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STATUS AND CONSERVATION OF THE ASIATIC WILD ASS ACROSS ITS RANGE

The report on the *Status and Conservation of the Asiatic Wild Ass across its Range* was prepared for the CMS Secretariat by Ms. Petra Kaczensky, Professor at the Inland Norway University of Applied Sciences and member of the IUCN Species Survival Commission Equid Specialist Group with input from experts in Wild Ass Range States. This work was funded as part of the cooperation agreement between the CMS Secretariat and the International Academy for Nature Conservation of the German Federal Agency for Nature Conservation (BfN INA) by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection. The views expressed herein are those of the author and do not necessarily reflect official opinions of the involved institutions. The document was revised to reflect updated numbers and distribution of the Indian Khur, on pages 5-7 and 9-12, pages 30 and 33.

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Taxonomy

There are currently five generally recognized subspecies:

- *Equus hemionus hemionus* - the Mongolian khulan (in southern Mongolia and northern China), formerly also referred to as *E. h. luteus* or dziggetai
- *E. h. khur* – the khur (India)
- *E. h. kulan* – the Turkmen kulan (in Turkmenistan and northern Iran, re-introduced in Kazakhstan, Uzbekistan)
- *E. h. onager* - the onager (southern Iran; mixed *E. h. onager* x *E. h. kulan* in northern Iran and re-introduced in Israel)
- *E. h. hemippus* – the Syrian Wild Ass (Extinct since 1927, formerly from the eastern shore of the Mediterranean Sea south into the Arabian Peninsula)

Recent genetic analysis of archaeological, historical, and modern samples indeed suggests that there is only one species of Asiatic Wild Ass (Bennett et al. 2017), which is subdivided into regional ecotypes rather than subspecies (Kuehn et al. 2018). If and how regional genetic differentiation is linked to functional genes (and local adaptations) is something that still needs to be studied in more detail.

Distribution, status and trend

In historic times the Asiatic Wild Ass (*Equus hemionus*) ranged throughout the steppes and desert steppes of Russia, Mongolia, northern China, north western India, Central Asia, the Middle East, including Iran, the Arabian Peninsula and Asia Minor (Bannikov 1981, Heptner et al. 1988, Denzau and Denzau 1999).

Autochthonous populations of the species have only survived in four countries: Mongolia, China, India, and Iran. Turkmenistan has recently lost its autochthonous population in Badhyz, but a small number of Asiatic Wild Asses remain in other locations in the country from past reintroductions with animals from Badhyz. Three more countries have re-established the species: Kazakhstan, Uzbekistan, and Israel.

Today the species is found in eight countries and estimated to number 87,000 individuals. The species stronghold is in southern Mongolia where an estimated 70,000 Asiatic Wild Ass or about 80% of the global population are found (Buuveibaatar et al. 2017, Kaczensky et al. 2020). All other remaining populations are much smaller and largely isolated from each other (Fig. 1, Table 1). Total Asiatic Wild Ass numbers in north-western India, northern China, and Kazakhstan number in the thousands, Iran has a population of 1,500, Israel 350, Uzbekistan 170, and Turkmenistan has 33 left (Table 1). There is a possibility, that there are some Asiatic Wild Asses left in Pakistan.

Asiatic Wild Asses globally are found in 10 more or less isolated populations, some of which have several subpopulations or segments (e.g., the Gobi population; Fig. 1, Table 1, I-X). In addition, there are 14 sites Asiatic Wild Ass occurrences (usually less than 50 individuals) or where recent reintroduction initiatives are currently trying to re-establish populations (Fig. 1, Table 1, 1-14).

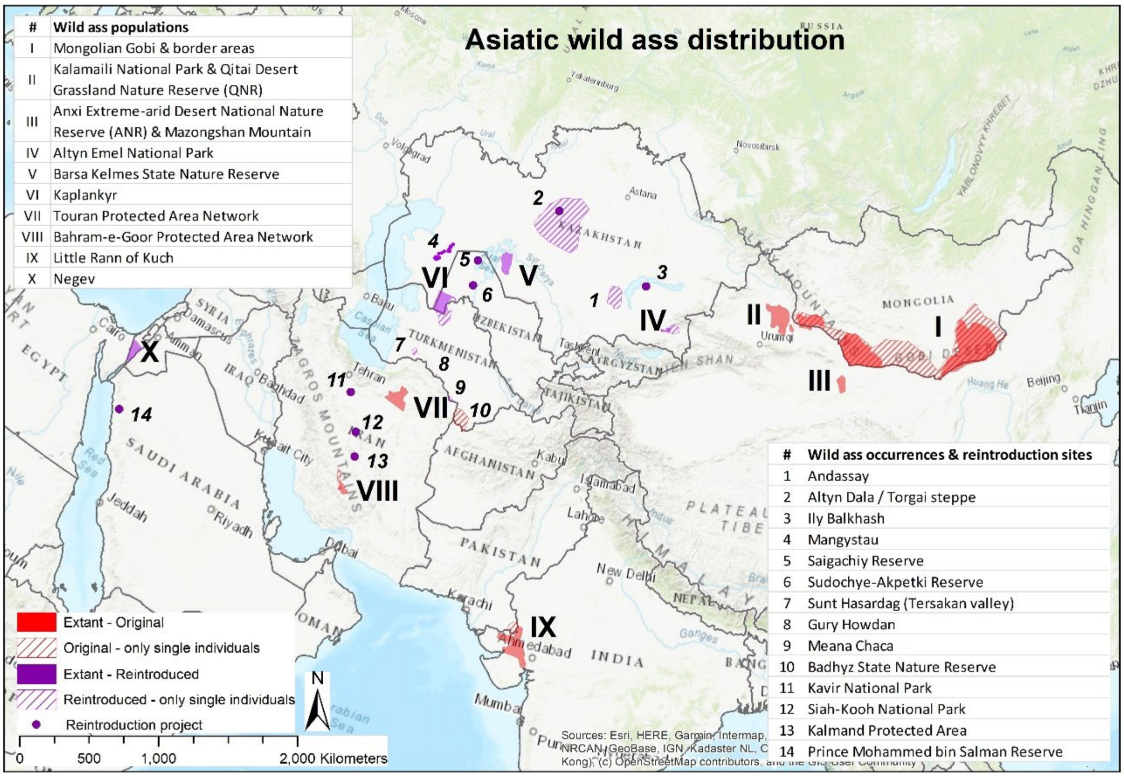

Fig. 1: Global distribution of the range of Asiatic Wild Ass in the CAMI Range States and beyond. Note: (4) shows GPS locations of a single Asiatic Wild Ass rescued and GPS collared in 2022 to highlight the area where sporadically single individuals have been observed in the past without spatially explicit documentation.

Monitoring intensity and methods vary widely between populations and countries. Very few populations are monitored following strict monitoring protocols, which also detail how estimates are calculated. Often total counts are attempted, or estimates are made based on the number or frequency of animals or signs encountered which are then converted to population estimates (likely involving some expert assessment).

Such population estimates are extremely challenging over large areas with different accessibility and visibility (Singh and Milner-Gulland 2011). They can also be strongly influenced by variability in water and pasture availability which can trigger long-distance movements by the animals (Kaczensky et al. 2011a; Vogler et al. 2023). Furthermore, total counts and rapid assessments give little information about the precision of the population estimates. Nevertheless, regularly done by an experienced team, such monitoring can produce valuable indices of a population's trend.

In China, the largest population in Kalamaili National Park (NP) is regularly monitored using ground transects (Zhang et al. 2020), while Asiatic Wild Asses in other parts of the range are monitored somewhat opportunistically. A recent effort compiled the most recent information for a national overview (Xu et al. 2022).

In **India,** the Wild Ass Sanctuary in the Little Rann of Kutch in Gujarat was established in 1973 and since 1976, population estimations are conducted at 5-to-7-year intervals using block counts (Rann is divided into 20 zones with 100 sub zones). The most recent count was conducted in March 2020, obtaining a population at 6,082 Asiatic wild in an area of 15,500 km^2 (Pandit et al. 2020). Vehicle transects, foot transects (Barman et al 2021) and in recent times aerial counts using a 4 seater Cessna aircraft and drones have been used for validation (Shah and Qureshi 2018). The most recent official estimate over the entire range was 6,800 animals. Over the last three decades, Asiatic Wild Asses have also expanded their range to areas outside the Wild Ass sanctuary, such as Khadir Bet in the Great Rann of Kutch, Ahmedabad, Surendranagar, and Bhavnagar and have also expanded into neighbouring Rajasthan (Rajsathan Forest Department 2019, S.H. Vardhan and S. Narwade pers.comm 2020) along the easternmost extension of the Rann of Kutch (Fig. 1).

Asiatic Wild Asses were previously reported in the province of Sind in adjacent **Pakistan** but are now considered extinct (Ghalib et al. 2018). However, there may still be some animals left, as the species presence was recorded in the desert lands of Tharparkar during the short mammals survey done in April, 2013; unfortunately no details on what the presence was based on, nor numbers or location were provided (Khan et al. 2015).

In **Iran**, annual total counts are done by protected areas staff and are reported to the Department of Environment (DoE) a governmental organization, under the supervision of the president, that is responsible for matters related to safeguarding the environment.

In **Israel**, Wild Ass observations are continuously recorded (biogis.huji.ac.il), and the population is roughly estimated as a minimum count (e.g., in May 2023, one day almost 200 individuals were observed in the main area in the Negev Highlands and it is estimated there might have been another 50 in the highlands which were not see on that day). Another two, smaller populations in the south of the Negev highland are estimated at about 100 individuals, so the minimum estimate is 350. Different monitoring protocols are currently developed for more precise estimates but will likely take another year before they can be implemented (A. Bouskila pers. comm. 2023).

In **Kazakhstan**, protected areas staff in Altyn Emel NP and Barsa Kelmes State Nature Reserve (SNR) conducts counts annually using line transects to obtain total counts which are reported to the Committee of Forestry and Wildlife (CFW) of the Ministry of Ecology and Natural Resources of Kazakhstan. In other parts of the country, Asiatic Wild Asses are recorded opportunistically by regional and national ranger teams (e.g., during annual aerial saiga census, or patrolling). There are additional aerial censuses for red list species (mainly ungulates), which also record Asiatic Wild Ass (e.g., Andassay Sanctuary or Ustyurt plateau). In Altyn Dala, adult re-introduced Asiatic Wild Ass are being monitored with GPS collars (Kaczensky et al. 2021). In 2022, an Asiatic Wild Ass captured by some local herders together with their horses was GPS collared and released back in the wild; but died after a month (Salemgareyev et al. 2023). The animal provided the first data on the movement of an Asiatic Wild Ass in the Ustyurt region (Fig. 1, location number 4).

In **Mongolia**, population estimates of Asiatic Wild Ass are scheduled every 5 years in Great Gobi B Strictly Protected Area (SPA) since 2010, and have been done in 2020, 2015, and 2022 (Ransom et al. 2012; Vogler et al. 2023). In the South Gobi Region, the Wildlife Conservation Society (WCS) has conducted large-scale ground surveys for Oyu Tolgoi’s Core Biodiversity Monitoring in 2013, 2014, 2015, 2019, and 2021 (Buuveibaatar et al. 2016; WCS 2021). Monitoring in the remainder of the range is sporadic to absent. In Great Gobi A SPA, staff has the impression that the population of Asiatic Wild Ass has declined (B. Buuveibaatar pers. comm. 2023). For the area between Great Gobi A SPA and Small Gobi A SPA in the South Gobi Region, there is concern that Asiatic Wild Ass may be largely absent (Adiya et al. 2016; Sukhchuluun et al. 2013). Movements of 100 Asiatic Wild Ass equipped with GPS collars in the South Gobi Region since 2013 has not documented any Asiatic Wild Ass to move to the west beyond Small Gobi A SPA, further indicating that movements between the Transaltai Gobi and the South Gobi Region may be rare (Kaczensky et al. unpubl. data).

In **Turkmenistan**, Asiatic Wild Ass population estimates are provided by protected area staff based on opportunistic observations and signs. In addition, camera traps have been used in Badhyz since 2010 (primarily to document leopard presence), and more recently in the Kopedag reserves including the Tersakan valley in Sunt Hasardag, and the Kaplankyr reserve. In Badhyz, no observations and signs of Asiatic Wild Asses have been recorded and none have been captured on camera traps at water points since 2015 (N. Khudaykuliyev pers. comm. 2023, (Kaczensky et al. 2019). We have to therefore conclude that this last autochthonous population of Turkmen kulan went extinct. There are also no confirmed observations from the reintroduced population in Meana Chaca. The Asiatic Wild Ass group in Gury Howdan is still present but has shrunk to only 6 animals. No Asiatic Wild Asses have been recorded in the Kaplankyr region, other than in the “no man’s land” between the cliff that makes the actual border with Uzbekistan and the border fence on Turkmen territory (see Fig. 4). In this area, which is accessible for Asiatic Wild Ass from Uzbekistan, 15 Asiatic Wild Asses have been observed recently (A. Amanov, pers. comm. 2023). In the Tersakan valley, rangers saw a group of 10 Asiatic Wild Asses and 3 were recorded on camera traps (H. Hojamyradov pers. comm. 2023).

In **Uzbekistan**, repeated expeditions have confirmed the presence of a population of Asiatic Wild Asses in what has become the South Ustyurt National Park (Marmazinskaya et al. 2016), Marmazinskaya et al. 2022). Genetic analysis of dung samples shows a high similarity with animals from Badhyz, low inbreeding, and quite good allelic richness, supporting that this population cannot be too small and fragmented (Kaczensky and Kuehn 2022). In addition, in 2022 two transports of captive bred Asiatic Wild Asses from the Jeyran Ecocenter near Bukhara have reintroduced Asiatic Wild Ass to Saigachy reserve and the Sudochye-Akpetki reserve. Rangers check parts of the protected areas for signs, but no systematic monitoring is conducted, so that the current numbers and fate of the released animals is not known.

Table 1: Most recent population estimates for Asiatic Wild Ass by country and region.

#	Area	Year	Area (km^2)	Method	Population estimate	% global / regional	95% CI or (95% CL)	Origin	Trend	Source
CHN	**China - rounded**		**40,000**		**4,000**	**4.6**				
II	Xingjiang - Kalamaili National Park	2018 & 2019	23,200	Line transects (vehicle)	3,275	81.9	±575	O	Fluctuating	Xu et al. 2022, Zhang et al. 2020
II	Xingjiang -Qitai county	2018	1,200	Direct counts	300-400	8.8	NA	O	Increase?	Xu et al. 2022, Qitai forestry administration, 2018
II	Xingjiang -Haftik Mountains	2010	2,000	Line transects (vehicle)	144	3.6	±84	O	Decrease	Xu et al. 2022, Xu 2012
III	Gansu - ANR and Mazongshan	2021	6,300	Guestimate based on camera traps	<100	<2.0	NA	O	?	Xu et al. 2022
I	Inner Mongolia – Border areas (including UNR)	2006	7,000	Line transects (vehicle)	200-300	6.3	NA	O	Decrease	Xu et al. 2022, Bi 2007
IND	**India - rounded**		**27,000**		**6,800**	**7.8**				
IX	India - Little Rann of Kutch	2020	27,000	Block counts, vehicle and foot transects	6,800	100	NA	O	Increase	Pandit et al. 2020, Barman et al. 2021
IRN	**Iran - rounded**		**30,000**		**1,500**	**1.7**				
VII	Touran*	2021	15,000*	Ranger based guestimate	175	11.9	NA	O	Stable	DoE 2022 pers. comm.
VIII	Bahram-e-Goor	2022	4,100	Total count	1,131	77.1	NA	O	Increase	DoE 2022 pers. comm.
	Ghara-Tappeh	2023	1,900	Total count	20	1.4	NA	O	Expansion	DoE 2023 pers. comm.
	Chahak-Shahriyari and adjacent areas	2023		Total count	50	3.4	NA	O	Expansion	DoE 2023 pers. comm.
13	Kalmand protected area	2023	2,300*	Total count	64 (54 + 19 in two separate parts)	4.4	NA	R	Increase	DoE 2023 pers. comm., DoE - CAMI News 2020

#	Area	Year	Area (km^2)	Method	Population estimate	% global / regional	95% CI or (95% CL)	Origin	Trend	Source
12	Siah-Kooh National Park*	2023	2,000*	Total count	14	1.0	NA	R	Too early	DoE 2023 pers. comm., DoE - CAMI News 2020
11	Kavir National Park*	2022	4,400*	Total count	13	0.9	NA	R	Too early	DoE 2022 pers. comm., DoE - CAMI News 2020
ISR	**Israel - rounded**		**7,400**		**350**	**0.4**				
X	Israel - Negev	2023	7,400	Minimum number, estimate based on observations	350	100	NA	R	Increase	A. Bouskila pers. comm. 2023; BioGIS (17/04/2023) - biogis.huji.ac.il
KAZ	**Kazakhstan - rounded**		**11,000** (100,000)		**4,400**	**5.1**				
IV	Altyn Emel - west	2022	1,200	Ranger observations along Line transects (vehicles)	3,608	82.3	NA	R	Increase	CFW 2022 pers. comm., Kaczensky et al. 2021
IV	Altyn Emel - east	2022	3,400	Ranger observations along Line transects (vehicles)	Singe individuals	<0.1	NA	R	Increase	CFW 2022 pers. comm., Kaczensky et al. 2021
V	Barsa Kelmes	2021	10,000	Ranger observations along line transects (vehicles)	690	15.7	NA	R	Stable	CFW 2021 pers. comm., Kaczensky et al. 2021
1	Andassay	2021	NA	Chance observations	40	0.9	NA	R	Unknown	CFW 2021 pers. comm.
2	Altyn Dala	2023	99,000	Collared kulan	Single individuals	<0.1	NA	R	Too early	Salemgareyev et al. 2023

#	Area	Year	Area (km²)	Method	Population estimate	% global / regional	95% CI or (95% CL)	Origin	Trend	Source
3	Ily Balkhash	2023	NA	Number released	48	1.1	NA	R	Too early	Salemgareyev et al. 2023
4	Ustyurt (Magystau)	2022	NA	Collared khulan	Single individuals	<0.1	NA	R	NA	Salemgareyev et al. 2023, CFW 2009
VI	Southern Ustyurt (border with UZB)	2019	NA	Single observations	Single individuals	<0.1	NA	R	NA	Pestov et al. 2018
MNG	**Mongolia - rounded**		**175,000** (260,000)		**70,000**	**80.5**				
I	Dzungarian Gobi - Great Gobi B	2022	13,000	Point transect Distance Sampling	5,204	7.4	2,121 – 12,771	O	Fluctuating	Vogler et al. 2023
I	Transaltai Gobi - Great Gobi A	2023	46,000*	Opportunistic sightings	Unknown	<0.1		O	Decrease	Great Gobi A has impression the population has decreased (B. Buuveibataar pers. comm. 2023)
I	South Gobi Region	2021	116,000	Terrestrial line transect distance sampling	65,307	92.6	43,387 – 98,301	O	Stable / Increase	WCS 2021
I	Areas in between the areas above	2009	85,000	Occasional	Unknown	<0.1		O	Unknown	There is concern that the species may be largely absent between the Trans-Altai Gobi and Small Gobi A SPA (Adiya et al. 2016; Sukhchuluun et al. 2013)
TKM	**Turkmenistan - rounded**		**800**		**33**	**0.04**				
10	Badhyz*	2023	11,000*	Camera traps, chance observations	0	0.0	NA	O	Extinct	No kulan observed or camera trapped since 2015 (N. Khudaykuliyev pers. comm. 2023, Kaczensky et al. 2019)

#	Area	Year	Area (km^2)	Method	Population estimate	% global / regional	95% CI or (95% CL)	Origin	Trend	Source
9	Meana Chacha*	2023	700*	Chance observations	0	0.0	NA	R	Extinct	No kulan observed since 2017/18 (Kaczensky et al. 2019)
8	Gury Howdan	2023	50-100	Ranger observations	6	18.2	NA	R	Decrease	Ranger observations 2023 (J. Saparmyradov pers. comm. 2023); Kaczensky et al. 2019
7	Sunt Hasardag (Tersakan valley)	2023	100-1,000	Camera traps, chance observations	10-15	36.4	NA	R	Stable	Camera traps 2022 & ranger observations (H. Hojamyradov pers. comm. 2023); CAMI Newsletter 10/2020
VI	Kaplankyr & border zone	2023	700	Rapid assessment & genetics	15	45.5	NA	R	Stable/Increase	A group of 15 was observed in the border zone (A. Amanov, pers. comm. 2023); Kaczensky et al. 2019
VI	Kaplankyr protected area network	2023	7,600	Rapid assessment & genetics	15	45.5	NA	R	Extinct	A. Amanov, pers. comm. 2023; Kaczensky et al. 2019
UZB	**Uzbekistan - rounded**		**15,000**		**170**	**0.2**				
VI	Kaplankyr -South Ustyurt National Park	2018	12,700	Repeated rapid assessments	100-150	72.5	NA	R	Stable/Increase	Marmazinskaya 2019 pers. comm., Marmazinskaya et al. 2022 *in press*, Kaczensky et al. 2019
5	Saigachy reserve	2021/22	9,000*	Number of animals released	13	7.5	NA	R	Too early	Buchalczyk 2022 - CAMI News 10/2022, Marmazinskaya et al. 2022 *in press*

#	Area	Year	Area (km²)	Method	Population estimate	% global / regional	95% CI or (95% CL)	Origin	Trend	Source
6	Sudochye-Akpetki reserve	2021/22	580*	Number of animals released	35	20.2	NA	R	Too early	Buchalczyk 2022 - CAMI News 10/2022, Marmazinskaya et al. 2022 *in press*
GLOBAL - rounded			**295,000 - 470,000**		**87,000**					

** Due to the lack of more explicit data, for these regions, the range size estimate is based on the size of the protected area Asiatic Wild Ass occur in.*

1. Habitat requirements

Asiatic Wild Asses live in open dryland habitats, such as steppes, desert steppes, semi-deserts, and deserts. They are very sure footed and can also live in mountainous regions, but tend to avoid steep slopes and rugged terrain, likely because it does not allow them to easily spot and outrun potential predators.

Wild Asses feeding strategy is similar to that observed in other equids in dry environments. When grass is plentiful, Asiatic Wild Asses are predominately grazers. During the dry season and in drier habitats, Asiatic Wild Asses will supplement their diet with shrubs and switch to become mixed feeders during certain seasons (Bannikov 1981; Burnik Šturm et al. 2017; Xu et al. 2012).

Like all equids, Asiatic Wild Asses need regular access to water. Especially when it is hot or the vegetation is dry, they drink daily, commuting between pasture and water (Payne et al. 2020). Water availability is a key resource determining the presence and movements of Asiatic Wild Asses throughout its range (Bannikov 1958; Esmaeili et al. 2021; Nandintsetseg et al. 2016; WCS 2021; Zhang et al. 2020).

Cut-off values for pasture use away from water seem to be in the range of 15-20 km (Bannikov 1981; Nandintsetseg et al. 2016). In Mongolia's South Gobi Region, khulan on average do not venture further than 7.2 km away from water when re-visiting the same waterpoint (Payne et al. 2020). Where subsurface flow exists in dry riverbeds, Asiatic Wild Ass also dig for water, creating craters up to a meter deep (Payne et al. 2020).

Habitat use of Asiatic Wild Asses is negatively influenced by human activity such as human settlements, livestock camps, and anthropogenic disturbance caused by mining and road development (Buuveibaatar et al. 2016; Zhuo et al. 2022). Evidence further suggests that disturbance negatively influences group size, requiring animals to spend more time being vigilant (Wang et al. 2016). Unfortunately, the impact of anthropogenic disturbance and habitat quality on population performance is difficult to assess and such analyses are currently missing.

2. The importance of movements

Asiatic Wild Asses are among the most mobile ungulates globally (Joly et al. 2019; Tucker et al. 2018). Their movements exceed the better-known classical migrations of caribou in the Arctic or wildebeest and zebra in the Serengeti-Maasai Mara ecosystem. These wide-ranging, nomadic movements allow Asiatic Wild Asses to thrive in large numbers under the harsh climate and unpredictable conditions of Central Asia's resource-poor drylands (Kauffman et al. 2021a; Nandintsetseg et al. 2019; Nandintsetseg et al. 2016).

Nomadism in combination with a flexible fission-fusion social system (where group membership as well as group size varies; (Renan et al. 2018; Rubenstein et al. 2015)) enables Asiatic Wild Ass to make the most of the available resources in an unpredictable environment that is prone to extremes. Contrary to range resident species, Asiatic Wild Ass can buffer the effect of local or temporary resource-poor seasons or years by moving to less affected areas (Kaczensky et al. 2011a).

Forcing migratory or nomadic species to become range resident greatly lowers the carrying capacity of the landscape by restricting the population's ability to track resources, avoid predators, and minimize exposure to parasites (Fryxell et al. 1988). Reduced mobility in combination with smaller population sizes makes populations more vulnerable to localized events and reduces their resilience to climate change (Kauffman et al. 2021a).

Climate change is expected to bring a further increase in temperatures and a higher frequency of extreme events like droughts and severe winter storms (Hijioka 2014; IPBES 2018; Nandintsetseg and Shinoda 2013), which can result in high local or regional mortality. Hence, maintaining mobility for Asiatic Wild Ass and other migratory ungulates is probably the single most important measure to mitigate the effect of climate change.

3. Barriers to migration

Movement becomes more and more difficult if suitable habitat is lost (e.g., conversion to agricultural, urban, or industrial use), becomes too disturbed (e.g., resource extraction, recreation), or is made inaccessible by barriers (e.g., roads, rails, fences). Due to their wide-ranging movements, Asiatic Wild Asses are particularly vulnerable to the barrier effects of linear infrastructure (Batsaikhan et al. 2014; UNEP/CMS 2019).

5.1. The role of CMS/CAMI

The importance of addressing the threat coming from linear infrastructure has been a key topic for CAMI and has resulted in several background documents, workshops, recommendations, including the Central Asian Mammals Migration and Linear Infrastructure Atlas (Lkhagvasuren et al. 2011; Slootweg 2021; UNEP/CMS 2015, 2019; Wingard et al. 2014). The ultimate purpose of this atlas is “to provide information to decision-makers and to guide infrastructure planning that provides benefits to people without causing unnecessary harm to migratory species”. In 2020, the Global Initiative on Ungulate Migration (GIUM) was created to broaden the scope and update the CAMI atlas to a global atlas (https://www.cms.int/en/gium; (Kauffman et al. 2021b).

Mongolia in particular has pioneered the CMS workstream on the topic and has been in the focus of two CMS workshops which addressed the effects of infrastructure on migratory mammals in Central Asia. As the result of the two workshops, Mongolia adopted the national “Ulaanbaatar Action Plan on Wildlife-friendly Infrastructure” in 2015 (CMS/CAMI 2015). The plan was based on the Guidelines for Addressing the Impact of Linear Infrastructure on Large Migratory Mammals in Central Asia, adopted by CMS Parties at the 11th Meeting of the Conference of the Parties in 2014.

5.2. Impact of linear infrastructure

Although the structural presence of roads and railways *per se* does not seem to constitute a major obstacle to Asiatic Wild Ass movements, traffic volume and steep embankment do reduce or hinder movements (Kaczensky et al. 2020; Kaczensky et al. 2023). Furthermore, Wild Ass – vehicle collisions are a conservation and safety concern, especially in India, Israel, and Iran (Anonymous 2002; Mohammadi et al. 2023; Warner 2014).

Fences constitute absolute barriers for Asiatic Wild Ass as they seem unwilling to jump over or crawl under fences. Particularly damaging are fences erected along linear infrastructure to prevent human accidents and livestock or wildlife collisions, and along international borders for security reasons as these fences stretch over hundreds of kilometres (Linnell et al. 2016; Olson 2012; Pestov et al. 2018).

In Mongolia, the fenced Trans Mongolian Railway (TMR) has acted as an almost impermeable barrier and become the eastern boundary of the population (Kaczensky et al. 2020). The background of fencing and allowing mitigation of the fence along the TMR has been recently

reviewed, coming to the conclusion that mitigation can be done within the existing legal framework and safety requirements (Wingard et al. 2022).
Mongolia also developed general requirements for wildlife crossings (Mongolian Agency for Standardization and Metrology 2015). However, the requirements for implementation (e.g., how many) and quality control are not yet formally regulated in most CAMI Range States (Wingard et al. 2014).

Of additional concern is fencing to delineate or protect pasture lands. So far, this is primarily an issue in northern China for the Asiatic Wild Ass and for its close relative, the kiang (*Equus kiang*), on the Tibetan plateau. Here the sheer number of fences makes it difficult for wildlife to find a way through the fenced areas and increases the risk of Asiatic Wild Ass getting entangled in the barbed wire most often used (Sun et al. 2020).

5.3. Recent projects on the impact of linear infrastructure in the region

The awareness for the negative effects of linear infrastructure has grown in Asia and the CAMI region and several projects have recently focussed on assessing the situation and moving towards solutions.

Oyu Tolgoi copper and gold mine in Mongolia's South Gobi Region is financing an offset program focussing on the mitigation of the Trans Mongolian Railway, commissioned to WCS Mongolia. Measures have included establishing an inter-ministerial working group, a study tour to the US to visit wildlife crossing structures, a legal review on fence removal, pilot fence modification for goitered gazelles, pilot openings for Asiatic Wild Ass, and respective monitoring with camera traps and hiring local guards to keep livestock away from the pilot openings (B. Buuveibaatar pers. comm. 2023).

In China, linear infrastructure, namely the railway, expressway, and national highway cutting through the middle of Kalamaili NP has been a major concern for Asiatic Wild Ass recovery and conservation (Zhuo et al. 2022). Recently, 58 wildlife crossings have been built along the expressways and 29 along the railway to mitigate the fragmentation effect of the infrastructure corridor bisecting the NP (W. Xu pers. comm. 2023)

In 2020, the U.S. Agency for International Development (USAID) launched the Linear Infrastructure Safeguards in Asia (LISA) Project—to assess the capacity of Asian countries to develop wildlife-friendly linear infrastructure. The final report (USAID 2021d) comes with annexes on spatial analysis (USAID 2021a), case studies (USAID 2021b), capacity assessment (USAID 2021c), literature review and a training manual (USAID 2021e).

The LISA project is currently followed up by Asia's Linear Infrastructure safeGuarding Nature (ALIGN). This project aims to expand the development and implementation of effective, high-quality infrastructure safeguards in Asia—with specific focus on India, Mongolia, and Nepal (USAID 2022).

5.4. New barriers

Barriers to migration have been mapped for a large part of the CAMI region in 2018 (UNEP/CMS 2019), but the maps have not since been updated. Furthermore, the resulting atlas did not include India or China, two important Range States for the Asiatic Wild Ass. And while some progress is being made on the mitigation of existing linear infrastructure, new infrastructure is being built.

In Mongolia, three new railroads, namely the Tavan Tolgoi – Gashuun Suhait railway (267 km), the Zuunbayan-Khangi railway (226 km), and the Tavan Tolgoi-Zuunbayan railway (416 km), were built across the Khulan range in the South Gobi to improve market access to China and beyond. The first two are aligned along a north-south axis, while the latter is aligned along an east-west axis from the Tavan Tolgoi Coal mine connecting to the Trans Mongolian railway. Regrettably, the new Tavan Tolgoi – Gashuun Suhait railway was fully fenced in 2022. The other two railways are only partly fenced, but concerns over livestock collisions may result in further fencing. Preliminary results for GPS collared Asiatic Wild Ass suggest that these new railways constitute barriers to their movements. There is therefore an urgent need to re-think the current infrastructure policy that is guiding the development of Mongolian railroads to accommodate the needs of migratory wildlife. (Kaczensky et al. 2023).

The region around the Wild Ass sanctuary in the Little Rann of Kutch in India is currently experiencing rapid development of linear infrastructure and energy networks such as upgrading the road and railway network, and building new canals (e.g., Narmanda canal), and wind and solar power parks. Development is happening in parallel and threatens to cordon off the protected area and impact wildlife movements.

Additional connective roads in Mongolia and the CAMI region are in planning or under construction, but an overview of all these projects was beyond the scope of this background document. However, a revision and update of the CAMI atlas has been agreed on and will start shortly.

5.5. Progress with mitigating linear infrastructure

There is a lot of literature available on crossing structures for wildlife (Clevenger and Huijser 2011; Iuell et al. 2003; WII 2016). However, so far, only very limited information on the use of wildlife crossings by Asiatic Wild Asses has been available:

- From India we knew that Asiatic Wild Asses in the Little Rann of Kutch used wildlife crossing under of the State Highway 07 (Anonymous 2002).
- From China we knew that kiang (*Equus kiang)* used crossing structures under the railway on the Tibetan Plateau. Kiang were much more likely to use small bridges rather than culverts (out of 14 small bridges and 11 culverts, kiangs used all bridges, but only 1 culvert) and preferred wider, higher, and shorter crossing structures (Wang et al. 2018). The authors further note "Kiangs were photographed near the entrance of other culverts, suggesting an interest in crossing but that culverts were unsuitable. The culvert the kiang successfully crossed is wider and taller than the other culverts. This indicates that the size of this culvert likely represents the smallest size (length, 8 m; width, 3 m; height, 3 m) suitable for kiang" (Wang et al. 2018).

In recent years, more evidence for successful mitigation measures has come forward:

- In Mongolia, a pilot project to improve connectivity along the TMR was initiated in 2019 and tested up to three test openings to evaluate their use by Asiatic Wild Ass and assess safety risks (concerning livestock and wildlife collisions with the train). On 16 March 2020, the first Asiatic Wild Ass was documented to cross at the opening and at least 2 more on later occasions.
- In Kalamaili NP in northern China, preliminary results of recently implemented crossing structures, suggest that Asiatic Wild Asses have adapted and make extensive use of these passages (W. Xu pers. comm. 2023).

4. Disease

Generally, wild equids, including the Asiatic Wild Ass, are susceptible to the same pathogens as domestic horses and donkeys. However, the wild equids are deemed hardy, and very few consequential infectious diseases have been reported in the literature. Due to the extensive wild-domestic equid interfaces across the entire region, a sharing of pathogens must be expected. As with any disease outbreak, it is essential to understand the local ecology and appropriate risk factors.

Pathogens that affect both wild and domestic equids include viruses, bacteria, rickettsial organisms such as *Anaplasma* spp., protozoa such as *Babesia caballi* and *Theileria equi*, as well as helminths. However, the prevalence and distribution of these pathogens vary between geographic regions.

Here we provide a non-comprehensive overview of three potentially consequential viruses that could impact Asiatic Wild Ass populations in the future. These include:

- Equine herpes viruses (e.g., EHV-1, EHV-3, EHV-4) is a ubiquitous DNA virus of horse populations across the world. It typically manifests in two distinct species, EHV-1 and EHV-4. EHV-1 can cause abortions, respiratory illness, and neurological issues. EHV-4 is mostly associated with respiratory illness, though it can cause abortion or rarely neurological disease too. Respiratory infection due to EHV is most common among recently weaned foals and yearlings, usually during autumn and winter. Adult equids are more likely than their younger counterparts to transmit the virus without exhibiting any symptoms of infection. EHV-1 is contagious and spreads by direct horse-to-horse contact via the respiratory tract through nasal secretions. The asinine herpesvirus-3 (AHV-3) is considered to be the progenitor of EHV-1. Recently gamma herpesviruses have also been identified in donkeys and Asiatic Wild Asses. Environmental stressors may heighten the risk for EHV reactivation (Seeber et al. 2018). A recent study has shown that EHV-1 remains stable and infectious under many conditions in water for up to three weeks and thus has a high potential to be transmitted at waterpoints (Dayaram et al. 2021).

- Equine influenza (EI) or “horse flue” is an extremely infectious, though usually non-lethal, respiratory disease of wild and domestic equids. This illness has been documented since antiquity with outbreaks having a significant effect on the economy during times when horses were main draft animals. EI is spread rapidly between animals through contact, coughing, and excreting of the virus. Even before the onset of clinical symptoms, fevered animals may already be able to pass on the virus to other equids. In areas where susceptible populations exist and with a short incubation period of one to three days, it is possible for outbreaks of EI to occur quickly and spread extensively in larger aggregations of wild equids. In 2010, during an outbreak of severe avian influenza H5N1 among private poultry in Egypt, several donkeys were identified to have respiratory issues which turned out to be stemming from the avian influenza H5N1 virus. This marked the first time that this virus had been known to spread to a member of the equid family. It serves as a reminder of the unpredictable nature of influenza viruses, especially in view of the ongoing devastating H5N1 “bird flu” panzootic. An outbreak of EI was documented in Przewalski’s horses in northern China in 2007 (Yin et al. 2014) and a recent study detected antibodies against hemagglutinin (H) H1, H3, H5, H7, H8 and H10 influenza A viruses in Asiatic Wild Asses in the Mongolian Gobi (Soilemetzidou et al. 2020)

- African horse sickness (AHS) is a highly fatal infectious disease that affects all equid species. It is caused by a virus of the genus Orbivirus belonging to the family Reoviridae. The virus has caused outbreaks in equids in Africa and other areas including Morocco, the Middle East, India, Pakistan, and the Iberian Peninsula. In March 2020, AHS virus serotype 1 was reported in Thailand, representing the first known incursion into Asia in over half a century and posing a significant challenge to the equine industry and Veterinary Services in the region. It has never been reported in the Americas, eastern Asia, or Australasia. The AHS epidemiology is dependent on host-vector interaction and outbreaks coincide with high numbers of biting midge *Culicoides imicola* in endemic areas. Outbreaks can be broken in nonendemic areas through long, cold winters since larvae do not carry the virus.

Diagnosis of the above-mentioned viral diseases can be challenging in wild equids under field conditions and in the absence of national laboratory capacity. Appropriate biosecurity measures should be employed to reduce transmission between wild and domestic animals, including limiting domestic horse incursions into wild equid habitat. Wildlife veterinary capacity building, paired with national and regional surveillance of domestic equid health, and robust and timely investigations and diagnosis of mortality events in domestic and wild equid populations are key to protect both animal populations from consequential disease outbreaks and epidemics.

Other diseases which could potentially result in large scale outbreaks with high mortality are:

- Strangles is a highly contagious bacterial disease of the upper respiratory tract of equids caused by the *Streptococcus equi* bacteria. It occurs worldwide and commonly affects adult animals. Equids can inhale or ingest the bacteria through contact with infected material, other horses, or contaminated water. The transmission originating from outwardly healthy animals may be of greater importance than that from sick horses in initiating new outbreaks. Clinical signs include fever, nasal discharge, swollen submandibular and retropharyngeal lymph nodes and node abscesses. A significant pharyngitis frequently accompanies infection with animals being reluctant or unable to eat or drink. Not all infections with *S. equi* are confined to the upper respiratory tract with abscesses reported in multiple sites including the brain, abdomen, and mammary gland. Severity of the disease varies greatly depending on the immune status of the animal. In Mongolia, multiple reintroduced Przewalski's horses died of *S. equi* during a harsh winter (Roberts et al. 2005). In domestic horses, complications have a 10% chance and 40% mortality rate. Some horses become asymptomatic carriers. Diagnostic testing involves collecting samples from the upper respiratory tract for microbial culture or qPCR.

- Anthrax is a noncontagious zoonotic disease caused by the spore-forming bacterium *Bacillus anthracis*. It commonly affects wild and domestic herbivores but is also capable of infecting humans through exposure to infected animals or contaminated animal products. Anthrax usually causes acute septicemia in herbivores and has high fatality rates. Spores of B anthracis can remain viable in soil for many years establishing "anthrax hotspots" or "anthrax-endemic areas". Biting flies are capable of mechanically transmitting spores. Feed contaminated with bone or animal meal, as well as raw or poorly cooked meat, also poses a risk of infection. The epidemic dynamics and geographic extent of *B. anthracis* remains poorly understood and many countries lack adequate surveillance systems for anthrax, even within known endemic regions (Carlson et al. 2019; Galante and Fasanella 2022).

- Surra is an infection caused by the parasitic Trypanosome *Trypanosoma evansi*. It is a common parasite in India and Iran and causes severe, often fatal, infection in mammals such as horses, donkeys, cattle and camels. Several species of hematophagous flies, including *Tabanids* and *Stomoxys* are implicated in transferring infection from host to host, acting as mechanical vectors. The disease is characterized by fever, progressive emaciation, anaemia, subcutaneous edema, nervous signs, and death. The disease is endemic throughout India, particularly in low-lying areas in the north. However, it is seasonal, and the incidence is higher during monsoon and post-rainy periods due to the preponderance of Tabanus flies (Dodiya et al. 2020).

5. Protection status

The Asiatic Wild Ass is protected with hunting prohibited in all Range States (see Table 2 for details). In the IUCN Red List of Threatened Species, it is globally assessed as Near Threatened (NT) because a population decline of at least 20% is projected over the next three generations, based on old prevailing and newly emerging risks, thus approaching Vulnerable (VU) under A3bcd (Kaczensky et al. 2015). Regionally, *Equus hemionus onager*, and *E. h. kulan* are assessed as Endangered (EN), and *E. h. hemionus* and *E. h. khur* as NT.

Under CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) the Asiatic Wild Ass has been listed since 1975, with subspecies *E. h. hemionus*, *E. h. khur* (Appendix I), and *E. h. kulan*, *E. h. onager* (Appendix II) [1 July 1975]. Stricter national measures were implemented to restrict trade for non-commercial purposes by Israel in 2019, India in 2018, and Afghanistan in 2013.

The Asiatic Wild Ass has been listed under CMS in Appendix II since 2002.

Table 2: Legal status of Asiatic Wild Ass throughout its range.

Country	Subspecies	National status Red List / protection status	Year assessed	CMS Party	CMS Appendix	CAMI Range State	CITES	CITES Appendix
China	*Equus hemionus hemionus*	VU A1acd; B1ab(i, ii, iii)+2ab(i ii iii)	2016	No	II	Yes	Yes	II
India	*Equus hemionus khur*	Highest protection: Schedule I of the Indian Wildlife Protection Act	2020	Yes	II	Yes	Yes	I
Iran	*Equus hemionus kulan* *Equus hemionus onager*	Protected by law	2022	Yes	II	Yes	Yes	II
Israel	*Equus hemionus kulan x Equus hemionus onager*	Protected, EN (B,D)	2004	Yes	II	No	Yes	II
Kazakhstan	*Equus hemionus kulan*	Category II (endangered species)	2022	Yes	II	Yes	Yes	II
Mongolia*	*Equus hemionus hemionus*	EN A4abd	2006	Yes	II	Yes	Yes	I
Turkmenistan	*Equus hemionus kulan*	CR	2023	Yes	II	Yes	No	II
Uzbekistan*	*Equus hemionus kulan*	1(CR)	2019	Yes	II	Yes	Yes	II

**For details on the red list status for Mongolia see (Clark et al. 2006) and for Uzbekistan see (Marmazinskaya 2019).*

6. National and/or sub-national action and conservation plans

In the following, the term "management plan" is used for any national or regional plan concerning the management and conservation of Asiatic Wild Asses and/or specifying actions or interventions concerning the species.

Country	Management plan status
China	No management plan. However, with the upgrading of Kalamaili Mountain Ungulate National Nature Reserve to Kalamaili National Park in 2022, protection for the khulan was strengthened, for this region which holds 80% of the national Asiatic Wild Ass population.
India	The Gujarat Forest Department has a 10-year management plan for the Wild ass sanctuary in Rann of Kutch. The last plan is from 2014/15 and be renewed by the Government of Gujarat in 2024/25.
Iran	A national action plan has been developed for the conservation of Onager about 2 years ago. However, the plan has not been implemented, yet.
Israel	No management plan.
Kazakhstan	No management plan.
Mongolia	A first draft of a management plan for Asiatic Wild Ass, which has been prepared by WCS Mongolia after stakeholder consultations. The draft still needs to be accepted and endorsed by the government (WCS 2023).
Turkmenistan	No management plan.
Uzbekistan	No management plan.

7. Transboundary issues and conservation priorities

Transboundary issues, like linear infrastructure, have been at the heart of CMS's Central Asian Mammals Initiative (CAMI) and have been mapped for all CAMI species in 2019 (Michel 2019). Here we focus only on those regions relevant for Asiatic Wild Asses, which are: I) Gobi region between southern Mongolia and China, II) the Ustyurt / Aralkum region shared between Kazakhstan, Uzbekistan, and Turkmenistan, III) the Kopedag range and Badhyz foothills shared between Turkmenistan, Iran, and Afghanistan, and IV) the Rann of Kutch shared between India and Pakistan (Fig. 2). These four larger geographic regions can be further broken down into 7 specific areas (Table 3).

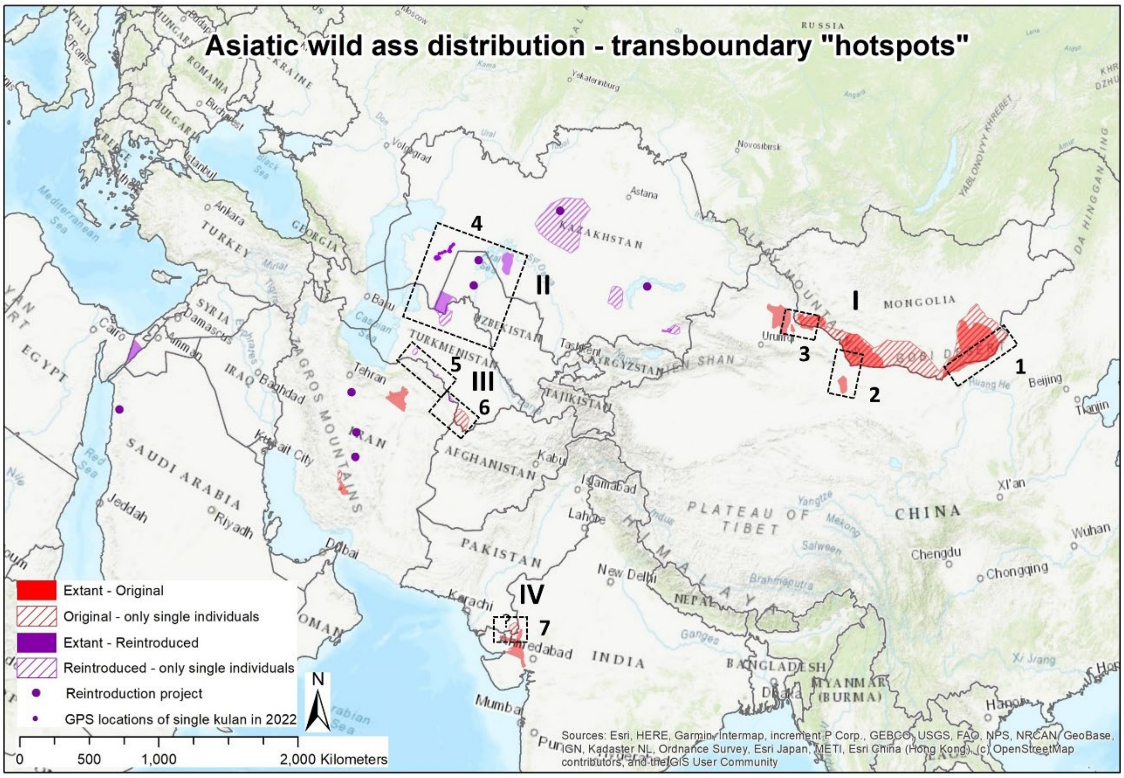

Fig. 2: Transboundary areas (dashed boxes) relevant for the management and conservation of the Asiatic Wild Ass.

Table 3: Region specific transboundary hotspots for the management and conservation of Asiatic Wild Ass.

#	Area	Countries	Protected areas	Summary assessment of the situation
I. Gobi				
1	Gobi - Eastern Alashan plateau	Mongolia - Inner Mongolian, China	**MON**: Small Gobi A & B SPA, Gun Gashuuni Khooloi Nature Reserve; **CHN**: Urad National Nature Reserve (UNR)	Border fence is an almost absolute barrier, but occasionally border breaches happen. The winter of 2022/2023 has seen a lot of Asiatic Wild Ass movement along the Mongolian - Chinese border, with larger numbers around the Zamyn Uud border crossing. Fairly small strip of remaining suitable habitat for Asiatic Wild Ass along the border. Asiatic Wild Asses have also been observed on the Chinese side.
2	Gobi - Western Alashan plateau	Mongolia - Gansu, China	**MON**: Great Gobi A SPA; **CHN**: Anxi Extreme-arid Desert National Nature Reserve (ANR)	Likely the population in ANR is isolated due to a border fence and highways and railways on the Chinese side (see Fig. 5 in: Xu et al. 2022). Restoring connectivity will be challenging but would also profit the wild camel (*Camelus ferus*).
3	Gobi - Dzungarian basin	Mongolia - Xinjiang, China	**MON**: Great Gobi B SPA (GGB); **CHN**: Kalamaili NP, Qitai Desert Grassland Nature Reserve (QNR)	Khulan movement from GGB to Baitag mountains was confirmed by two GPS collared khulan in the past. Border crossings happened in the mountains where fencing is/was absent.
II. Ustyurt				
4	Ustyurt plateau	Kazakhstan, Uzbekistan, Turkmenistan	**KAZ**: Kaplankyr – under revision, Ustyurt Zapovednik, Barsa Kelmes SNR; **UZB**: Saigachiy reserve, Sudochye-Akpetki reserve, South Ustyurt NP; **TKM**: Gaplankyr Reserve, Shasenem Sanctuary, Sarykamysh Sanctuary	Border fences have been identified as a major barrier for movement. In Turkmenistan the border fence around the "no-man's land" may currently safeguard Asiatic Wild Ass from high poaching pressure outside the border security area.
III. Kopedag range				
5	Kopedag foothills	Turkmenistan, Iran	**TKM**: Sunt Hasardag Reserve, Kopedag Reserves, Gury Howdan Sanktuary; **IRN**: Tandoureh NP & PA, (Kosh Yeilag, Touran)	The border fence of the Turkmen side constitutes a nearly absolute barrier. There is no evidence of Asiatic Wild Asses on the Iranian side and very few individuals remain on the Turkmen side in the Tersakan valley near Sunt Hasardag reserve and in Gury Howdan. The Kopedag range itself also constitutes a natural barrier to movement as the species tends to avoid steep terrain.
6	Badhyz / Meana Chacha	Turkmenistan, Iran, Afghanistan	**TKM**: Badkhyz Reserve, Gyzyljar Sanctuary, Chemenabat Sanktuary, Meana Chacha Sanctuary; **IRN**: Bagh-e-Keshmir, Tedjen protected river, Jangal-e-khajeh, (Sekohak); **AFG**: none	Likely no Asiatic Wild Ass left on the Turkmen side and none on the Iranian side. Unconfirmed rumours about Asiatic Wild Ass left in the border security zone are highly unlikely. The border to Afghanistan is politically extremely sensitive. Previously there were kulan reported in Iran along the Tedjen protected river and there was a cross-border population near Seraks.
IV. Rann of Kutch				
7	Rann of Kutch	India, Pakistan	**IND:** Wild ass sanctuary, Kutch desert sanctuary; **PAK:** Rann of Kutch sanctuary	The Asiatic Wild Ass population in India is expanding. Cross-border movements are currently impossible due to the fenced international border. It is currently unknown, if there are any Asiatic Wild Ass left on the Pakistan side (last records were from 2013).

9.1. Gobi

Gobi - Eastern Alashan plateau

The international border fence is a major barrier for movement of Asiatic Wild Asses, none out of >100 animals GPS tracked in this region has ever crossed into China. However, the border area, including the no-man's land between the Chinese and the Mongolian fence, seems an attractive grazing area.

Breaches of the fence happen occasionally, and especially in the winter 2022/23 groups of Asiatic Wild Ass have reportedly crossed into China and many Asiatic Wild Asses were observed near the Trans Mongolian Railway near Zamyn Uud border crossing since last winter (B. Buuveibaatar and D. Nandinsetseg pers. comm. 2023). At present, UNR has opened four special "green passageways" for wildlife migration, which can provide more extensive foraging and activity places for wildlife such as khulan in the border areas between China and Mongolia (W. Xu pers. comm. 2023; also see: https://baijiahao.baidu.com/s?id=1758341178802089996&wfr=spider&for=pc).

The available habitat on the Chinese side seems to be limited to a fairly narrow strip just along the border (Fig. 3). Coordination between Mongolian and Chinese conservation authorities seem to be largely lacking but would be very desirable in the future. How much the population along the border depends on immigration from Mongolia is unknown. However, with an estimated 200-300 animals, the population would be large enough to re-populate further suitable areas; immigration from Mongolia could however speed up this process.

In the past, concerns over poaching on the Chinese side were high. However, poaching seems to be only sporadic and no longer a serious threat. This is likely due to the species strict protection status which results in severe punishment of poachers (the maximum sentence is 10 years fixed-term imprisonment and a fine or confiscation of property; W. Xu pers. comm. 2023).

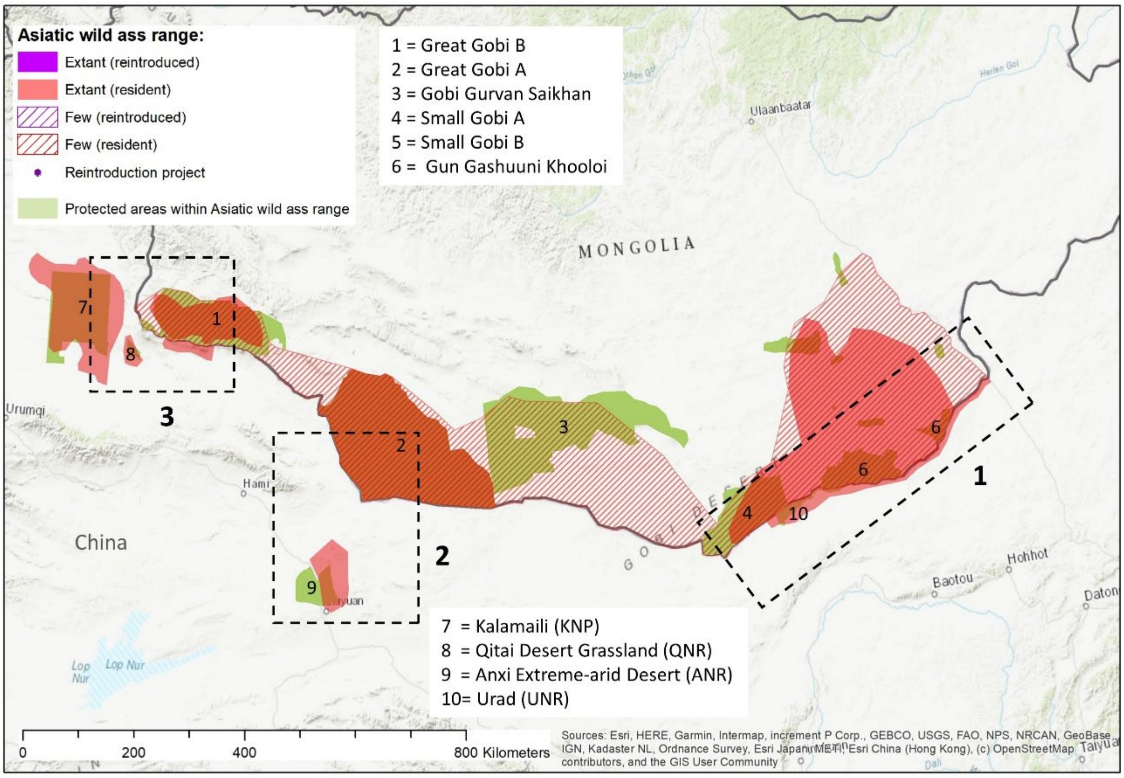

Fig. 3: Transboundary areas in the Gobi.

Gobi - Western Alashan plateau

Ideally the entire protected area complex with the two Great Gobi SPAs on the Mongolian side, and Klamaili NP, QNR and ANR could be connected via the border security zone and additional corridors where needed (Kaczensky et al. 2011b). Probably the most challenging will be re-connection of the currently isolated ANR (Fig. 3). This protected areas is already surrounded by railways on three sides and several connective roads (Xu et al. 2022). In addition, a new national highway is currently built near the border and will be opened for traffic soon.

Gobi – Dzungarian basin

Re-establishing connection between Kalamaili NP, QNR, and Baitag Mountains on the Chinese side and Great Gobi B on the Mongolian side should be first priority (Fig. 2). It would give animals access to a large area which would help to buffer the effects of potential climate extremes such as in 2001/2002, 2009/10 and most recently in 2022/23. This would not only profit Asiatic Wild Ass, but also other CMS/CAMI species such as Przewalski's horse (*Equus ferus przewalskii*), goitered gazelle (*Gazelle subgutturosa*), Argali sheep (*Ovis ammon*), snow leopard (*Unica unica*).

The areas are very close to each other and the border security zone could be used as a corridor which could be managed in close cooperation with protected area administrations. However, the border area in Xinjiang is politically sensitive and mitigation of the border fence to allow for wildlife migrations, will likely require some remote surveillance technology in order to also satisfy national security needs.

Within Mongolia, maintaining functional connection between the two Great Gobi SPAs should be a priority and will require careful planning and mitigation of existing and planned resource extraction infrastructure. Nominating the Greater Great Gobi landscapes as a World Heritage site will be an important step in this direction (the area has been on the tentative list since 2014). The good experiences made with mitigating infrastructure in Kalamaili NP could be used as a blueprint. Ideally, China will join CMS, which should facilitate cross border cooperation for the conservation of migratory species.

One additional challenge for connectivity outside of protected areas in China are fenced grazing enclosures, once erected to protect the grassland from overgrazing by livestock. With the institutional reform of the government, the rangeland management department was merged into the forestry department. Consequently, in Xinjiang province, construction of new rangeland fences has been halted and existing fences lack effective management in recent years (basically broken fences have not been repaired in recent years; W. Xu pers. comm. 2023).

9.2. Ustyurt plateau

The Ustyurt plateau is a vast dryland plateau shared by Kazakhstan, Uzbekistan, and Turkmenistan. In 2012 a population of Asiatic Wild Ass was discovered on the Uzbek side of the plateau near Sarykamysh lake (Marmazinskaya et al. 2012). This newly discovered population originates from past reintroductions on Turkmen territory in the 1980s (Kaczensky et al. 2016). However, on the Turkmen side of the Ustyurt plateau, Asiatic Wild Asses have all but disappeared so that the population in Uzbekistan, estimated at some 100-150 animals, has become the most important source for natural recolonisation of the Ustyurt plateau (Fig. 4).

However, such recolonisation is currently greatly hindered by the international border fences between the three Range States.

In the Northern Ustyurt between Kazakhstan and Uzbekistan openings have been included, that allow a certain permeability for ungulates and other larger mammals. In the southern Ustyurt similar measures are in preparation and will hopefully be implemented soon. The border between Kazakhstan and Turkmenistan and Uzbekistan and Turkmenistan are completely blocked by a double line of fences. Between Kazakhstan and Turkmenistan, the situation is even worse, as there are some openings in the border fences on the Kazakhstan side, but none in the border fence on the Turkmen side. This can result in animals becoming trapped in the no-man's-land between the two fences and perish.

On the Turkmen side, the border fence near lake Sarykamysh cuts off a ca. 100-200 km^2 piece of "no-man's land" between the unfenced Uzbek border (running along a cliff and the edge of the lake) and the border fence on the Turkmen territory. This border security zone is currently the only place where Asiatic Wild Asses are found on the Ustyurt plateau in Turkmenistan. Opening the border fence towards Turkmen territory, should not be a priority before the high poaching pressure, which has resulted in the functional extinction of the species on the Turkmen side of the Ustyurt / Gaplangyr region has been addressed (Kaczensky et al. 2019).

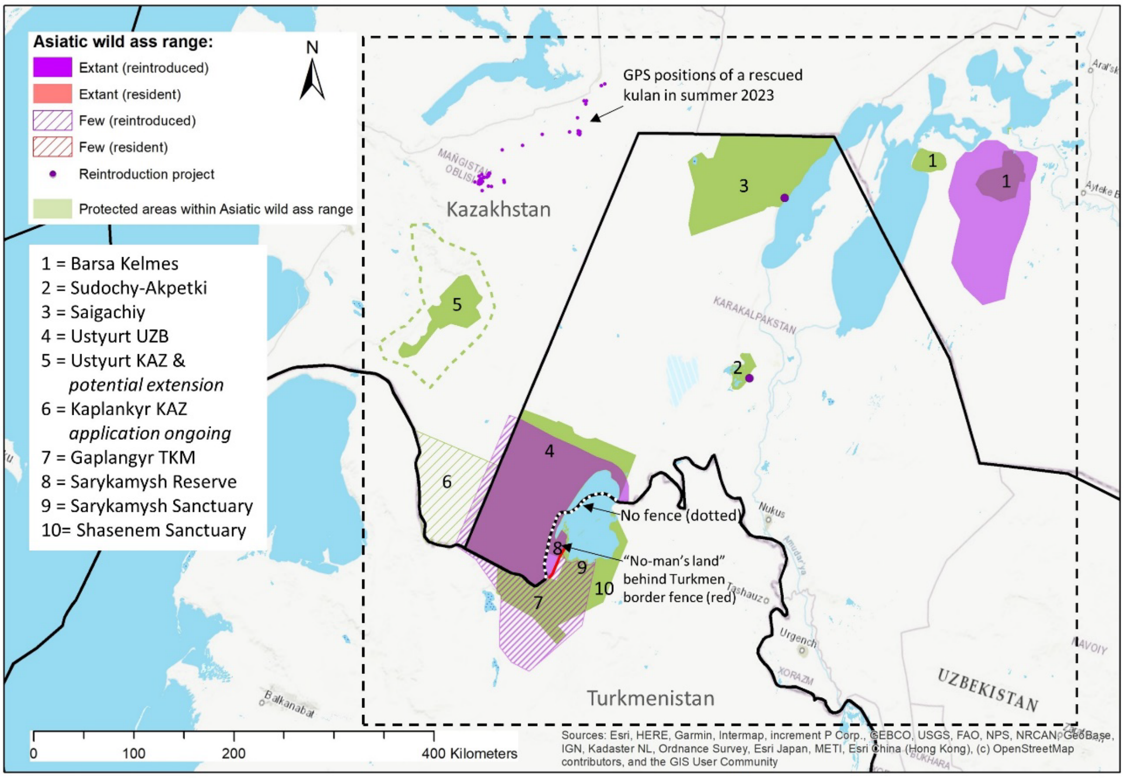

Fig. 4: Transboundary areas in the Ustyurt and Aralkum region. The dotted line shows the actual border between Uzbekistan and Turkmenistan, which is not fenced as it runs along a cliff edge and the lake in this section. The border fence on the Turkmen side goes to the lake edge and creates a ca. 100-200 km^2 "no-man's land" behind the fence and the actual border.

Poaching occurs, but does not seem to be a big threat in Uzbekistan, as this population has persisted and maintained good genetic diversity and low inbreeding (Kaczensky and Kuehn 2022). There are no permanent settlements, and only staff of S Ustyurt national park, fishermen, border security and rare visitors come into the Asiatic Wild Ass habitat. Furthermore, the meat of Asiatic Wild Ass is not popular with the local Muslim population (E. Bukova, pers. comm. 2023).

With the right protection regime in Uzbekistan and the two neighbouring countries, this population has the potential to recolonise the Ustyurt plateau. A single Asiatic Wild Ass was spotted on the Kazakh side of the border fence in the southern Ustyurt in April 2019 (Pestov et al. 2018) and a female with a foal, as well as faeces and tracks, were noted on the Uzbek side in May 2017 (Marmazinskaya et al. 2022). This area is one of the most inaccessible, least studied, and least inhabited areas in Kazakhstan’s Mangistau province and has recently been proposed for nomination as a new SNR; but approval is still pending (Pestov et al. 2022).

Conservation measures needed are mitigation of the border fences in combination with anti-poaching measures. This would not only benefit Asiatic Wild Asses and other ungulates, but also enable the expansion of the Persian leopard (*Panthera pardus*) from Turkmenistan northwards into Kazakhstan and Uzbekistan (Rosen et al. 2022; UNEP/CMS 2022). One constraint for recovery may be the extreme arid conditions and a lack of water points which may be enhanced by increasing temperatures due to climate change.

Furthermore, Asiatic Wild Asses have recently been reintroduced to Saigachiy and Sudochy-Akpetki protected areas. If successful, these animals could expand north and southward, potentially connecting the reintroduced population in Barsa Kelmes with the Ustyurt population. In 2022, a single Asiatic Wild Ass was captured by a local herder together with his horses. This animal could have stemmed from the recent reintroductions to the Saigachiy and Sudochy-Akpetki protected areas. However the conditions of the animals hooves (resembling those from Barsa Kelmes living on soft ground) and comments by the local herders that they had already seen the occasional Asiatic Wild Asses in the past (Salemgareyev et al. 2023), suggests that there still exists a movement corridor between the Ustyurt and the Aralsk or Aralkum region (Fig. 4).

9.3. Kopedag and Badhyz

Kopedag

There are only two small groups of Asiatic Wild Asses left on the Turkmen side of the border, both stem from reintroduction with animals from Badhyz in the 1980s (Kaczensky et al. 2016). The potential for natural recovery is small due to the small population size of 6 in Gury Howdan Wildlife Sanctuary and 10-15 in the Tersakan valley (Fig. 5). Poaching is not a problem in Gury Howdan, which is very close to the capital Ashgabat, but available habitat is very restricted and the animals are squeezed between forest plantations, agricultural areas, and livestock pastures (Kaczensky et al. 2019). The Tersakan valley is close to the Sunt Hasardag reserve, but currently has no special protection status.

The border to Iran is fully fenced and there is no possibility for Asiatic Wild Ass to cross. The Kopedag range itself likely acts as a natural barrier, but transboundary riverbeds could act as potential corridors if not fenced. There are no Asiatic Wild Asses left anywhere near the border on the Iranian side. The closest population is in Touran protected area network some 200+ kilometers away. In 1973 there were attempts to reintroduce Asiatic Wild Ass to Kosh Yeilag protected area with animals from Touran (Denzau and Denzau 1999); but this reintroduction did not succeed.

Distances of 200 kilometers should not be a problem for natural re-colonisation, and with an estimated 175 individuals the population has the potential to become a source for recovery. However, so far, the population in Touran has been largely stagnant with little indication of range expansion.

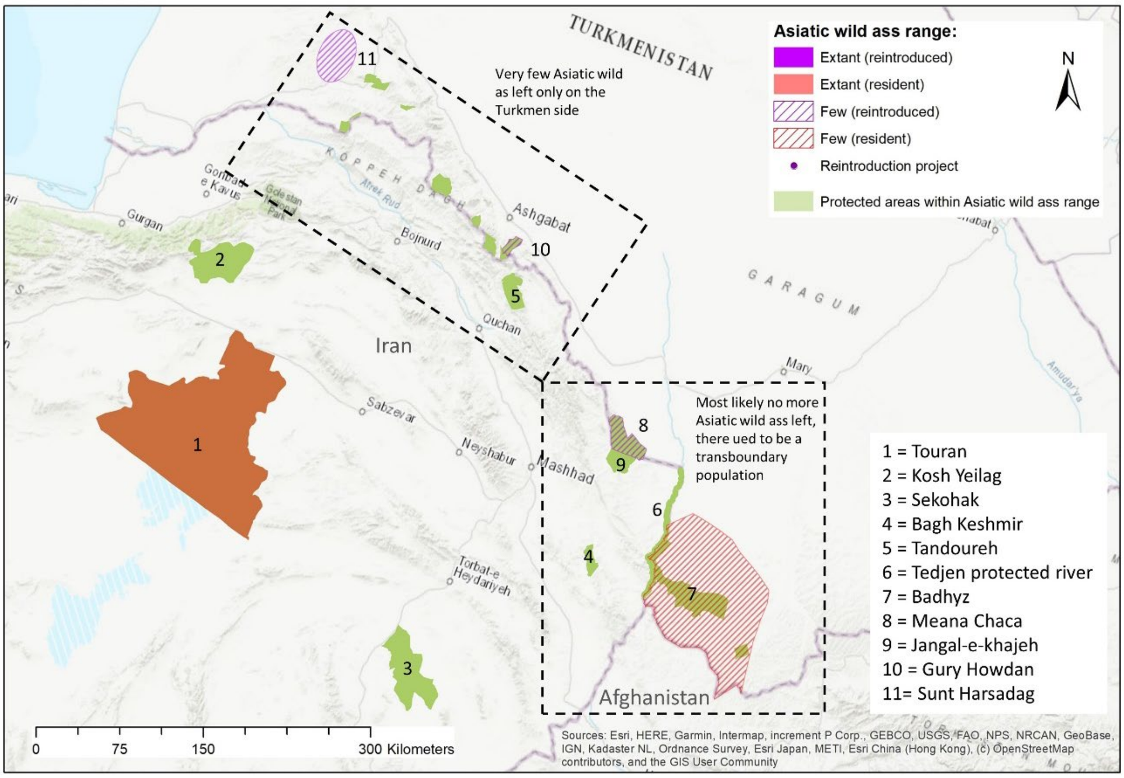

Fig. 5: Transboundary area along the Kopedag mountain range and Badhyz foothills.

Badkhyz / Meana Chacha

Likely no Asiatic Wild Asses are left on the Turkmen side and none on the Iranian side. Unconfirmed rumours about Asiatic Wild Ass left in the border security zone are highly unlikely and could not be confirmed. There are also no Asiatic Wild Asses left in Afghanistan and the border is politically extremely sensitive.

Previously, there were Asiatic Wild Ass reported in Iran along the border, namely near Seraks and along the Tedjen protected river and in Jangal-e-khajeh protected area (with last observations in 2011). Asiatic Wild Asses were also reported in the past from Bagh-e Keshmir protected area, and Dokouhak No Hunting Area.

The habitat is still there, but the Asiatic Wild Asses are gone, and natural recovery would require immigration from Touran which is over 300 kilometers away. Whether natural expansion from Touran can even be expected based on habitat suitability and barriers is currently being modelled within an ongoing PhD thesis by Azita Rezvani, Isfahan University of Technology, Isfahan under the supervision of Mahmoud-Reza Hemami.

9.4. Rann of Kutch

The Asiatic Wild Ass population in India is expanding. Cross-border movements are currently impossible due to the fenced international border, which constitutes an absolute barrier. It is currently unknown, if there are any Asiatic Wild Ass left on the Pakistan side (last records were from 2013). Furthermore, Wild Ass movements are likely made more difficult as in India, the entire region around the sanctuaries sees rapid development of linear infrastructure, the energy sector, and other development.

It is not certain if any Asiatic Wild Asses are left on the Pakistan side of the border as the last unspecified records were from 2013. If the Asiatic Wild Ass became extinct, natural recolonisation is currently blocked by the international border fence. Threats to the species in Pakistan include poaching and rapid development. Exploitation of the huge coal reserves known to be present bring the protected area under pressure of large-scale developmental activities mainly on account of Thar Coal mining. Furthermore, as many as 11 Farm to Market roads have been constructed under the Sindh Road Sector Development Programme during 2006 – 2010; all these roads pass through the Protected Area (Khan et al. 2015).

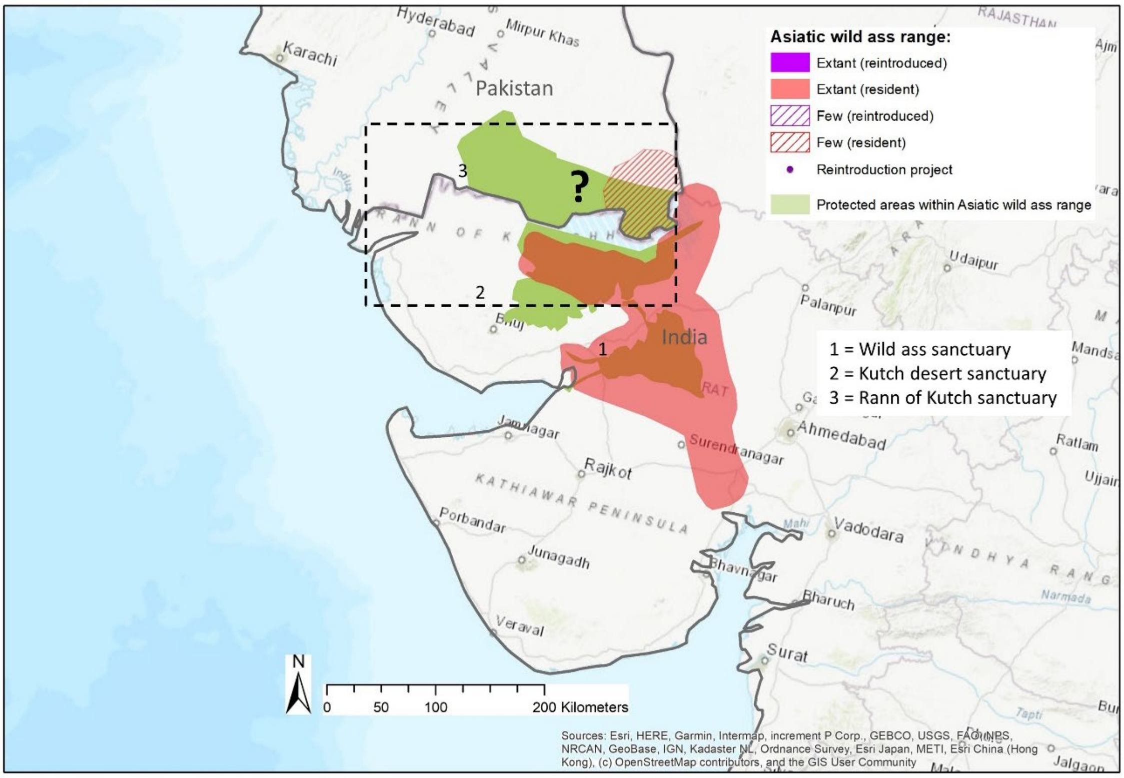

Fig. 5: Transboundary area in the Rann of Kutch.

8. Ongoing reintroduction projects and captive populations

9.1 Ongoing reintroductions

The reintroduction of Asiatic Wild Ass to Barsa Kelmes, a former island in the Aral Sea, in 1953-1964 was probably the first ever reintroduction project using a wild equid (Bannikov 1981; Kaczensky et al. 2018). Further reintroductions followed in Turkmenistan, Kazakhstan, Uzbekistan, Iran, and Israel (Kaczensky et al. 2016). Some have eventually failed, while others have succeeded in establishing populations in Barsa Kelmes and Altyn Emel in Kazakhstan, on the Ustyurt plateau in Uzbekistan and Turkmenistan, and in the Negev in Israel (Fig. 1).

In recent years (post 2000), new reintroductions were initiated, particularly in Iran, Kazakhstan, and Uzbekistan. Most recently, Saudi Arabia is planning to introduce the first Asiatic Wild Asses in 2023 (Table 4). Asiatic Wild Asses are not easy to capture in larger numbers, transport, or breed in captivity and it would therefore be desirable to compile past and ongoing experiences so that losses of animals can be minimised, and procedures optimised.

Infanticide and high aggression levels in stallions are a common problem in captive facilities. Damage to transport boxes resulting in self-injury or transport related accidents are also not uncommon. Closer cooperation between people working *ex situ* with wild populations and those working *in situ* with captive populations could only be beneficial for both sides and will likely result in better animal husbandry *in situ* and better animal welfare *ex situ* (Huber et al. 2019; Schook et al. 2016).

A major concern for safely handling Asiatic Wild Asses is the limited availability or outright ban of standard veterinary drugs for equids in several of the Range States. These restrictions make it *de facto* illegal to use the well tested etorphine based anaesthesia protocols for capture and marking of free-ranging wild equids (Walzer 2014). Alternatives may be possible, but need to be tested with wild animals under field conditions (Bohner et al. 2022). Due to the lack of state-of-the-art veterinary drugs, the capacity of veterinarians to work with wildlife is rather restricted and experienced wildlife veterinarians are desperately needed.

Table 4: Ongoing reintroduction projects with Asiatic Wild Asses. For location see # in Figure 1.

#	Country	Start	Transported	Released	Most recent population estimate	Source	Year	GPS collars	Status	Responsible agency
IRN	**Iran**									
13	Kalmand PA (Tang-e Hanne)	2010 & 2019		11 & 33	69	Captive (own breeding centers)	2023	No	Ongoing	Department of Environment (DoE)
12	Siah-Kooh NP	2019		11	15		2023	No	Ongoing	
11	Kavir NP	2018			13		2022	No	Ongoing	
KAZ	**Kazakhstan**									
2	Torgai steppe	2017	17	10	1	Wild	2023	7	Ongoing	ACBK and The Committee of Forestry and Wildlife (CFW) of the Ministry of Ecology and Natural Resources of Kazakhstan (MoENR)
3	Ily Balkash	2022	60	0	Release planned for April 2023	Wild	2023	??	Ongoing	WWF/UNDP and CFW
UZB	**Uzbekistan**									
5	Saigachiy Sanctuary (W-side of Aral lake)	2021	13	13	unknown - no systematic monitoring	Captive (Jeryan breeding center)	2023	No	??	Ministry of Natural Resources of Uzbekistan under the Cabinet of Ministers of the Republic of Uzbekistan order No. 317-F
6	Sudoch`e-Akpetki sanctuary - S of Aral lake	2021	35	35			2023	No	??	
SAU	**Saudia Arabia**									
14	Prince Mohamed bin Salman Reserve	2023	The plan is to bring the first 4 animals in 2023			Captive (EEP)			Planning	Prince Mohammed bin Salman Reserve Development Authority

9.2. Captive populations

Persian onager

In Europe, Asiatic Wild Asses are being bred in captivity under two Endangered Species Breeding Programs (EEPs), the Persian onager and the Turkmen kulan EEP. Recent genetic analysis using microsatellites supports breeding these two subspecies or ecotypes in two separate lines. Both EEP populations are very similar to the populations where their assumed founders came from and their overall genetic constitution is quite good (Kaczensky and Kuehn 2022). Hence, these two EEP populations constitute a valuable resource for reintroductions.
Currently, there are 109 Persian onagers in the EEP or the international Studbook in 13 institutions in Europe, 3 in North America, and 1 in Australia (A. Prahl, EEP coordinator at Tierpark Hagenbeck, Germany, unpubl. data 2023; Table 5). These animals originate from 15 founders captured in the wild in Iran.

Table 5: Persian onager kept in captive facilities registered in the EEP and/or International Studbook.

Captive facilities (Studbook)	Male	Female	Unknown
Persian onager - *E. h. onager*	**26**	**82**	**1**
Europe			
Zoologicka zahrada Ostrava, Czech Republic	3	13	1
Ree Park - Ebeltoft, Denmark	1	6	
Chester Zoo, England	1	5	
Parc De Lunaret, Montpellier, France	4	3	
Parc Zoologique, Le Vigen, France	1	4	
Reserve Africaine De Sigean, France		3	
Cologne Zoo, Germany		5	
Tierpark Hagenbeck - Hamburg, Germany	4	4	
Zoo Karlsruhe, Germany	1	2	
Zoologischer Garten Augsburg, Germany	1	2	
Zoologischer Garten Magdeburg, Germany	1	3	
Wildlands Adventure Zoo Emmen, Netherlands	1	6	
Bursa Zoo, Turkey		2	
North America			
Smithsonian National Zoological Park, Virginia, USA	4	9	
The Wilds, Ohio, USA	2	14	
Canyon Colorado Equid Sanctuary, Colorado, USA	0	1	
Australia			
Taronga Western Plains Zoo, Australia	2	0	

Additionally, there are 35 Asiatic Wild Asses in captivity in breeding facilities or zoos in Iran. All animals in Iran have now been separated based on their origin being either from Touran (Turkmen kulan type) or Bahram-e-Goor (Persian onager type; Table 6).

Turkmen kulan

Currently, there are 116 Turkmen kulan in the EEP or the international Studbook in 4 institutions in Asia, 26 in Europe, and 1 in North America (P. Scroka, EEP coordinator at Wroclaw Zoo, Poland, unpubl. data 2023; Table 6). These animals originate from 32 founders captured in the wild in Badhyz, Turkmenistan.

An additional 115 Turkmen kulan are kept in the Jeyran Ecocentar (5145 ha) in Uzbekistan founded in 1978. These animals originate from just 5 founders (1 stallion and 4 mares) from Barsa Kelmes (Yasinetska 2022). In Turkmenistan, 10 Turkmen kulan are kept in an enclosure near Badhyz SNR (the founders are 1 mare and 1 stallion from the Badhyz) and another 7-8 in a zoo near Ashgabat (the founders came from Badkhyz and/or Gaplangyr; S. Karryeva pers. comm. 2023).

Around 500 Turkmen kulan were present in Ukraine before the Russian invasion, the majority in Askania Nova and Azov-Syva National Nature Park. The fate of the animals in Azov-Syva National Nature Park is unknown (V. Havrylenko pers. comm. 2024). As of the beginning of 2022, there were 173 animals in Askania Nova. They originate from 15 founders (13 from Badhyz, 1 from Kyiv, 1 from Bratislava), but only 7 individuals (2 stallions and 4 mares) have been involved in reproduction and there is evidence of inbreeding such as white markings and deformities (Yasinetska 2022).

Table 6: *Turkmen kulan kept in captive facilities registered in the EEP and/or International Studbook.*

Captive facilities (Studbook)	**Male**	**Female**	**Unknown**
Turkmen kulan - *E. h. kulan*	**34**	**82**	
Asia			
Yerevan Zoo, Armenia	2	1	
Chimkent Zoo, Kazakhstan	1	0	
Karagandinskii Zoopark, Kazakhstan	2	0	
Tashkent zoo, Uzbekistan	1	1	
Europe			
Grodznenski Dzyarzhauny Zaalagichny Park, Belarus	1	0	
Zooloski vrt Zagreb, Croatia	0	2	
Zoologická a botanická zahrada Plzen, Czech Republic	2	3	
Tallinn Zoo, Estonia	3	9	
Parc Animalier d'Auvergne, France	1	2	
Parc Zoologique Et Botanique Mulhouse, France	0	2	
Korkeasaari Zoo, Helsinki, Finland	0	2	
Tierpark Berlin-Friedrichsfelde, Germany	1	6	
Tierpark Chemnitz, Germany	0	2	
Serengeti-Park Hodenhagen, Germany	0	10	
Pforzheim, Germany	0	1	
Tierpark Stroehen, Wagenfeld, Germany	0	6	
Tierpark Floersheim, Wiesbaden, Germany	3	1	
Tiergarten der Stadt Nürnberg, Germany	2	6	
Rostock Zoologischer Garten, Germany	0	3	

Miskolci Városgazda, Hungary	1	2	
Rome Zoo, Italy	1	0	
Borysew Zoo - Poland	1	0	
Park i Ogrod Zoologiczny, Krakow, Poland	2	3	
Ogród Zoologiczny Opole, Poland	1	2	
Rostov-on-Don Zoo, Russia	0	1	
Zoologicka Zahrada Bratislava, Slovakia	1	3	
Zoologicka Zahrada Kosice, Slovakia	2	3	
Kolmardens Djurpark, Sweden	4	9	
Karkov Zoo, Ukraine	0	2	
Nikolaev Zoo, Ukraine	1	0	
North America			
Fund for Animals' Black Beauty Ranch	1	0	

Indian khur

The Indian khulan captive population was established in 1958. Sakkar Baugh Zoo (SBZ) in Junagadh, Gujarat is the coordinating zoo for the Conservation Breeding Programme (CBP) for *E.h. khur* following an initiative by the Central Zoo Authority (an autonomous body under Ministry of Environment, Forests & Climate Change (MoEFCC). In 2018, only two zoos (Sakkar Baugh Zoo, Junagadh and Arignar Anna Zoological Park, Chennai) had a total of 15 Indian khur (Nigam et al. 2018). In 2021-2022, the number had decreased to 11 animals in three zoos (Central Zoo Authority 2022, Table 7).

The population was founded with 53 wild captured animals of which 14 contributed to the population. However, all current 15 *E.h. khur* go back to only four founders and have a mean kinship of 0.22. The small size of the living populations, despite the majority of specimens being of reproductive ages, limits the likelihood of the populations achieving conservation goals (Nigam et al. 2018). Captive recruitment is poor due to poor foal survival in captivity (N. Shah pers. obs.).

Table 7: *Indian khur kept in captive facilities registered in the National StudBook.*

Captive facilities (Studbook)	Male	Female	Unknown
Indian - *E. h. khur*	**6**	**5**	
India			
Sakkar Baugh Zoo, Junagadh	2	4	
Arignar Anna Zoological Park, Chennai	1	2	

9. Ongoing larger research projects & recent publications

In the following we list ongoing research and monitoring projects in the Range States and list the most recent publications (last 5 years, ≥2018) focussing on Asiatic Wild Ass.

11.1. China

- Study on the impact of major development projects on wildlife activities and habitats in Xinjiang. Projects from NSFC.
- Population and Multi-Scale Habitat Selection of Mongolian Wild Ass in the Dzungarian Desert. Projects from NSFC.

Xu, W., Liu, W., Ma, W., Wang, M., Xu, F., Yang, W., Walzer, C., Kaczensky, P., 2022. Current status and future challenges for khulan (*Equus hemionus*) conservation in China. Global Ecology and Conservation 37.

Zhuo, Y., Xu, W., Wang, M., Chen, C., da Silva, A.A., Yang, W., Ruckstuhl, K.E., Alves, J., 2022. The effect of mining and road development on habitat fragmentation and connectivity of khulan (*Equus hemionus*) in Northwestern China. Biological Conservation 275.

11.2. Iran

- Modelling Asiatic Wild Ass habitat and connectivity
- Understanding and addressing conflicts over Asiatic Wild Ass in Bahram-e-Goor protected area
- Reintroduction of Asiatic Wild Ass

Esmaeili, S., Hemami, M.R., Goheen, J.R., 2019. Human dimensions of wildlife conservation in Iran: Assessment of human-wildlife conflict in restoring a wide-ranging endangered species. PLoS ONE 14, e0220702.

Mohammadi, A., Nayeri, D., Alambeigi, A., Glikman, J.A., 2023. Evaluation of motorist's perceptions toward collision of an endangered large herbivore in Iran. Global Ecology and Conservation 41.

Mohammadi, A., Almasieh, K., Wan, H.Y., Nayeri, D., Alambeigi, A., Ransom, J.I., Cushman, S.A., 2021. Integrating spatial analysis and questionnaire survey to better understand human-onager conflict in Southern Iran. Sci Rep 11.

Walzer, C., Kaczensky, P., Reza-Hemami, M., Petit, T., Ekrami, B., Zuther, S., Salemgareev, A., Linnell, J., 2018. Coral Capture and Anesthesia of Asiatic Wild Ass in Iran and Kazakhstan. Wildlife Disease Association - 67th Annual International Conference, August 5 - 10, 2018 in St. Augustine, FL, USA.

11.3. India

- Monitoring Asiatic Wild Ass in the Little and Great Rann of Kutch
- Genetic monitoring
- Disease monitoring
- Preparation of an action plan for Asiatic Wild Ass outside the Wild as sanctuary

Barman, B.B., Shah, N., Prasad, A., Sanyal, A., Chavda, V., Qureshi, Q., 2021. Monitoring Spatial and Seasonal Abundance of Indian Wild Ass (Equus hemionus khur) in Little Rann of Kutch Landscape, Western India. Journal of Ecophysiology and Occupational Health 21, 29033.

Khaire, D., Atkulwar, A., Farah, S., Baig, M., 2017. Mitochondrial DNA analyses revealed low genetic diversity in the endangered Indian Wild Ass Equus hemionus khur. Mitochondrial DNA A DNA Mapp Seq Anal 28, 681-686.

Pandit, S.J., Vora, U., Shah, N., Shah, Y., 2020. 9th Wild Ass Population Estimation-2020. Final Report, Forest Department, Gujarat, India.

Pokharia, A.K., Basumatary, S.K., Thakur, B., Tripathi, S., McDonald, H.G., Tripathi, D., Tiwari, P., Van Asperen, E., Spate, M., Chauhan, G., Thakkar, M.G., Srivastava, A., Agarwal, S., 2022. Multiproxy analysis on Indian Wild Ass (Equus hemionus khur) dung from Little Rann of Western India and its implications for the palaeoecology and archaeology of arid regions. Review of Palaeobotany and Palynology 304.

11.4. Israel

- Monitoring and population genetics

Greenbaum, G., Renan, S., Templeton, A.R., Bouskila, A., Saltz, D., Rubenstein, D.I., Bar-David, S., 2018. Revealing life-history traits by contrasting genetic estimations with predictions of effective population size. Conserv Biol 32, 817-827.

Renan, S., Speyer, E., Ben-Nun, T., Ziv, A., Greenbaum, G., Templeton, A.R., Bar-David, S., Bouskila, A., 2018. Fission-fusion social structure of a reintroduced ungulate: Implications for conservation. Biological Conservation 222, 261-267.

Zecherle, L.J., Bar-David, S., Nichols, H.J., Templeton, A.R., Hipperson, H., Horsburgh, G.J., Brown, R.P., 2020. Landscape resistance affects individual habitat selection but not genetic relatedness in a reintroduced desert ungulate. Biological Conservation 252.

Zecherle, L.J., Nichols, H.J., Bar-David, S., Brown, R.P., Hipperson, H., Horsburgh, G.J., Templeton, A.R., 2021. Subspecies hybridization as a potential conservation tool in species reintroductions. Evolutionary Applications.

11.5. Kazakhstan

- Drone surveys to estimate population size of Asiatic Wild Asses and goitered gazelles in Altyn Emel and Barsa Kelmes.
- Monitoring of reintroduced Asiatic Wild Asses in the Torgai steppe and in the source populations in Altyn Emel NP and Barsa Kelmes Reserve.
- Monitoring wildlife along the border fence on the Ustyurt plateau.
- Population genetics of Asiatic Wild Asses in central Asia and of the captive EEP population.
- Reintroduction of Asiatic Wild Asses to Ily Balkash region (https://www.undp.org/kazakhstan/stories/wildlife-kazakhstan-iconic-heritage-future-generations)

Gliga, D.S., Petrova, N., Linnell, J.D.C., Salemgareyev, A.R., Zuther, S., Walzer, C., Kaczensky, P., 2020. Dynamics of Gastro-Intestinal Strongyle Parasites in a Group of Translocated, Wild-Captured Asiatic Wild Asses in Kazakhstan. Frontiers in Veterinary Science - Brief Research Report 7, 598371.

Huber, N., Marasco, V., Painer, J., Vetter, S.G., Göritz, F., Kaczensky, P., Walzer, C., 2019. Leukocyte Coping Capacity: An Integrative Parameter for Wildlife Welfare Within Conservation Interventions. Frontiers in Veterinary Science 6, 105.

Kaczensky, P., Kovtun, E., Habibrakhmanov, R., Hemami, M.-R., Khaleghi, A., Linnell, J.D.C., Rustamov, E., Sklyarenko, S., Walzer, C., Zuther, S., Kuehn, R., 2018. First population-level genetic analysis of free-ranging Asiatic Wild Ass populations in Central Asia - implications for conservation. Conservation Genetics 19, 1169–1184.

Kaczensky, P., Salemgareyev, A.R., Zuther, S., Suttibayev, M., Adilbekova, F., Linnell, J.D.C., 2020. Reintroduction of kulan into the central steppe of Kazakhstan: Field Report for 2018-2019. NINA report 1782.

Kaczensky, P., Salemgareyev, A., Linnell, J.D.C., Zuther, S., Walzer, C., Huber, N., Petit, T., 2021. Post-release Movement Behaviour and Survival of Kulan Reintroduced to the Steppes and Deserts of Central Kazakhstan. Frontiers in Conservation Science 2, 703358.

Pestov, M.V., Dietrich, T., Terentyev, V.A., Nurmukhambetov, Z.E., Mukhashov, A.T., 2018. The problem of border wire fences that impede migration ungulates, in the Mangystau region of the Republic of Kazakhstan and ways to solve it. Selevinia 26, 92-98 [in Russian].

Salemgareyev, A., Kaczensky, P., Putilin, A., 2022. «Reintroduction of kulan into the central steppe of Kazakhstan» Annual report 2021. Project report. DOI: 10.13140/RG.2.2.17040.07683

11.6. Mongolia

- Oyu Tolgoi’s Core Biodiversity Monitoring Program (Asiatic Wild Ass collaring and other related activities – ground-based population surveys, foal counts, carcass monitoring, passive acoustic monitoring at waterpoints for poaching pressure, population modelling - started as early as 2012 and have been mainly implemented by WCS Mongolia)
- Analysis of khulan GPS tracking data to identify suitable habitat and quantify barriers to movement.
- Development of the first Khulan Management plan for Mongolia
- Simultaneous point counts using distance sampling over the expanse of the GGB every 5 years
- Feeding ecology

Burnik Šturm, M., Smith, S., Ganbaatar, O., Buuveibaatar, B., Balint, B., Payne, J.C., Voigt, C.C., Kaczensky, P., 2021. Isotope analysis combined with DNA barcoding provide new insights into the dietary niche of khulan in the Mongolian Gobi. PLoS ONE 16, e0248294.

Lkhagvasuren, D., Batsaikhan, N., Fagan, W.F., Ghandakly, E.C., Kaczensky, P., Müller, T., Samiya, R., Schafberg, R., Stubbe, A., Stubbe, M., Ansorge, H., 2017. First assessment of the population structure of the Asiatic Wild Ass in Mongolia. European Journal of Wildlife Research 64, https://doi.org/10.1007/s10344-10017-11162-x.

Kaczensky, P., Khaliun, S., Payne, J., Boldgiv, B., Buuveibaatar, B., Walzer, C., 2019. Through the eye of a Gobi khulan – Application of camera collars for ecological research of far-ranging species in remote and highly variable ecosystems. PLoS ONE 14, e0217772.

Kaczensky, P., Buuveibaatar, B., Payne, J.C., Strindberg, S., Walzer, C., Batsaikhan, N., Bolortsetseg, S., Victurine, R., Olson, K.A., 2020. A conservation strategy for khulan in Mongolia: background and key considerations. NINA report 1889.

Payne, J., B. Buuveibaatar, D. Bowler, K. Olson, C. Walzer and P. Kaczensky. 2020. Hidden treasure of the Gobi: understanding how water limits range use of khulan in the Mongolian Gobi. Scientific Reports. 10: 2989.

Soilemetzidou, E.S., de Bruin, E., Eschke, K., Azab, W., Osterrieder, N., Czirjak, G.A., Buuveibaatar, B., Kaczensky, P., Koopmans, M., Walzer, C., Greenwood, A.D., 2020. Bearing the brunt: Mongolian khulan (*Equus hemionus hemionus*) are exposed to multiple influenza A strains. Vet Microbiol 242, 108605.

Sugimoto, T., Ito, T.Y., Taniguchi, T., Lkhagvasuren, B., Oyunsuren, T., Sakamoto, Y., Yamanaka, N., 2018. Diet of sympatric wild and domestic ungulates in southern Mongolia by DNA barcoding analysis. Journal of Mammalogy 99, 450-458.

Vogler, T., Altansukh, N., Ganbaatar, O., Sukhbaatar, D., Devineau, O., Kaczensky, P., 2023. Steppe ungulate count in Great Gobi B Strictly Protected area 2022. INN Oppdragsrapport 3-2023. https://hdl.handle.net/11250/3050225

Wildlife Conservation Society (WCS). 2021a. Population abundance and distribution of ungulates in the Southern Gobi. Report prepared for the Oyu Tolgoi LLC under Core Biodiversity Monitoring Programme.

Wildlife Conservation Society (WCS). 2021b. Foaling rates of khulan population in the South-eastern Gobi, Mongolia. Annual report prepared for the Oyu Tolgoi LLC.

11.7. Turkmenistan

- Camera trapping in Badhyz, Kaplankyr, and Tersakan valley
- Rapid assessments
- Genetic analysis
- Awareness raising
- GEF project in the Aral basin 2022-2027 which includes also capacity building and monitoring of ungulates in the Gaplangyr State Nature Reserve

Kaczensky, P., Linnell, J.D.C., 2015. Rapid assessment of the mammalian community of the Badhyz Ecosystem, Turkmenistan, October 2014. Norwegian Institute for Nature Research, NINA Report 1148.

Kaczensky, P., Kovtun, E., Habibrakhmanov, R., Hemami, M.-R., Khaleghi, A., Linnell, J.D.C., Rustamov, E., Sklyarenko, S., Walzer, C., Zuther, S., Kuehn, R., 2018. First population-level genetic analysis of free-ranging Asiatic Wild Ass populations in Central Asia - implications for conservation. Conservation Genetics 19, 1169–1184.

Kaczensky, P., Rustamov, E., Karryeva, S., Iankov, P., Hudaykuliev, N., Saparmyradov, J., Veyisov, A., Shestopal, A., Mengliev, S., Hojamyradov, H., Potaeva, A., Kurbanov, A., Amanov, A., Khekimov, G., Tagiyev, C., Rosen, T., Linnell, J.D.C., 2019. Rapid assessments of wildlife in Turkmenistan 2018. NINA report 1696, Trondheim, Norway.

Kaczensky, P., Kuehn, R., 2022. Genetic characterisation of the Turkmen kulan and Persian onager EEP as a basis for future in situ and ex situ conservation strategies. Project Report, Inland Norway University of Applied Sciences.

Rustamov, E.A., Kaczensky, P., Saparmuradov, J., 2015. Asiatic Wild Ass on the brink of extinction and its conservation in Turkmenistan. Pages 98-108 in: Vasilevich F.I., Spitsin V.V., Popov S.V., Ostapenko V.A. (Eds). Modern Problems of Zoology, Ecology and Conservancy. Eurasian Regional Association of Zoos and Aquariums, The Moscow State Zoological Park, Moscow State Academy of Veterinary Medicine and Biotechnology, Moscow, Russia. [in Russian with English abstract].

11.8. Uzbekistan

- Central Asian Desert Initiative (CADI) project (https://www.succow-stiftung.de/en/protected-areas-biosphere/central-asia-central-asian-desert-initiative-cadi)
- Monitoring
- Reintroduction with Asiatic Wild Asses from Jeyran Ecocenter, Uzbekistan

Bykova E.A., Marmazinskaya N.V., Esipov A.V., Gritsyna M.A. Brief review of the state of rare ungulates in Uzbekistan. 2020. “Ecosystems of Central Asia: research, conservation, rational use”. Pages 199-205 in Materials of the XV Ubsunur International Symposium (Kyzyl, July 5-8, 2020) / ed. Ch. N. Sambyla. Offset Publishing House, Krasnoyarsk. (In Russian)

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Appendix 1: Experts directly involved in the draft action plan.

Name	Affiliation	Range State	Focal topic
Bayarbaatar Buuveibaatar	Wildlife Conservation Society (WCS) Mongolia	Mongolia	
Nandintsetseg Dejid	Senkenberg Biodiversity and Climate Research Center (SBiK-F), Frankfurt	Mongolia	Movement ecology
Weikang Yang	Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi	China	
Wenxuan Xu	Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi	China	
Elena Bykova	Institute of Zoology, Uzbek Academy of Sciences, Tashkent	Uzbekistan	
Natalya Marmazinskaya	Institute of Zoology, Uzbek Academy of Sciences, Tashkent	Uzbekistan	
Albert Salemgareev	Association for the Conservation of Biodiversity of Kazakhstan (ACBK)	Kazakhstan	
Shirin Karryeva	CEPF/CLLC Project Manager, Ashgabat	Turkmenistan	
Mahmoud-Reza Hemami	Department of Natural Resources, Isfahan University of Technology, Isfahan	Iran	
Amosh Bouskila	Dept. of Life Sciences, Ben-Gurion University of the Negev, Beer Sheva	Israel	
Nita Shah	Independent expert, c/o Wildlife Institute of India, Dehra Dun	India	
Qamar Qureshi	Wildlife Institute of India, Dehra Dun	India	
Sarah King	IUCN Equid specialist group, Colorado State University, Fort Collins, USA		IUCN Equid specialist group
Patricia Moehlman	IUCN Equid specialist group		IUCN Equid specialist group
Petra Kaczensky	IUCN Equid specialist group, CMS Asiatic wild ass focal point	Mongolia, Kazakhstan, Turkmenistan	Movement ecology & monitoring
Chris Walzer	WCS		One Health
Adriana Prahl	EEP Persian Onager coordinator; Tierpark Hagenbeck Hamburg		Captive breeding
Rustam Murzakhanov	CADI project, Michael Succow Foundation	Uzbekistan, Kazakhstan, Turkmenistan	Winter cold deserts Transboundary issues
Jens Wunderlich	CADI project Michael Succow Foundation	Uzbekistan, Kazakhstan, Turkmenistan	Winter cold deserts Transboundary issues

Appendix 2: Related Activities from CMS CAMI PoW relevant for Asiatic wild ass.

Vision Secure and viable populations of migratory mammals that range across the landscapes of Central Asia in healthy ecosystems, are valued by, and bring benefits to, local communities and all stakeholders.		
Goal To improve the conservation of migratory large mammals and their habitats in the Central Asian region by strengthening coordination and cross-border cooperation.		
Part I. Cross-cutting Measures		
1. Transboundary Cooperation	**Responsible**	**Priority**
1.1 Develop an understanding and make best use of political processes, specifically: a) CMS to coordinate a review of the formal processes within each Range State concerning adoption of transboundary conservation agreements; and b) Highlight areas where CMS and other conservation partners can have an influence.	CMS, Government agencies	Medium
1.2. Build on existing agreements, specifically: a) Use the Transboundary Hotspots study to identify entry-points for enhanced cooperation with other existing Multilateral Environmental Agreements (MEAs), governmental/multi-partner agreements and platforms in the CAMI region; b) Partner with and integrate migratory species conservation into relevant MEAs; c) Explore the possibility to strengthen cooperation between CITES and CMS on CAMI similar to the Joint CITES-CMS African Carnivores Initiative; d) Partner with ongoing processes on Other Effective Area Based Conservation Measures (OECMs) such as CBD and IUCN working groups with a view to integrating CAMI; e) Promote regular exchange between National Focal Points of CMS and other relevant MEAs.	CMS, INGOs, NGOs, relevant MEAs and international fora, Government agencies	Medium
1.3 Implement the recommendations outlined in the Transboundary Hotspots study, specifically a) Continue the process to highlight priority sites; b) Identify stakeholders and crucial actors for all identified hotspots; c) Establish working groups for each of the proposed priority sites to elaborate work streams for establishing transboundary cooperation as appropriate; d) Carry out targeted workshops for priority sites identified in the study; e) Encourage countries to set up Memoranda of Understanding or Agreements for the conservation of those priority sites; f) Review and update the Transboundary Hotspots study for the next CAMI Range State Meeting.	CMS, IUCN, Government agencies, NGOs, GSLEP	High

1.4 Build on and enhance scientific and working level collaboration, specifically: a) Continue promoting formal and informal collaboration through scientific working groups and conferences; b) Encourage cooperation at field and working level on survey, research, monitoring and management as well as for study tours and exchange visits.	CMS, all NGOs with presence across relevant countries, Scientific institutions	High/ Medium
1.5 Increase awareness about the benefits of transboundary cooperation among governments and stakeholders.	CMS, Government agencies, NGOs	High
1.6 Use the existing knowledge and experience available to advance transboundary cooperation, e.g. taking into account the IUCN diagnostic tool for analysing the feasibility of setting up Transboundary Conservation Areas (TBCA).	CMS, Government agencies, NGOs	Medium
1.7. Foster the development of transboundary solutions to facilitate the removal and / or mitigation of border fences.	CMS, Government agencies, NGOs	High
1.8 Urge all CAMI Range States to become a contracting Party to CMS and CITES.	CMS, Government agencies	High

2. Illegal Hunting, Possession and Trade	**Responsible**	**Priority**
2.1 Promote the review of national legislation (in line with the CMS National Legislation Programme) and its enforcement with regard to illegal hunting, possession and trade (including relevant penalties, the simplification of prosecution, bonus payment mechanisms to create adequate incentives for enforcement personnel and reinvest fines in conservation, enforcement powers of rangers and recognition of cybercrime) and compliance with CITES.	Government agencies, NGOs	High
2.2 Increase and strengthen the technical capacity of rangers and other relevant enforcement personnel to counteract illegal hunting, possession and trade, including by providing the appropriate equipment to address it (see also 7.5).	Government agencies, NGOs	High
2.3 Promote the use of new technologies, methods and tools for enforcement (including use of SMART (Spatial Monitoring and Reporting Tool), wildlife detection dogs, risk assessments).	Government agencies, Scientific institutions	High/ medium
2.4. Improve inter-agency communication and cooperation (i.e. multi-agency task forces) at the national and regional levels concerning scientific, management and enforcement issues (e.g. through the development of a Wildlife Enforcement Network and greater cooperation with Customs, Border Control, Police and Judiciary).	Government agencies, NGOs	High/ medium
2.5 Promote information exchange mechanisms across range, transit and consumer states to counteract illegal hunting, possession and trade and, *inter alia,* ensure adequate information is available on trophy hunting regulations.	Government agencies, NGOs, TRAFFIC (tbc), CITES (tbc)	High/ Medium
2.6 Secure support by local communities for addressing illegal hunting, possession and trade through outreach and development of "citizen/informant networks".	Government agencies, NGOs, TRAFFIC (tbc), CITES (tbc)	High
2.7 Promote cooperation between relevant agencies to improve access to and take action against illegal hunting, possession and trade information on the internet.	Government agencies, NGOs	Medium

2.8 Foster and promote community and incentive-based approaches to combat the underlying causes of illegal hunting (see also section 5).	Government agencies, NGOs	High

3. Industry and Infrastructure Development / Barriers to Movement	**Responsible**	**Priority**
3.1 Continually update and further develop the Central Asian Mammals Migration and Linear Infrastructure Atlas, specifically a) Include the whole CAMI region to cover countries that have not yet been considered; b) Integrate the most up-to-date and accurate information available to further refine the information and maps contained in the Atlas (see 3.2); c) Develop the Atlas into an interactive online tool that is easy to access and used by decision-makers, infrastructure developers, investors and other relevant stakeholders, d) Establish a working group to support the maintenance and further development of the Atlas, its dissemination and the raising of necessary funding.	CMS, Government agencies, NGOs, Scientific institutions	High
3.2 Update and standardize geographical information knowledge about species and landscapes necessary to inform risk management strategies of infrastructure developers and investors, specifically: a) Update and develop where necessary: i. common standards for GIS and maps; ii. distribution maps (layers) per country per CAMI species; iii. maps of key areas and nationally and internationally designated important areas such as protected areas, Key Biodiversity Areas (KBAs), and OECMs, as well as areas of importance for community-based sustainably used natural resources; iv. species-specific connectivity and corridor maps; v. layers on existing and planned potential barriers; b) Develop species-specific factsheets (including behaviour, ecology, key ecological needs); c) Integrate the information into the CAMI Atlas and the process outlined under 3.1; d) Identify knowledge gaps and initiate targeted applied research.	Government agencies, National scientific institutions, NGOs, CMS, UNEP	High (a, b, c) Medium (d)
3.3 Develop horizon scanning approaches to enable CAMI partners to look at trends in investment and determine where future infrastructure development is likely to occur, in order to be able to tackle it at the early planning stage, specifically a) Compile information from multi-sectoral spatial planning and climate change impact modelling; b) Promote discussions with infrastructure development stakeholders to understand their information requirements when developing risk management plans.	Government agencies, Scientific institutions, NGOs	High

3.4 Increase awareness and knowledge sharing on barriers to migration, specifically: a) Publicize information to the broad public on the benefits from migratory species, the environmental and socio-economic costs of poorly planned infrastructure and possible solutions to encourage citizen engagement and empowerment; b) Promote using the CAMI Migration Atlas to inform governments, developers, environmental impact assessments (EIA) groups and other relevant stakeholders when planning infrastructure projects and developing risk management strategies (see 3.1); c) Raise awareness of the impact and mitigation options to planners and infrastructure industry thereby influencing the location and design of infrastructure to minimize their impacts; d) Encourage decision makers to mainstream sustainable landscape management into key economic sector planning.	CMS, Government agencies, National scientific institutions, NGOs, mass-media	High
3.5 Promote the knowledge and application of mitigation solutions implemented in the CAMI region, specifically: a) Compile the available information on mitigation solutions for specific cases, species, landscape and type of barrier in the CAMI region; b) Include and update information about mitigation measures and hierarchies in the CAMI Atlas (see 3.1); c) Document and monitor impacts and effectiveness of mitigation solutions and update accordingly the mitigation hierarchy guidelines; d) Engage academics to incorporate mitigation measure in relevant study courses (e.g. civil engineering); e) Make maps (GIS) available at national, bilateral and regional level (see 3.2); f) Mitigate the impacts of existing or unavoidable linear infrastructure where feasible and following the mitigation hierarchy (avoid, minimize, mitigate, offset).	CMS, Government agencies, National scientific institutions, NGOs, private sector	High
3.6 Engage with governments, financial organizations and companies developing infrastructure, specifically: a) Develop and implement national infrastructure mitigation standards using the CMS infrastructure guidelines for Central Asia; b) Encourage national and bilateral multi-agency consultation on border fences (including border security agencies, customs, ministries of foreign affairs, environmental / wildlife agencies and transboundary protected areas), where feasible; c) Establish national multi-agency task force on big infrastructure projects (i.e. transportation and other relevant ministries); d) Integrate migratory species conservation into national EIA regulations and implementation as well as into the requirements of international financing institutions; e) Engage with lender / finance organizations and governments and urge them to make CAMI species-friendly infrastructure planning mandatory, and the application of EIAs standard criteria for migratory species for approval of proposed investments obligatory; f) Urge companies that develop infrastructure in target landscapes to adopt best practices in line with CMS infrastructure guidelines and allocate funds for conservation as part of their mitigation or off-setting plans; g) Encourage adherence to International Finance Corporation Performance Standard 6 (IFC PS6) and other existing international standards in relation to all planned developments.	CMS, Government agencies, National scientific institutions, NGOs, private sector	High/ medium

4. Overgrazing and Livestock Competition	**Responsible**	**Priority**
4.1 Undertake research on pasture productivity and suitability, disease impacts, grazing and livestock management, extent and scale of standing herds as investments, feasibility of traditional pastoralism, livestock vs. soil / rangeland carbon sequestration, wildlife conflicts, effects of climate change and seasonal use and disseminate the results to relevant managers.	Government agencies, Scientific Institutions, NGOs	High
4.2 Review and modify existing grazing norms (both legal and customary) based on carrying capacity and critical wildlife habitat (see also 6.1).	Government agencies, Scientific Institutions, NGO's	High
4.3 Identify routes to enact mechanisms that will encourage livestock owners to invest in quality (breeds promotion, herd health, added-value livestock products, productivity) rather than quantity.	Government agencies, NGOs	High
4.4 Develop and promote awareness and educational programmes among herding communities on wildlife protection, conflict resolutions, and the unintended impact of livestock intensification.	NGOs, Government agencies (e.g. education ministries)	High
4.5 Promote a range of strategies (e.g. alternative livelihoods, temporary no-grazing, etc.) in herding communities to reduce livestock numbers and focus on livestock as their main asset.	NGOs, Government agencies, Businesses	High
4.6 Establish joint working groups with relevant organizations, including pastoralist communities, to address pasture use and wildlife protection issues.	Government agencies facilitated by NGOs	High
4.7 Create incentive mechanisms for members in the herding communities residing near wildlife and / or protected areas / ecological corridors to become community rangers (see also 5.1, 5.8 and 5.11).	Government agencies, local communities, NGOs	High
4.8 Explore options to minimize livestock grazing on wildlife migration routes (where possible).	Government agencies, Scientific Institutions, NGOs, herders, local communities	High
4.9 Encourage livestock owners to insure their livestock against natural disasters and discourage them from killing wildlife in times of heavy livestock losses.	Government agencies, Insurance sector, NGOs	Medium
4.10 Introduce certification schemes for livestock products originating from sustainably managed rangelands.	Government agencies, NGOs	Medium
4.11. Support the vaccination of livestock and herder dogs against transmissible diseases to wildlife sharing the same landscape.	Government agencies, NGOs, local communities, herders	High
4.12 Explore methods to control and reduce numbers of free-ranging herder and feral dogs and their impact on wildlife populations.	Government agencies, NGOs, local communities, herders	High
4.13 Implement and promote the use of conflict reduction methods to avoid wildlife-livestock conflicts.	Government agencies, NGOs, local communities, herders, Scientific Institutions	High

4.14 Design grazing rangeland management plans based on scientific research and with involvement of local communities outside of protected areas.	Govern NGOs,
4.15 Promote community-based pasture management to increase ownership and responsibility for the protection of pastures by local communities.	Govern NGOs, herders Institut

5. Community Engagement and Sustainable Use	**Respo**
5.1 Promote sustainable livelihood schemes linked to conservation and local conditions, which should benefit conservation and whole communities in the long term.	Nationa NGOs
5.2 Support local development (education, health, energy etc.), linked to conservation and the needs of the communities.	Govern INGOs agenci
5.3 Promote predator proof corrals among communities to avoid killing of livestock by predators.	Govern NGOs
5.4 Promote the regulation of water use by livestock in places with limited water resources in order to allow wildlife access to the water	As a pl implem and int
5.5 Establish and share best practice of community-based insurance schemes (predation, other conflict, bad weather etc.) and establish community-based conservation awards/support schemes.	As a pl implem and int
5.6 Provide culturally and species-appropriate activities and rewards for motivated community members and teachers using current examples such as establishing wildlife clubs and celebrating species days and using communication strategies.	Nationa NGOs, agenci ministr
5.7 Build functional associations within and between communities along migration routes, under the mandate of national governments, to facilitate communication and cooperation.	Govern commu govern
5.8 Promote and support the use of local knowledge and skills in community-based management plans, participatory research, and reporting outcomes, in a suitable language and format.	Local a Resea institut
5.9 Promote non-extractive use especially community-based ecotourism within the CAMI region and develop sustainable ecotourism programmes.	NGOs,
5.10 Integrate biodiversity conservation issues (for migratory species) into the strategies of international and national development agencies with community and rural development programmes.	CMS, (

5.11 Engage community conservationists and promote direct involvement in conservation initiatives, such as monitoring anti-poaching, ecotourism and citizen science and empower local community organizations by assigning them an official status and role.	Natio agen
5.12 Encourage investment from NGOs and business, especially local large industries (e.g. oil, gas, mining) to support community conservation initiatives on migratory species.	CMS curre
5.13 Promote regular and sound monitoring of species and apply best practices for sustainable use in order to ensure that any legal hunting of species is sustainable and supports conservation, taking also into account the wide-ranging movements of most species.	Gove Scien comn
5.14 Assess the feasibility of sustainable use of CAMI species across the region, looking at accruing benefits for local communities, as well as relevant legislation.	Gove NGO
5.15 Promote community-based practices and explore other sustainable wildlife use options (i.e. subsistence hunting, photography, ecotourism) that create incentives for conservation and review according legislation.	Gove NGO

7. Capacity Development	**Resp**
7.1 Develop and implement funding schemes and training programmes in wildlife conservation for students and emerging conservationists on monitoring, participatory involvement, conservation planning and implementation in partnership with relevant scientific institutions and IUCN Species Specialist Groups.	Gove Scien
7.2 Train protected area and community-based rangers and managers in wildlife management, human-wildlife conflict, combating illegal hunting and developing participatory conservation.	Gove Scien
7.3 Launch annual / biannual wildlife conservation meetings for CAMI Range States as a continuous forum for wildlife conservation in the region.	CMS agen

11. Asiatic Wild Ass (*Equus hemonius*)	Respo
11.1 Update status and distribution of Asiatic Wild Ass in all countries and develop a cross-boundary conservation vision.	IUCN CMS, Scient
11.2 Develop an International Single Species Action Plan for the Asiatic Wild Ass covering all Range States as well as national action plans.	IUCN CMS, Scient CMS
11.3 Assess the impact of linear infrastructure and its cumulative effects on Asiatic Wild Ass and develop and implement mitigation measures (see also 3.3 and 24.3), including wildlife-friendly infrastructure standards.	Gover NGOs
11.4 Review and improve the regulatory framework on combating wildlife crime and linear infrastructure (as 2.1)	Gover NGOs interna sector
11.5 Enact measures to increase the population size and range of Asiatic Wild Ass in Kazakhstan and Turkmenistan (Badhyz, Kaplankyr, Meanachacha).	Gover NGOs
11.6 Assess the possibility for reintroductions where needed and where suitable habitat exists, e.g. in Uzbekistan, Turkmenistan and Kazakhstan.	Gover NGOs
11.7. Raise awareness for the need of Asiatic Wild Ass to regularly access water points, identify water points of population level importance and guarantee unobstructed access for Asiatic Wild Ass by avoiding infrastructure development, human disturbance (including illegal hunting), and depletion of the water sources for other uses.	Gover NGOs
11.8. Promote Asiatic Wild Ass as a flagship species for the conservation and functional connectivity of steppe and desert-steppe ecosystems in Central Asia.	Gover NGOs

Part III. Landscape-level Measures	
27. Gobi-Steppe Ecosystem **Countries:** China, Mongolia, Russia **Species:** Asiatic Wild Ass, Gobi Bear, Goitered Gazelle, Mongolian Gazelle, Przewalski's Horse, Saiga Antelope, Wild Camel	**Respo**
27.1 Develop a Gobi steppe ecosystem action plan involving all adjacent Range States to ensure long-term permeability of the landscape, avoidance or mitigation of barriers, availability of areas without human use and including species-specific actions.	Goverr scientif
27.2 Establish a platform of all interested and invited scientists to scale up species specific actions and to encourage transboundary collaboration on monitoring and research and to mitigate impacts from international border fences.	Goverr scientif
27.3 Assess impact of linear infrastructure and its cumulative effects to develop and implement mitigation measures (see 3.3. and 3.4), including wildlife-friendly infrastructure standards.	Goverr NGOs, interna sector
27.4 Establish an "Environmental Mitigation Fund" aiming at safeguarding the migratory species of the Gobi-Eastern Steppe ecosystem to implement mitigation measures for existing and newly constructed infrastructure, research and monitoring financed by contributions from private sector, government and donors.	NGOs, interna sector

Part IV. Implementation Support	
29. Coordination, Data Sharing and Review Processes	**Resp**
29.1 Strengthen the staff resources for the coordination of CAMI within and possibly outside of the CMS Secretariat to enable sustainable and long-term coordination services for CAMI.	CMS, agen institu
29.2 Continue issuing the biannual CAMI newsletter and updating the website in English and Russian language.	CMS
29.3 Establish an information entry template per species with important information about the species (e.g. species population status, monitoring method, date and area covered, reference and source of the data), which is available on the CAMI website (editing password-restricted), taking into account suitable templates from existing sources such as Saiga Resource Centre, Saiga News, Cat News, etc.	CMS, agen institu

29.4 Confirm and amend the Species Focal Point list (and in the process review suitable platforms such as Snow Leopard Network, IUCN Specialist Groups) at each renewal of the Programme of Work and publish on the CMS website.	CMS
29.5 Review CMS National Focal Points and regularly update the list for CAMI countries on the CMS website. Request non-Party Range States to nominate a Focal Point for CAMI.	CMS
29.6 Conduct regular technical, thematic, ecoregional workshops in between COPs, facilitate exchange of scientific information among institutions and where appropriate, establish working groups on thematic issues of the POW.	CMS, agenc
29.7 Organize a Range State meeting of CAMI Range States and stakeholders prior to COP15 to agree on the new POW covering the period 2027-2032.	CMS, agenc
29.8 Within the frame of the Asian group under the CMS Standing Committee, connect CMS Focal Points from the CAMI region to discuss issues of mutual concern and advance implementation.	CMS,
29.9 Ensure national consultation of the POW in the relevant ministries after endorsement at the COP13 for national review and approval.	Gover
29.10 Collect information including existing species action plans on the CMS website and consider developing Action Plans for species that do not have one.	CMS, agenc
29.11 Implement the reporting and review process as agreed at the Second Range State Meeting in Ulaanbaatar in 2019 to monitor implementation and strengthen implementation.	CMS, agenc
29.12 Nominate a mammal expert for the Scientific Council.	CMS

31. Funding	**Respo**
31.1 Continue and expand existing initiatives and funding programmes to support implementation of CAMI and its POW, such as the IUCN SOS Central Asia Programme as a funding mechanism specifically designed to provide funding for the implementation of the POW.	IUCN, agenc
31.2 Promote co-funding to donor initiatives from governments as well as co-funding from donors to government initiatives for the implementation of the POW.	Gover
31.3 Include conservation actions for migratory species as outlined in the POW in the existing / updated / elaborated state programmes on nature protection.	Gover
31.4 Channel national environmental funds that exist under state bodies and include measures on migratory species and the implementation of the POW.	Gover NGOs
31.5. Conduct an 'inventory' of donors and funding programmes and identify a "champion" for CAMI.	CMS,
31.6 Explore funding options through the Global Environment Fund (GEF) including GEF Small Grants Programme projects for joint proposals between several countries with involvement of GEF implementing agencies (World Bank, Asian Development Bank, UNDP) in the processes of project application.	Gover NGOs
31.7 Strengthen bilateral cooperation between countries as well as with donors in fundraising and joint project development.	Gover Donor
31.8 Consider organizing charity events or other innovative funding sources to mobilize funding for CAMI and its POW.	Gover NGOs
31.9 Engage in and contribute to the development of donors' funding priorities in line with CAMI.	CMS,
31.10 Develop mechanisms for using revenues from sustainable wildlife management for conservation activities (e.g. trophy hunting and others) in cooperation with CITES.	Gover NGOs
31.11 Establish a trust fund for CAMI, including with funding from the private sector.	Gover CMS,