endemic mammals, birds, and reptiles combined. Data from WCMC Endemics Database and information held at WCMC.

Threatened species: country totals for species of mammals, birds, and reptiles that have been assigned to one of the standard IUCN-SSC status categories in the 1994 IUCN Red List (Groombridge, 1993); Commercially Threatened taxa (CT) are excluded. Widespread marine cetaceans lacking full country-specific range data are excluded, as are sea turtles and sea snakes.

Higher Plants

Species known: country totals for flowering plants, gymnosperms and ferns combined. Data taken mainly from Table 8.3 in Global Biodiversity (WCMC, 1992) updated from the WCMC Threatened Plants Unit Database. Data for Botswana from Stuart and Adams (1990).

Endemic species: country totals for single-country endemic flowering plants, gymnosperms and ferns combined. Data mainly from Table 8.3 in Global Biodiversity (WCMC, 1992) updated from the WCMC Threatened Plants Unit Database.

Threatened species: country totals for higher plant taxa listed as threatened in the WCMC Threatened Plants Unit Database. Numbers may include some taxa below species level.

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TABLE 3. PROTECTED AREA COVERAGE FOR DRYLAND COUNTRIES

	Country area (km^2)	No. of sites	Total area of sites (km^2)	Country coverage (%)
AFRICA				
Algeria	2,381,745	19	119,193	5.0
Benin	112,620	2	7,775	6.9
Botswana	582,000	9	106,633	18.3
Burkina Faso	274,122	12	26,619	9.7
Chad	1,284,000	9	114,940	9.0
Djibouti	23,000	1	100	0.4
Egypt	1,000,250	12	7,932	0.8
Eritrea	-	0	0	0.0
Gambia	10,690	5	229	2.1
Libya	1,759,180	6	1730	0.1
Mali	1,240,140	11	40,120	3.2
Mauritania	1,030,700	4	17,460	1.7
Morocco	710,895	10	3,621	0.5
Namibia	824,295	12	102,178	12.4
Niger	1,186,410	5	84,162	7.1
Senegal	196,720	9	21,803	11.1
Somalia	630,000	1	1,800	0.3
Sudan	2,505,815	15	93,565	3.7
Tunisia	164,150	6	444	0.3
Western Sahara	252,120	0	0	0.0
ASIA				
Afghanistan	652,225	6	2,184	0.3
Armenia	30,000	4	2,139	7.1
Azerbaijan	87,000	12	1,909	2.2
Bahrain	661	0	0	0.0
Cyprus	9,250	4	753	8.1
Iran	1,684,000	67	82,993	4.9
Iraq	438,317	0	0	0
Israel	20,770	15	3,078	14.8
Jordan	90,650	9	2,891	3.2
Kazakhstan	2,717,300	9	8,915	0.3
Kuwait	24,280	2	270	1.1
Lebanon	10,400	1	35	0.3
Oman	271,950	29	37,363	13.7
Pakistan	803,940	55	37,209	4.6
Qatar	11,435	1	16	0.1
Saudi Arabia	2,400,900	10	62,014	2.6
Syria	185,680	0	0	0.0
Turkey	779,450	44	8,194	1.0
Turkmenistan	488,100	8	11,116	2.3
United Arab Emirates	75,150	0	0	0.0
Uzbekistan	447,400	10	2,442	0.5
Yemen	477,530	0	0	0.0
EUROPE				
Malta	316	0	0	0.0
Moldova	33,700	2	62	0.2
OCEANIA				
Australia	7,682,300	803	504,219	6.6

NOTES

Data for protected areas taken from WCMC Protected Areas Data Unit Database. Table shows data for protected areas in IUCN categories I-V inclusive, > 1,000 ha (10 km^2). Marine protected areas excluded. Country areas from Times Atlas of the World (1992 paperback edition).

CASE STUDY: THE REINTRODUCTION OF ARABIAN ORYX TO OMAN

A large, straight-horned, medium-sized desert-dwelling antelope, the Arabian (or White) Oryx *Oryx leucoryx* formerly inhabited arid gravel plains and sandy deserts throughout the Arabian Peninsula, its range extending northwards into Israel, Jordan, Iraq, Syria and the Sinai Peninsula of Egypt. It lived in groups of 8-20, composed of both sexes and all ages. Its diet consisted mainly of annual and perennial grasses, but it also took herbs and *Acacia tortilis* seedpods, dug up roots and tubers, and browsed the fresh growth of *Acacia* and *Prosopis* trees. It was highly nomadic in its search for pasture and was largely independent of free water.

Populations began to disappear due to over-hunting in the mid 19th Century and by 1914 there were few left outside Saudi Arabia. The decline was accelerated after the First World War by the spread of modern firearms and efficient four-wheel drive vehicles, which facilitated the hunting of oryx. By the early 1960s the species was confined to two small areas: where the borders of Saudi Arabia, Yemen and Oman meet; and north-eastern Oman. The last wild oryx were probably killed in 1972 in the Jiddat al-Harasis of Oman (Henderson, 1974) although rumours of sightings persist.

Fortunately, significant numbers of oryx remained in captivity in the Middle East and elsewhere, notably at Phoenix in Arizona, USA, where a herd had been established in the 1960s in response to the continued depletion of the species in the wild. In 1974 the 'White Oryx Project' was launched by the Sultan of Oman, with the aim of re-establishing a wild population. In 1980 the first oryx were returned to Oman for acclimatisation and eventual reintroduction at Yalooni in the Jiddat-al-Harasis. In 1982, the first herd of 10 was released from the 1km^2 pre-release enclosure into the wild. Further releases were made in 1984, 1988 and 1989. Numbers increased steadily and by 1990 there were 109 free-ranging oryx, of which 80% were wild-born, occupying an unrestricted known range of more than 10,000km^2 (Spalton, 1990). Numbers peaked at 126 in 1991, but two severe drought years in 1990 / 1991 reduced the herd to 115. Following good rains in April and October 1992, numbers increased once again, to 175 in August 1993 (Anon., 1993). Further releases are planned to reinforce the wild population demographically and genetically.

For the first few years of the programme all released individuals were monitored closely by a force of locally-recruited Harasis rangers, using radio-tracking equipment and continuous surveillance from 4-wheel drive vehicles. Now that numbers have increased, only a selected 40 or so individuals are monitored. All the oryx are protected from poaching by strict legislation enforced by the rangers.

Reintroductions from Arizona were hampered by quarantine restrictions occasioned by the disease blue tongue, which is endemic in the USA but absent from Oman. Many captive oryx populations in the Middle East also suffer from tuberculosis. Proper veterinary procedures were therefore observed at all stages of the project.

It is estimated that the Yalooni area could eventually support 200-300 oryx, but competition with increasingly large herds of domestic livestock is beginning to cause problems. Agreement has therefore been reached with the local tribesmen not to graze their herds within a certain distance of the release site. Nevertheless, with continued sound management and effective protection - the keys to the success of this project so far - the future of the reintroduced Arabian Oryx at Yalooni seems now to be assured.

Reintroductions have also occurred into fenced reserves in other countries, namely the Shaumeri Reserve in Jordan, and the Mahazet As'eed Reserve in Saudi Arabia. Further reintroductions are planned in Saudi Arabia, Syria and Israel.

The Arabian Oryx reintroduction programme serves to demonstrate that such projects require the long-term commitment of substantial amounts of funding and manpower if they are to succeed. As such, they will of necessity be confined to a handful of species in the foreseeable future, and their contribution to the maintenance of biodiversity will remain very limited.

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WCMC THREATENED SPECIES DATA SHEET

Gazella dama (Pallas, 1776)
Dama Gazelle

IUCN Threat Category: Endangered
CITES: Appendix I

DISTRIBUTION

The Dama Gazelle, also known as the Mohor or Adrar, was once widespread in the desert and sub-desert regions of west and north Africa, from the Atlantic coast eastward to Egypt and Sudan. It is now extinct in most of its former range. It is only present in any numbers in the Sahel region of Chad, and Niger, although scattered groups may occur in Mali and a few individuals possibly persist in Algeria and Morocco (2).

HABITAT AND ECOLOGY

The species is the largest and most colourful of the gazelles with a striking reddish-brown and white coat, in contrast to the more normal gazelle colouring of fawn or sandy brown (1). It is believed to be largely independent of free water, instead obtaining all the moisture it requires through browsing. Seasonal watercourses, or wadis, which provide green forage and shade, are a preferred habitat (1). In the southern half of its range Dama Gazelle are believed to move north into the Sahara in the rainy season and south again in the dry (November/May) season (1,6). These migrations are probably governed by pasture rather than water availability (1). In the past these migratory herds numbered many hundreds, but the animals usually lived in small groups of up to 10 individuals (1).

POPULATION

There are probably now less than 10,000 Dama Gazelle surviving in the wild (2). During the 1970s the stronghold of the species was the Ouadi Rimé - Ouadi Achim Faunal Reserve in Chad, which contained an estimated population of between 6,000 and 8,000 (5). Unfortunately civil war broke out, the area was occupied by Libyan-backed rebel forces, and the Dama Gazelle population is believed to have declined drastically.

The best recent data available are for Niger, where total numbers are less than 1,000 and declining (2). The two main populations are in the Termit region, estimated in 1980/1982 as 2-400 individuals (2), and in the Aïr and Ténéré National Nature Reserve, estimated in 1990 as 170 (4). However, the Aïr Reserve was subject to rebel attacks in 1992 and 1993, forcing the withdrawal of foresty officials, and the current status of the population is unknown.

The population in Mali, which in the early 1980s may have been in the hundreds to > 1,000, is now much reduced and continuing to decline, while populations in Burkina Faso and Morocco are only vestigial or by now extinct (2). Dama gazelle are considered extinct in Mauritania and Senegal (2). The status of populations in Sudan is unknown.

The species breeds well in captivity. In 1990, 385 (126 Male: 259 Female) individuals were held in 37 institutions around the world, most of which are presumed captive-bred (3). However, populations of some subspecies have experienced high degrees of in-breeding, and breeding programmes must be carefully managed to avoid loss of genetic diversity. For example, there are approximately 160 Mhorr gazelle *Gazella dama mhorr* in captivity, but these are all descended from only 4 wild-caught founders.

CURRENT RESEARCH

Current research is limited due to political instability. Once hostilities have ceased and reserves in Chad and Niger can once again be visited, surveys will be needed to ascertain the status of populations (2). The health and welfare of the reintroduced animals at Gueumbeul need monitoring to assist future reintroduction efforts.

THREATS

Historically the major threat to the species was hunting for food, which escalated with the advent of firearms and motorised vehicles. With its conspicuous white rump, red coat, large size, and bounding run the Dama Gazelle is very attractive to so-called "sport" hunters, who often pursue the animals to exhaustion in vehicles. Although the species is nominally conserved in many protected areas, enforcement is weak to non-existent, especially in those that civil unrest has effectively removed from government control.

Another threat is habitat modification. The destruction of tree cover has removed much of the shade that the species required for resting in to conserve body fluids during the day. The Dama Gazelle's range has also been decreased by new permanent bore holes which have opened up previously unsuitable land to domestic cattle. Both these factors have increased the Dama Gazelle's susceptibility to the adverse effects of drought. Many died, weakened by disease or hunger, during the droughts in 1976/7 and 1983/4 (1). Others moved south of their normal range in search of food, bringing them into greater contact with sub-desert nomads, and leading to an increase in hunting (2).

CONSERVATION MEASURES

The Dama Gazelle is on CITES Appendix I and is listed in Class A of the African Convention, which permits hunting, killing, capture or collection of specimens only on the authorization of the highest competent authority, and only if required in the national interest or for scientific purposes (1). In addition to existing reserves (which mostly require improved management) a number of new reserves are under consideration, notably in the Termit region of Niger. The viability of the population in the Ouadi Rimé - Ouadi Achim Faunal Reserve in Chad and the Aïr and Ténéré Nature Reserve in Niger need assessing (2).

A reintroduction program in the Gueumbeul Faunal Reserve in northern Senegal started in 1984 using captive-bred stock from Almeira, Spain. Once the animals are adapted and a breeding nucleus is organized a free-living population will be established in the Ferlo region in the centre of the country.

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WCMC THREATENED SPECIES DATA SHEET

Equus ferus przeswalskii (Poliakov, 1881)
Przewalski's (Mongolian) Wild Horse or Takh

IUCN Threat Category: Extinct?
CITES: Appendix I

DISTRIBUTION

Przewalski's (pronounced Shevalsky) Horse originally occurred from south of the Altai mountain range, in the Dzungarian Basin to the north of Tien Shan, along the Ulungu river eastward to North Tower mountain, and to the Kobdo basin (3). This region now comprises parts of Mongolia, Kazakhstan, and the Xinjiang-Uygur Autonomous Region of China. The population is believed to have been a remnant of the wild horses that once roamed all central Asia and western Europe (including the Tarpan, or European wild horse). Horses highly reminiscent of Przewalski's Horse are featured in the cave paintings at Lascaux, France (2). Przewalski's Horse is believed to be extinct in the wild, but a number exist in various collections and zoos. A number of reintroduction programmes are currently underway in Mongolia and China.

HABITAT AND ECOLOGY

Przewalski's Horse is physically quite distinctive with a dun coloured hide, short tail and erect brush-like mane. It inhabited the southern slopes of high mountains in autumn and winter, moving to semi-desert in spring and summer (3). Adults weigh 350 kg, and fed on grasses, sagebrush, wild bulbs and halophytes. Females and young lived in herds of 5-15 animals led by a dominant stallion, while other males lived in bachelor groups (3).

POPULATION

The last four scientific research expeditions to the area have failed to find any trace of Przewalski's Horse. Annual investigations by the Joint Mongolian-Soviet Expedition have consistently failed to uncover any indication of the species in the wild (2). The last definite sighting was in 1968 by an expedition of MPR Academy of Sciences Biological Institute (3). The captive population is expanding rapidly, with population growth of over 9% per annum in recent years. More than 1,100 are now held in over 30 zoos and private collections (4). Organisations such as the Przewalski Horse Global Management Plan Working Group are working towards establishing a reintroduced population inside protected areas within its original range.

CURRENT RESEARCH

Research is focused on restoring Przewalski's Horse to its natural habitat. Two plans are currently in operation (3). One is to create breeding herds in the western countries, e.g. North America, France and Mexico, and from these herds to pick the most genetically and physically healthy individuals for reintroduction to the traditional range inside protected areas. The second plan aims to transfer wild horses from collections around the world to existing reserves in Mongolia as soon as possible. The former is currently favoured because most scientists feel that the reserves in Mongolia are on the edge of the horse's range, and that genetically diverse individuals bred specifically for reintroduction would stand a better chance of survival (3).

THREATS

The decline in Przewalski's Horse numbers occurred due to competition with domestic livestock for water and pasture, and hunting by local people armed with increasingly sophisticated rifles. Frontier conflicts and extensive military activity in the area may have hastened its demise (4). In addition to these threats, any reintroduction would have to cope with a number of other problems. The reintroduction site would need to be fenced and free of domestic horses, since although Przewalski's Horse has two more chromosomes than the domestic horse (66 compared to 64), interbreeding between the two can produce fertile offspring. Such interbreeding could quickly result in the loss of the genetic characters that make Przewalski's Horse unique (1). Another problem is maintaining the genetic variability of captive and reintroduced herds. All the Przewalski's Horses in captivity today are descendants of 13 wild-caught individuals (4). Considerable inbreeding has occurred, and existing collections have to be very carefully managed to retain their genetic diversity. To this end several organizations, such as the IUCN Przewalski's Horse Captive Breeding Group and the Foundation for the Preservation and Protection of the Przewalski's Horse, have been created.

CONSERVATION MEASURES

Proposed measures include the reintroduction of the horse into the Gobi Altai National Park (Mongolia), a Biosphere Reserve and proposed World Heritage Site. In June 1992 a small group was established in a fenced enclosure in the Mongolian Gobi Desert. A small herd was also established in 1993 in the Causse Méjean in France: the aim is to allow free choice of mates and provide Przewalski's Horses for eventual reintroduction to Mongolia. None of the reintroduction programmes has so far established a free-ranging wild population unrestricted by fences.

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SIGNIFICANT TRADE IN CITES APPENDIX II PLANTS

ALOES

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Introduction

The genus *Aloe*, with around 360 species, occurs predominantly in Africa with centres of species richness in South Africa, east Africa, Arabia and Madagascar. The entire genus is listed on Appendix II of CITES, with the exception of five South African species listed on Appendix I. Leaves and parts and derivatives of naturalised and artificially propagated *Aloe vera* have been exempt from CITES controls since 1985.

A comprehensive tabulation of all reported trade in CITES Appendix II plants for the period 1983-1989 was prepared by WTMU, as part of a review of the levels of trade in Appendix II plants. The main aim of this broad study is to analyze where levels of trade may be having a significant impact on populations of species in the wild. The project has been funded by the EC and Conservation Treaty Support Fund and a report presented at the Eighth Meeting of the Conference of the Parties to CITES.

Data on *Aloe* species have subsequently been subject to more thorough review involving consultation with botanists, the TRAFFIC network, CITES authorities and the trade, and the results of the review are presented in this report. A list of suppliers of *Aloe vera* was provided by the Cosmetic, Toiletry and Perfumery Association Ltd (UK). Suppliers based in the UK were contacted for information. A full list of people and organisations contacted is given in Annex 2. Other sources of statistical information have been consulted for comparison with the CITES data.

The use of Aloe species

Species of the genus *Aloe* are grown as ornamental plants and also yield extracts used medicinally and in the manufacture of cosmetics. *A. vera* is the major species used commercially for medicinal and cosmetic use. *A. vera* is not known in the wild but is believed to be originally native to the Arabian Peninsula. It is widely naturalised in southern USA, the Caribbean, Central America and elsewhere.

The main species used to produce the drug "aloes" is *A. ferox*. Other species which yield commercial sources of "aloes" are listed in Table 1.

Table 1 Botanical origin of chief commercial *Aloe* drugs

SPECIES	DISTRIBUTION	CONSERVATION STATUS	PRODUCT
A. ferox	South Africa	nt	Cape Aloes
A. africana	South Africa	nt	Cape Aloes
A. vera	many countries	nt	Curacao Aloes (Barbados Aloes)
A. perryi	Socotra	nt	Socotrine Aloes Zanzibar Aloes
A. spectabilis	South Africa	nt	Natal Aloes
A. candelabrum	South Africa	nt	Natal Aloes
A. marlothii	South Africa Botswana	nt (S. Africa)	Natal Aloes
A. bainesii	Mozambique Swaziland South Africa	R (Swaziland) nt (S.Africa)	Natal Aloes
A. succotrina	South Africa	nt	Natal Aloes
(*A. sponaria*) *A. maculata*	Lesotho South Africa Swaziland Zimbabwe	?	Natal Aloes
A. distans	South Africa	Rare	Natal Aloes

Source: Species list and products from Reynolds, 1985; distribution and conservation status from WCMC database.

It is not thought however that most of the species in Table 1 are currently being exploited for commercial use. *A. maculata* is for example, not known to be used commercially and the only commercial interest in *A. succotrina* has been in the use of the purple-staining leaf sap. *A. distans* is again not thought to be harvested (Van Jaarsveld *in litt.*, 1992). *Aloe ferox* is thought to be the only indigenous *Aloe* species harvested in South Africa at present (Botha *in litt.*, 1992).

Aloe species included by Lewington (1992) in a priority list of the world's most widely used medicinal plants are *Aloe africana*, *A. ferox*, *A. spicata*, and *A. vera*. Another species which has been subject to scientific investigation for medicinal use is the Madagascan *A. vahombe*. Kenyan species considered, on the basis of habitat and growth to have possible potential value for growing in plantations for medicinal use and cosmetics are *A. classenii*, *A. graminicola*, *A. macrosiphon*, *A. ruspoliana* and *A. ukambensis* (Newton, 1987, *in litt.*, 1992). Of these only three, *A. macrosiphon*, *A. ruspoliana* and *A. ukambensis* might possibly produce leaves of an acceptable size in under plantation conditions. The three species are of relatively limited distribution and Newton (1987) concludes that collection of the plants in quantities necessary for further investigation would harm the wild populations. In Zimbabwe indigenous Aloe species are being investigated for possible commercial use and this poses a potential threat to wild populations (Müller *in litt.*, 1992).

A number of other species are used locally for medicinal and cosmetic purposes. These include *A. capitata*, *A. divaricata*, *A. macroclada* used medicinally in Madagascar (Jenkins, 1987); *A. aristata*, *A. chabaudii*, *A. cooperi* and *A. linearifolia* used in South Africa (Cunningham, 1990). One of these South African species, *A. aristata* has a relatively small population and is considered to be vulnerable to over-exploitation if exploitation for medicinal purposes increases (Cunningham, 1991).

International trade in Aloe products

There is a substantial international trade in *Aloe* products which is extremely difficult to quantify in terms of overall value and volume. For the US alone it was estimated in 1985 that the value of *Aloe* imports was more than $1 million, domestic production worth more than $20 million, and sales worth more than $100 million. Attempts to obtain accurate figures were frustrated by variation in published figures, lack of response to enquiries to the 20 or 30 aloe companies, and the nature of aggregated data for international trade in drug products (Duke, in litt. 1985).

Customs statistics rarely distinguish *Aloe* products at the commodity level. For the present study published statistics of countries expected to be involved in the export and import of *Aloe* products were reviewed. The only statistics found to mention *Aloe* specifically were Eurostat. In these European trade statistics, which use the Harmonised System, tariff heading 1302.19 Vegetable Saps and Extracts is further subdivided. Tariff heading 1302.19-10 includes saps and extracts of *Quassia amara*, Aloes and Manna. The statistics for 1987 separate out *Q. amara*. Table 2 summarises European imports based on Eurostat data.

Table 2 Imports of *Aloe*, *Manna* and *Quassia amara* extracts into the EC, 1988 - 1991, by quantity (tonnes)

EXPORTING COUNTRY	1988	1989	1990	1991
France	75	78	62	31
Belgium/Luxembourg	x	-	-	3
Netherlands	3	4	4	4
Germany	14	13	12	22
Italy	29	33	39	40
UK	4	2	-	4
Ireland	-	x	x	2
Spain	5	9	8	1
Sweden	x	5	x	4
Switzerland	-	9	17	4
Austria	x	-	x	-
Poland	x	x	x	-
Kenya	7	5	8	73
South Africa	216	190	163	165
Namibia	x	x	7	9
USA	136	92	105	105
Canada	x	x	1	x
Mexico	-	-	1	-
Dominica	x	x	-	x
Aruba	-	x	x	x

EXPORTING COUNTRY	1988	1989	1990	1991
Brazil	6	6	11	12
Philippines	10	20	x	x
Australia	1	x	1	x
New Zealand	1	4	1	1
INTRA-EC	132	141	128	106
EXTRA-EC	378	329	313	376
TOTAL	510	468	443	484

Note: x signifies that the country is not included in the list of exporting countries.

In 1987, the total import of Aloes and Manna was 431 tonnes and the total import of Q. amara amounted to 3 tonnes. It is likely that quantities of *Q. amara* form a similarly small proportion of the import figures given in Table 2. Extracts of this species, used as a source of bitters, vermifuge and poison in fly-papers are assumed to be imported to the EC from Brazil where the species is native.

Modern commercial sources of Manna include *Fraxinus ornus* and it is also collected from other species such as *Tamarix* species, *Hammada salicornica*, and *Larix decidua*. It is thought that Manna imports to the EC represent a relatively small proportion of the quantities shown above but this is in need of verification. Assuming that Manna and *Quassia amara* imports into the EC are relatively minor it would appear that an estimated 400 tonnes of *Aloe* extracts are imported into the EC annually. The approximate annual value of this trade is ECU 2 million.

Another source of information on quantities of *Aloe* products imported, used in the study was information provided by traders. 30 UK suppliers were contacted and ten responses were received. One company reported importing between 10 and 20 tonnes of *Aloe vera* per annum from a US-based manufacturing company. Another reported annual imports of about 20kg of aloes grown in the US, from France; another reported importing about 25kg of *A. vera* from Germany and another importing 50kg of *Aloe vera* gel p.a. from the US. These firms all supply the cosmetics industry. One company supplying pharmaceutical products, reported importing 25 - 30kg per annum of "Cape Aloes" from South Africa.

The CITES trade statistics for 1983-1989 include data on trade in a range of *Aloe* parts and derivatives. It would appear likely, however, that the proportion of this trade reported to CITES, as shown in Table 3, is only a fraction of the overall international trade.

Table 3 CITES reported trade in Aloe parts and derivatives (1983 -1989)

TAXON	TERM	UNIT	ANNUAL AVERAGE
Aloe species	extract		153
Aloe species	extract	bottles	1
Aloe species	extract	cartons	1
Aloe species	extract	cases	128
Aloe species	oil	bottles	8
Aloe arborescens	extract	kg	1446

TAXON	TERM	UNIT	ANNUAL AVERAGE
Aloe ferox	extract		4285
Aloe ferox	extract	boxes	24
Aloe ferox	extract	cans	67
Aloe ferox	extract	cartons	1
Aloe ferox	extract	kg	1363350
Aloe ferox	leaves		23415
Aloe ferox	leaves	kg	16686
Aloe vera	derivatives	bottles	1236
Aloe vera	derivatives	kg	65
Aloe vera	extract	kg	156
Aloe vera	extract		22
Aloe vera	oil	bottles	33

Note: The above table does not include trade in seeds, pieces, roots, scraps, flowers, timber or live plants.
Information in Table 3 is, in general, derived from the annual reports of exporting countries.
Limited information is available from the annual reports of importing countries. Imports of *Aloe* parts and derivatives into EC countries are, for example, not generally reported as they are not deemed to be readily recognisable and are therefore not controlled for the purposes of CITES.

Very few *Aloe* imports into Germany have been noted. The last import of wild material recorded was 2500 (pieces?) of dried leaves of *A. ferox* exported from South Africa in September 1991 (Schippmann, in litt. 1992). Germany is, however, the largest importer of medicinal plants in Europe (Lewington, 1992) and it is probable that there are sizeable imports of *Aloe* material.

There have been a number of recent applications to import *Aloe* extracts from Kenya to the UK (McGough, *in litt.*, 1992).

The main countries recorded as exporting *Aloe* parts and derivatives in CITES statistics are South Africa and the US, in each case concentrating on one species, as discussed in more detail below. Other exporting countries do not report trade in *Aloe* parts and derivatives in their CITES Annual Reports. The export of *Aloe* extracts from Kenya was, for example, noted at the CITES Plants Committee meeting in Malawi, and imports from Kenya are recorded in Eurostat Customs data. The only CITES reported trade in *Aloe* plants or derivatives from Kenya is, however, the import of 11 plants reported by the US in 1985. This transaction was reported to be illegal.

The main *Aloe* species exploited in Kenya is *A. secundiflora* although *A. turkanensis* is also thought to be used. Exploitation is all for export, with no company using *Aloe* exudate to manufacture *Aloe* products within the country (Newton *in litt.*, 1992). Concern about over-exploitation of aloes in Kenya led to a Presidential declaration in November 1986, prohibiting the commercial harvesting of leaf exudate from aloe plants in the wild, and calling for the establishment of plantations. Field observation has shown however that the law is rarely observed and there is abundant evidence of continuing illegal harvesting. In some areas of Kenya harvesting from the wild appears to do little harm to populations because almost all defoliated plants survive. In contrast, a plantation that has been set up in northern Kenya, was established by transplanting wild plants and has done considerable harm to wild populations (Newton, 1991). In other areas, it has been reported that

wild plants have been completely destroyed by harvesting activity. In the Baringo area of Kenya, collection of *Aloe* leaf exudate is causing serious damage to wild populations. Local people are paid Ksh. 20 for 20 litres of leaf extract (£1 = Ksh 66) which would involve harvesting several hundred plants (Newton *in litt.*, 1992).

There is no published information on levels of production and trade.

Aloe ferox

All trade in *A. ferox* parts and derivatives recorded in the CITES trade statistics for the period 1983-1989 is reported to be exported by South Africa. Exports include extract, flowers, leaves, stems, and timber. The export of live plants of *A. ferox* from South Africa is also reported. The only other countries reported to export products of this species are Germany, reported to re-export dried plants originating in South Africa, and France which is reported to re-export extract of *A. ferox*, from South Africa, to Japan. The export of artificially propagated live plants is recorded from Brazil and the US.

Within South Africa *A. ferox* is very common from the Cape to southern Natal. It is probably the most common aloe species in South Africa and additionally it is widely cultivated for its ornamental properties. It propagates with ease and plants reach maturity (flowering stage) within four to six years. *A. ferox* leaves are harvested predominantly from wild plants which account for over 95% of the total leaf harvest. Collection takes place mainly in the coastal belt of the regions generally designated South Cape and Eastern Cape (Botha *in litt.*, 1992). Recently *Aloe ferox* has been planted as a crop in the Albertinia district of the southern Cape and a factory established for production of extracts (Van Jaarsveld *in litt.*, 1992). This factory produces about 50kg of *Aloe* gel powder annually and the export market is being developed (Botha *in litt.*, 1992).

The traditional method of production of *A. ferox* extract in South Africa is described by Reynolds (1970). A skin is spread over a hollow in the ground and leaves are stacked in a circular manner with the cut basal ends inwards. The aloetic juice collected in the skin is boiled and then cooled. It is ready for sale when dry and hard.

Commercial Bitter Aloes., prepared in the filed, is almost exclusively for export. There is small consumption locally, mainly as traditional medicine but as an increasing level by immigrant populations. A small proportion of commercially produced Bitter Aloe is also used in veterinary practice (Botha *in litt.*, 1992). Although production figures are available a dramatic increase in production for export was noted ten years ago. Harvesting increased enormously in response to the opening of export markets in Europe and North America with up to 600 tons of the dried sap exported annually (Bond, 1983). For the last three years there has been a shortage of crystalline Bitter Aloes for export, as a result of decreased harvesting. This has been a consequence of sever drought and widespread attack by leafmining larva of a species of blackfly, *Penetagromyces aloephaga*. Recent rains have promoted a remarkable recovery and strong overseas demand has been met this year (Botha *in litt.*, 1992).

At present detailed trade statistics are not collected for *Aloe ferox*. The Commissioner of Customs and Excise does not have a separate tariff listing for *Aloe* products and these are included in a general heading "other vegetable". It has been suggested recently that a separate registration of import and export of *Aloe* products into South Africa should be provided for (Botha *in litt.*, 1992).

Although *A. ferox* cannot be considered a threatened species, some concern has been expressed about the effects of the removal of leaves off plants in wild populations. It is thought that the continuous cover of persistent dead leaves surrounding the stem of *A. ferox* has evolved in response to fire. Harvesting the leaves for medicinal purposes could cause heavy mortality in populations exposed to fire (Bond, 1983). This threat is more significant in grassveld and sclerophyll regions where fire is a regular occurrence. The species is, however, also very common in karoo regions where fire is not generally a problem (van Jaarsveld, in litt. 1992). Land management practices in general contribute to greater losses of the species. The impact of veld management on *A. ferox* is discussed by Holland and Fuggle (198?).

Aloe vera

As stated above, leaves and parts and derivatives of naturalised and artificially propagated *Aloe vera* are exempt from CITES controls. Nevertheless, the US has reported exports of *A. vera* extracts in CITES Annual Reports during the period 1983-1989. The extracts derive from cultivated plants. The US is also the major exporter of live plants of *Aloe vera* as recorded in the CITES statistics (see below).

Use of *Aloe vera* in the US began in the farming areas near the Rio Colorado in Southern Texas. Large-scale cultivation rose from 240 ha in 1979 to 1600 ha in 1982. 95% of the arable acreage of *Aloe* in the US is located in Texas (Hoffmann, 1989). The species is also grown as a crop in Florida and Arizona. *A. vera* is grown by farmers contracted to processors, or on farms owned by the processing companies themselves. For example, one company Terry Corp (N.D.), reportedly grows around 2000 acres of *A. vera*, claiming to have the largest reserve of *Aloe* leaves of any supplier in the world (Grindlay and Reynolds, 1986). There is an American Aloe Growers Association.

European cosmetic companies and chain stores buy *A. vera* gel in bulk from the US for incorporation into their own cosmetic brands and various firms produce extracts and dried products in various formulations to meet this export market (Grindlay and Reynolds, 1986). Correspondence with UK traders has shown that *A. vera* is imported in a variety of different forms including gels of different concentration, lipid extracts and freeze dried/spray dried powders.

There are approximately 20 - 30 companies in the US which specialise in aloe products (Duke, in litt. 1985). Some companies act as primary growers and processors of the plant and many more are secondary producers. *A. vera* "juice" is widely available in the US as a tonic and is claimed to cure a variety of illnesses. In Europe, however, the trade is confined to cosmetic products (Grindlay and Reynolds, 1986). There is a growing interest in aloe cosmetics in some Asian countries (Landes and Blumenthal, 1990).

Aloe plantations within the US are susceptible to frost, and, for example the Texas crop was entirely destroyed in December 1989. *Aloe* growers looked for alternative supplies from the Caribbean and South Pacific to fill their orders (Landes and Blumenthal, 1990).

It is not known to what extent *A. vera* is grown commercially in other countries, but cultivation is reported to be important in Mexico, where the naturalised plants are also harvested (Grindlay and Reynolds, 1986); Venezuela and the Netherlands Antilles have also been important areas of production (Duke, in litt. 1992); the species has been promoted as a crop in Australia (Callister, in litt. 1992); and cultivation is set to expand worldwide (Hoffmann, 1989). *Aloe vera* plantations have recently been established in Natal and all far Northern Transvall, in South Africa (Botha *in litt.*, 1992). In Zimbabwe there is considerable interests in developing commercial production of *Aloe vera* (Muller *in litt.*, 1992).The exporting countries listed below are presumably harvesting either cultivated or naturalised plants. Other countries consume large quantities of the species for traditional medicinal use. In China for example *A. vera* has been used as a major medicine for centuries and the species is also of major importance in India.

The list of suppliers of *Aloe vera* provided for the present study by CTPA lists 25 companies which supply *Aloe vera* in the UK, 9 in the US, 3 in France, 3 in Japan, 2 in Germany, and one in Australia, Mexico and the Netherlands.

Aloe arborescens

The export of *Aloe arborescens* extract is reported by the US. In 1985, 10,120kg were exported to Japan. As can be seen in Table 4, this species is native to Southern Africa, where it is widespread. It is probably the most common *Aloe* grown in South African gardens. It is not currently harvested in the country (van Jaarsveld *in litt.*, 1992). The species is used medicinally, for example as a remedy against light burns. It has apparently been grown in Russia and Brazil as a source of aloin, although it yields less latex than *Aloe vera* (Morton, 1977).

International trade in live Aloe plants

International trade in live *Aloe* plants is dominated by *A. vera*. The annual average number in international trade for the period 1983-1989 is 183,975. The major country of export is the US with an annual average of around 96,034 plants. Other significant exporters are the Dominican Republic and Canada. Countries which have exported small quantities of *A. vera* plants, according to the CITES statistics are: Bermuda, UK, Netherlands Antilles, Mexico, Germany, India, Australia, Belize, Somalia, Thailand, Honduras and Jamaica. Trade in live plants of this species generally has no conservation significance. The species is naturalised in all the countries listed above. Of these countries only Somalia has native *Aloe* species It is unlikely that *A. vera* is grown commercially there (Holmes, in litt. 1992) and it is possible that other plants are being exported under the wrong name.

Other species that are traded in relatively large quantities (annual average over 100) as live plants are shown in Table 4.

Table 4 Aloe species frequent in trade (excluding *A. vera*)

SPECIES	AVERAGE NO. IN ANNUAL TRADE	EXPORTING COUNTRIES	DISTRIBUTION & CONSERVATION STATUS
A. ferox	12585	S.Africa	S. Africa (nt)
A. arborescens	5204	US, S.Africa, Bermuda	Malawi (nt), Mozambique (?), Zimbabwe (nt), Swaziland (?), S.Africa (nt)
A. variegata	1782	S.Africa, Cyprus, Japan, Germany, US, Dominican Republic, UK	Namibia (rare)*, S. Africa (nt)
A. mitriformis	1372	S.Africa, US	S.Africa (nt)
A. distans	862	S.Africa, US	S.Africa (R)
A. erinacea	463	S.Africa, Namibia	S. Africa (very rare)*; Namibia (rare)**
A. marlothii	432	France, Netherlands, S.Africa, US	S.Africa (nt); Botswana (presumed common)*
A. dichotoma	384	US, S.Africa Germany	S.Africa (nt); Namibia (not threatened)#
A. brevifolia	191	S.Africa, US, UK	S.Africa (rare)*
A. humilis	173	Netherlands, S.Africa, US	S.Africa (nt)

Note: Conservation status is take from WCMC database except where indicated * (information provided by van Jaarsveld *in litt.*, 1992) or # (information provided by Supthut *in litt.*, 1992) or ** (information provided by Newton *in litt.*, 1992)

Many species of *Aloe* are widely cultivated for commercial trade, including some of the species listed in Table 4. It has been reported, for example, that *A. ferox*, *A. humilis* and *A. variegata* are entirely in European trade as artificially-propagated stock. Wild-collected plants of *A. dichotoma* have, however, recently been seen on sale in Italy and specimen-sized plants of *A. marlothii*, thought to be wild-collected are offered by one Dutch

nursery (Jenkins, 1992). *Aloe variegata*, *A. brevifolia*, and *A. humilis* are all propagated commercially in South Africa for horticultural purposes (Van Jaarsveld *in litt.*, 1992).

The level of trade in *A. distans* appears to be high, for a species which is Rare in the wild. The CITES reported trade is however all in artificially propagated plants. In 1986, for example, the US exported 3980 artificially propagated plants of this species, of which 1980 were exported to Japan. In 1988 the US exported 2035 artificially propagated plants of *A. distans* to Japan. Trade in *A. erinacea* would also appear to be high. The species is confined to the Richtersveld and southern Namibia. Again all the plants in trade are reported to be artificially propagated, exported from South Africa. This species is also cultivated in large quantities in the USA (Supthut *in litt.*, 1992).

In addition to the species listed in Table 4, trade in over 180 other species of *Aloe* is recorded in the CITES statistics for the period 1983-1989, in small quantities. Some of these species are rare or threatened in the wild as shown in Annex 1. In many cases the small numbers in trade are reported to be artificially propagated, often in the US, and the trade in species reported in the CITES statistics, does not generally appear to be a cause of concern.

There is, however, also a significant international trade in *Aloe* plants reported at generic level. The average number of live plants reported in trade as *Aloe* species during the period 1983 - 1989 is 64,242. A wide range of countries report the export and import of *Aloe* species in this way. Countries reported to export individual transactions of over 1000 plants include the Netherlands, Japan, Dominican Republic, France, Madagascar, Canada, Brazil and Taiwan. Usually these transactions are reported to be artificially propagated plants. The volume of export of unnamed species from Madagascar has, however, been a cause for concern.

In 1984, Madagascar reported the export of 10,000 live plants of *Aloe* species to Germany, within the CITES Annual Report, and the same quantity was reported in 1985. In general the succulents exported from Madagascar are wild-collected and commercial propagation facilities have not yet been established on the island. Trade at these levels is therefore likely to have had a significant impact on wild populations. Madagascar has over 60 taxa of *Aloe*. The conservation status of many of these remains unclear but some are known to be rare or endangered. The following small species are, for example, all endangered by fire and collection for trade: *A. haworthioides*, *A. parvula*, *A. bellatula*, *A. perrieri*, *A. calcairophila*, *A. descoingsii*, *A. rauhii*, *A. albiflora*, *A. versicolor*, *A. parallelifolia*, *A. bakeri*, *A. compressa* var. *rugo-squamosa*, *A. compressa* var. *chistophila*, *A. millotii* and the tree species *A. suzanne* and *A. helenae* are also endangered (Supthut, *in litt.*, 1989). All these species, with the exception of *A. versicolor* and *A. helenae*, are also reported in the CITES statistics for 1983-89, at species level. Reporting at generic level is clearly inadequate given the threat to such species in the wild. Although the genus *Aloe* is not currently fashionable with collectors in Europe, except for the Dwarf species (Newton *in litt.*, 1992), there is still a demand for the rarer Madagascan and South African species (Jenkins, 1992).

Concern about the number of Madagascan wild succulent plants being imported into Europe as artificially propagated plants led to a ban by the EC on plants from Madagascar claimed to be artificially propagated. This was introduced in April 1987. It has also been recommended by the IUCN/SSC Cactus and Succulent Group that CITES Appendix I listing be considered for Madagascan *Aloe* species which are threatened by international trade.

Discussion

Out of the wide range of *Aloe* species only a small number are of importance in international trade. *Aloe vera* and *A. ferox* are the dominant species used industrially. Present investigations suggest that it is unlikely that other species will become as important in international trade. There have been suggestions, however, that other species maybe substituted in trade consignments.

At present the data on levels of trade in *Aloe* parts and derivatives contained within CITES Annual Reports have limited value for conservation purposes. The only significant trade in parts and derivatives from wild populations reported to the CITES Secretariat is the trade in *Aloe ferox* from South Africa. International trade in *A. ferox* is large but appears to be sustainable and does not currently have a detrimental impact on the widespread species. CITES monitoring in this case has benefits for long-term management of the species.

International trade in *Aloe* parts and derivatives from other countries with native species is not currently recorded in CITES Annual Reports. This is unfortunate given the threat to wild populations from over-exploitation and at the same time the opportunities for developing sustainable harvesting and trade. CITES Parties that have indigenous *Aloe* species and are currently exporting *Aloe* extracts but not reporting the trade for CITES purposes include Kenya and Namibia. More information on the species and quantities exported would be desirable. It would also be desirable for major importing countries to review their provisions for reporting on imports. The only currently known example where the commercial extraction of derivatives has been a cause of conservation concern is the harvesting of material in Kenya.

The data on levels of trade in live plants recorded in CITES statistics for the period 1983-1989, show that the most heavily traded species are generally "not threatened" in the wild and are commonly artificially propagated. Relatively small-scale trade in rarer species may however be a cause for concern. Collector demand is thought to focus on South African and Madagascan rarities. A number of Madagascan species are strong candidates for Appendix I listing.

Reporting of trade in live *Aloe* plants at generic level prevents a thorough analysis of trade in *Aloe* species and the likely impact on wild populations. It is particularly important that countries with indigenous species should record exports of *Aloe* at species level.

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Review of significant trade in species of plants listed on Appendix II of CITES.

1983-1989

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3. PLANT GROUPS

CACTACEAE

Cacti are the most heavily traded group of plants recorded in CITES trade statistics. The average total number of cacti recorded in annual trade is 13,997,047. It is difficult to assess to what extent the CITES statistics reflect the actual total world trade in cacti. Some idea of the huge potential for world trade can be seen by looking at production figures for some of the major nurseries. One wholesale nursery in the Netherlands, for example, produces over 18 million cacti annually which is probably mainly taken up by the European market. In the US total cactus production has been estimated at between 10 - 50 million annually, with over 20 million produced in nurseries of Vista, California alone (Fuller, 1987).

In 1983 only 5.4% of the cacti recorded in in CITES statistics were recorded as artificially propagated. This figure rose to 96.31% in 1984 suggesting a diferent method of reporting rather than a huge increase in artificial propagation. The average percentage artifically propagated over the seven year period is 80.18% which may be a reasonable reflection of the actual situation. Based on the current nursery survey being carried out for TRAFFIC Europe, however, this proportion may be an underestimate. Within Europe less than 1% of cacti on sale is wild-collected (Jenkins, pers. comm. August 1991).

If around 20% of the huge world trade in cacti is in wild plants this does give some grounds for concern especially as there is inevitably additional unreported trade in wild plants. On the whole the most heavily traded species of cacti appear to be those which are readily propagated in not in difficult or slow-growing genera. It is difficult to generalise, however, because even in the most popularly cultivated genera such as *Mammillaria* there are some species which are subject to collecting pressures in the wild.

The countries with the highest levels of trade in cacti are as follows:

Country	Average annual trade	Average art. prop. in trade	percentage art. prop.
Netherlands	6,617,532	6,611,595	99.91
Japan	5.857,268	3,594,353	61.37
Brazil	1,669,508	1,493,743	89.47
Korea	621,682	563,741	90.68
Canada	607,276	596,333	98.2
Spain	466,996	446,151	95.54
Dominican Republic	327,062	29,801	9.11

There are seven other countries which trade in over 10,000 cacti annually. Five of the fourteen countries with an annual trade of over 10,000 cacti are within the EEC. In addition to Brazil, Canada and Dominican Republic, the only other country with indigenous cacti which has a large recorded cactus trade is Mexico.

The trade in cacti from the Netherlands and Japan is briefly discussed in the source countries section. The high level of trade in cacti from other major exporters, Korea, Canada and Spain is predominantly in artificially propagated cacti produced within these countries, as reflected in the statistics, and does not give rise to any concern. The export situation from Brazil is different in that both artificially propagated specimens of indigenous and non-indigenous species are traded together with wild-collected plants.

Details of the Brazilian cactus nurseries are not currently known, but there are several major nurseries in the south of the country which are thought to deal entirely in artificially propagated plants.

In contrast there is concern about levels of trade in wild-collected plants of certain Brazilian genera, such as *Uebelmannia* and *Discocactus*, together with some species of *Melocactus*, which has led to the suggestion that these taxa be transferred to Appendix I of CITES. There is also the possibility that wild-collected plants of the genus *Notocactus* are being exported in small quantities by Brazil.

It would appear that there is substantial under-reporting of cacti exports from other South American countries. The annual average reported trade for Peru, for example, is 1037 plants, 55.16% of which are reported to be artificially propagated. There is an internationally known cactus nursery within the country which has exported wild-collected plants of both indigenous and non-indigenous cacti, in contravention of CITES, during the past ten years.

Notes on highly traded Appendix II cacti

The brief notes given below are on the ten most heavily traded cactus genera in decreasing order of levels of trade.

1. *Mammillaria*

This is one of the largest genera in the Cactaceae with around 150 species, concentrated in Mexico. The genus is very commonly cultivated. It has, however, been reported that wild populations are exploited to fill the commercial demand for large specimens and that commercial collection is a threat to the survival of certain species (McCarthy, 1987).

Heavily traded species	Status in wild
M. bombycina	*recently rediscovered in the wild*
M. hahniana	I, Mexico
M. elongata	nt, Mexico
M. decipiens	nt, Mexico
M. magnimamma	nt, Mexico
M. spinosissima	nt, Mexico
M. dixanthocentron	V, Mexico
M. bocasana	nt, Mexico. numerous cultivated forms
M. candida	nt, Mexico
M. albilanata	nt, Mexico
M. karwinskiana	nt, Mexico
M. microhelia	R, Mexico
M. zeilmanniana	mass-produced, recently rediscovered in wild
M. geminispina	nt, Mexico
M. pennispinosa	R, Mexico
M. guerreronis	R, Mexico
M. haageana	nt, Mexico

Trade in the majority of these species is unlikely to be of concern because the level of propagation will support the mass trade. The species which warrant closer attention are, however, *M. dixanthocentron* which is slow-growing in cultivation and Vulnerable in the wild, *M. candida* which is not an easy species in cultivation and *M. guerreronis* which is sought after but not common in cultivation (Taylor, pers. comm. August, 1991).

2. *Gymnocalycium*

About 50 weakly defined species occurring in Bolivia, S. Brazil, Argentina, Paraguay and Uruguay.

There are many cultivated ornamentals in the genus. The trade is dominated by *G. mihanovichii* which is most heavily traded cactus species as recorded in CITES statistics. There are at least a dozen forms and varieties of this species most of which have red mutant forms which are widely cultivated. In cultivation they are grown by grafting onto stock plants and they are propagated easily by offshoots. Only one other species, *G. baldianum* shows up in Data Table 2 but over 70 other species names are recorded in CITES trade statistics in small quantities.

There is no information on the status of species in the wild currently recorded in the WCMC database. No evidence of commercial collection from the wild is known. Levels of international trade in plants of this genus are unlikely to be any cause for concern.

3. *Opuntia*

The largest genus in the Cactaceae with around 200 species, occurring in S. Canada, US, Caribbean, Central and South America and Galapagos.

The genus is very easy in cultivation and commercial collection for horticulture is unlikely to be a significant threat. *Opuntia* spp. are however dug from the wild for landscaping in the SW US (Lyons, 1987). Conservation categories for Mexican species are recorded in the WCMC database, and there are a few categories recorded for species in other areas.

Heavily traded species	Conservation status
O. leucotricha	nt, Mexico
O. microdasys	nt, Mexico (one var. is V)
O. romana	
O. pilifera	nt, Mexico
O. azurea	nt, Mexico
O. italiana	
O. violacea	
O. aciculata	
O. papyracanthus	

It is unlikely that any of the species listed above are collected from the wild for trade. A total of 120 species names are recorded in trade in the CITES statistics.

4. *Echinopsis*

There are more than 50 definable species, S. America (Andes) (Anon, 1986).

An easy genus in cultivation.

The conservation status of one species, *E. fulvilana*, is recorded in the WCMC database as V in Chile. This species is not recorded in the CITES trade statistics. A total of 93 species names are recorded in the trade statistics.

Heavily traded species:
- *E. bridgesii*
- *E. formosa*
- *E. ancistrophora*
- *E. rauschii*
- *E. haematantha*
- *E. calochlora*
- *E. chamaecereus*

Of these species it is possible that *E. formosa* is traded as wild plants but the others are unlikely to be so (Taylor, pers. comm. August, 1991).

5. *Epiphyllum*

10-15 species, tropical and subtropical America and Caribbean (Anon, 1986). There are countless hybrids in cultivation obtained by crossing with other genera, such as *Nopalxochia* and *Disocactus*.

18 species names are recorded in the CITES trade statistics but no individual species is recorded as highly traded.

Four Mexican species have threatened categories recorded in the WCMC database. Small quantities of these plants have been recorded in trade. It is unlikely, however, that levels of trade in this genus give grounds for conservation concern.

6. *Notocactus*

c 25 species have been described in this genus occuring in Brazil, Uruguay and Argentina. It is now included in the genus *Parodia*.

Easy to grow, most flower whilst still small plants.

There is no information on the conservation status of *Notocactus* spp. currently recorded in the WCMC database. The taxonomy of the genus is poorly understood and there is little knowledge of individual species in the wild. It is likely, however, that species are under threat in their natural habitats in Southern Brazil and Uruguay where very limited natural habitat remains and the plants are growing on rocky islands amongst cultivated land (Taylor, pers. comm. August, 1991).

48 species names are recorded in the CITES trade statistics.

Heavily traded species:
- *N. scopa*
- *N. leninghausii*
- *N. haselbergii*
- *N. magnificus*
- *N. succineus*
- *N. ottonis*
- *N. mammulosus*
- *N. crassigibbus*
- *N. buiningii*
- *N. herteri*

These species are all commonly cultivated and levels of trade in them is unlikely to be a cause of concern. There is, however, great interest in the genus at present centred on collectors in the Netherlands, Czechoslovakia, Hungary and Germany, and a significant trade in habitat plants is suspected. It is probable that these are taken out in hand luggage during collecting trips. Very little overt trade in wild Notocactus plants has been seen in the current European nursery survey (Jenkins, pers. comm. August 1991).

7. *Cereus*

c 25-30 species, Caribbean and South America (Anon, 1986).

16 species names are recorded in CITES trade statistics.

WCMC has records of 9 species of US and Caribbean with threatened categories. None of these shows up in the CITES statistics.

Heavily traded species:

C. peruvianus	a cultivar
C. azureus	
C. forbesii	

It is unlikely that any of these species are traded as wild plants and it is not thought that commercial trade poses any threat to the genus as a whole.

8. *Cleistocactus*

Many weakly defined species described, Andes to S. Brazil (Anon, 1986).

28 species names are recorded in CITES trade statistics. None of the species is individually recorded as being heavily traded.

There is no information on the conservation status of *Cleistocactus* spp. within the WCMC species database.

It is not thought that levels of trade pose a threat to any species in the genus.

9. *Ferocactus*

23 species, Mexico and SW US (Anon, 1986).

Collection from the wild for trade has been a problem with this genus, for example for landscaping. Some species are seriously threatened by commercial exploitation (McCarthy, 1986). There have been unsubstantiated claims of removal of wild Mexican populations by Japanese collectors. The demand for large wild-collected *Ferocactus* apparently remains.

Heavily traded species	Conservation status
F. pilosus	nt, Mexico
F. latispinus	nt, Mexico
F. hamatacanthus	nt, Mexico
F. peninsulae	nt, Mexico

Trade in these species is likely to be in propagated specimens and is not thought to pose a threat to wild populations. However, other species such as *F. chrysacanthus* and *F. horizonthalonius* may be subject to commercial collecting pressures (Taylor, pers. comm. 1991).

A total of 26 species names are recorded in the CITES trade statistics.

10. *Echinocactus*

5 species, Mexico and US (Anon, 1986). The genus is well known in cultivation. There has however been a considerable trade in wild-collected specimens, for example imported into Japan via the Netherlands and US (Milliken, Yokoi and Matsumura, 1987).

Heavily traded species	Conservation status
E. grusonii	E, Mexico. well established in commercial cult.
E. horizonthalonius	widespread sp., one var. is E/V in Mexico

Six species names are recorded in CITES trade statistics.

ORCHIDS

The average number of plants traded annually as recorded in the CITES statistics is 4,996,508. The average percentage recorded as artificially propagated is 79.62% These figures clearly indicate that there is a high volume of wild-collected orchids in international trade.

The major sources of live orchids, and roots where recorded separately, in international trade are as follows:

Country	Average annual trade	Average art. prop. in trade	Percentage propagated
Thailand	2,334,468	1,925,740	82.49
Taiwan	852,772	655,263	76.85
roots	69,406		
Japan	850,909	544,307	63.97
roots	343,354		
Netherlands	554,681	553,666	99.82
USA	248,586	166,645	67.04
UK	157,025	154,828	96.15
China	156,132	24,405	15.63

A further 14 countries export over 10,000 orchid specimens annually. Some of these are noteworthy for the low percentage of artificially propagated plants in trade. Examples of such countries which have a relatively high trade in orchids, for which less than 50% are recorded as artificially

SUCCULENTS

The average number of succulent plants traded annually as recorded in the CITES statistics is 2,248,464 and the percentage of which is reported as artificially propagated is 56.95%. The major sources of live succulents in international trade are as follows:

Country	Average annual trade	Average art. prop. in trade	Percentage propagated
Dominican Republic	871,124	39,668	4.55
Netherlands	729,321	727,218	99.71
Japan	295,745	280,636	94.89
Madagascar	134,894	15,941	11.82
US	130,883	130,972	100.07

The lack of artificial propagation carried out by Madagascan nurseries accounts for the low proportion of reported trade in propagated plants from the country. Madagascar now accurately reports trade in wild plants whereas these were previously claimed to be artificially propagated. The majority of succulents exported by Dominican Republic are commonly cultivated species and the low proportion of reported trade would appear to reflect inaccurate reporting.

Notes on highly traded Appendix II succulent plants

1. *Euphorbia*

c. 700 species, occurring in Africa, Madagascar, parts of India, Ceylon, the Canary Is. and America.

Propagation of succulent *Euphorbia* spp. is from seed, which is generally not freely available, cuttings or grafting. Some succulent species are well-established in cultivation and are widely sold as house plants in supermarkets and garden centres. *E. milii* (a spiny shrub known as Crown of thorns) and *E. trigona* are, for example, commonly propagated on a commercial scale in Denmark, Netherlands and elsewhere. *E. ingens* is propagated on a large scale in the Canary Islands and *E. obesa* in Japan. Other species have been routinely collected from the wild both for the specialist and more general market and trade in some species remains predominately in wild-collected plants. Most of the rare species are slow growing and difficult to propagate.

Concern about the level of exports of Madagascan *Euphorbia* spp., initially claimed to be artificially propagated, led to the transfer of 9 species to Appendix I of CITES in 1989.

The depletion of natural populations of succulent *Euphorbia* species has also been noted in South Africa (Fourie, 1984).

The conservation status of succulent *Euphorbia* spp. is recorded in the WCMC species database. The status of most Madagascan species remains uncertain (IUCN category K), however, including heavily traded species.

Heavily traded species:

E. trigona	
E. lactea	
E. lophogona	K, Madagascar
E. milii	K, Madagascar, many wild varieties - some still sought after by collectors
E. ingens	
E. grandicornis	
E. acrurensis	
E. cap-saintemariensis	K, Madagascar
*_E. tulearensis_	I, Madagascar
*_E. cylindrifolia_	K, Madagascar (ssp. tuberifera I).
E. alluaudii	K, Madagascar
E. enterophora	K, Madagascar
E. mammillaris	nt, South Africa
*_E. decaryi_	I, Madagascar

* transferred to Appendix I in 1989.

2. _Pachypodium_

13 species of Madagascar, S. and S.W. Africa.

Two species _P. lamerei_ and _P. geayi_ are widely propagated and are readily available in trade. _P. lamerei_ is the most heavily traded species recorded in the CITES trade statistics. Other species which are now quite widely propagated are _P. namaquanum_, _P. brevicaule_, _P. bispinosum_ and _P. decaryi_.

Wild collected plants continue to be included in international trade. There has been particular concern about the levels of trade in Madagascan spp., initially claimed to be artificially propagated in CITES documentation. This led to the transfer of three species from Appendix II to Appendix I of CITES in 1989.

Other heavily traded species:

*_P. brevicaule_	V, Madagascar
P. bispinosum	

* transferred to Appendix I in 1989

3. _Ceropegia_

160 species, Old World with one reaching Australia.

Many species are cultivated ornamentals, but only one species, _C. woodii_, is frequent in commercial cultivation. It is propagated on a large scale in the Netherlands and elsewhere using stem segments. _C. woodii_ is the most heavily traded species of the genus recorded in CITES trade statistics. There is no recording of trade at generic level within the highly traded CITES taxa recorded in Data Table 2.

Other heavily traded species:

C. armandii	I, Madagascar
C. volubilis	

4. _Aloe_

c 360 species, tropical and especially S. Africa, Madagascar, Arabia.

Trade in products from *Aloe* spp. is more significant than trade in live plants, as recorded in the CITES trade statistics. The trade is mainly in extracts of *A. ferox* for medicinal use and there is also a significant level of trade in timber, leaves and flowers of *A. ferox*. There is also a significant level of trade in derivatives of *A. vera*.

Aloe spp. can be propagated by seed, offshoots and stem cuttings. They are propagated commercially as houseplants in EEC countries and elsewhere, with a smaller level of production than other CITES succulent species such as *Euphorbia* and *Pachypodium*. There are collecting pressures on some of the rarer species, for example in Madagascar, for the specialist market.

Heavily traded live plants:

A. vera
A. ferox
A. arborescens
A. mitriformis

CYCADS

The average number of plants of Cycadaceae and Zamiaceae traded annually as recorded in the CITES statistics is 1,035,102 with 50.13% of this figure reported to be artificially propagated. As well as trade in live plants, there is also a major international trade in cycad seeds recorded in the CITES statistics.

The major source countries for cycads in international trade are:

Country	Average annual trade	Average art. prop. in trade	Percentage propagated
Japan	789,061	356,267	45.15
Dominican Republic	74,948	4,208	5.61
Netherlands	66,574	66,574	100.00
Australia	49,021	48,718	99.38
Taiwan	34,164	34,162	99.99
Israel	27,280	26,600	97.51
Mexico	11,986	214	1.70
US	11,255	11,255	100.00

Other countries which have an annual average trade of over 1000 plants are South Africa, Spain and Brazil. All Spain and Brazil's recorded cycad trade is reported to be in propagated plants and for South Africa the percentage reported as propagated is 94.76%.

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