

Rapid assessment of the mammalian community of the Badkhyz Ecosystem, Turkmenistan, October 2014

Petra Kaczensky
John D. C. Linnell



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Petra Kaczensky
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In cooperation with;



Norwegian Institute for Nature Research

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Asiatic wild asses. Photo: Nury Khudaykuliyeu

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Abstract

Kaczensky, P. & Linnell, J. D. C. 2015. Rapid assessment of the mammalian community in the Badhyz Ecosystem, Turkmenistan, October 2014 – NINA Report 1148. 38 pp.

We visited Badhyz State Nature Reserve in southern Turkmenistan and the surrounding area between 12th and 26th November 2014. 12 days were spent within the reserve and surrounding wildlife sanctuaries (Gyzyljar and Chemenabat wildlife sanctuaries), during which we drove 763 km and walked 68 km. In addition, we spent 3 days in the office discussing with the reserve director and the head of the science department and collating existing information from the park's records and from recent camera-trapping studies that the reserve has conducted. The objective of the expedition was to conduct a rapid assessment of the status of the populations of wild ungulates – kulan (Asiatic wild ass), urial (wild sheep), and goitered gazelle. However, because of the need to view species conservation within an ecosystem context we also collated information on community structure and the presence of the other key species that make up the Badhyz ecosystem.

The Badhyz grasslands ecosystem represents a complex and relatively intact ecosystem. Our general impression is that a variety of rodents (sousliks, gerbils, voles, and jerboas) that exist at very high densities, supporting a large community of mammalian (red fox, wild cat), avian (raptors) and reptilian (snakes, monitor lizards) predators. Rodents may well be the dominant herbivores in this ecosystem and deserve further investigation. By comparison, the only medium sized herbivore, the Tulai hare, appears to occur only at very low densities.

Our visit confirmed the presence of all of the expected large mammals. We personally saw urial (464 observations), goitered gazelle (346 observations), kulan (59 observations), wolves (5 individuals), red foxes, and wildcats along with many fresh tracks from striped hyaena and wild boar, some older leopard tracks and one observation of a set of potential caracal track. The reserve's camera trapping also provides evidence for leopards, hyaenas and wolves, kulan, gazelles, urial in addition to red foxes and wildcats. Visual observations by reserve staff also confirm the presence of caracal and honey badger. The only species missing from the ecosystem are the Asiatic cheetah, which has not been seen since the 1960's, and the Bezoar wild goat. Among the carnivores, our observations of tracks and the reserve's records (visual and camera trapping) confirm the presence of multiple leopard individuals, including adult males and reproductive females. Striped hyaena and wolves appear to be widespread throughout the reserve and relatively abundant. Caracal, honey badger and korsac fox appear to occur at very low densities, and only in small parts of the reserve.

Our own observations support the picture obtained by the reserve's censuses that the populations of gazelle and urial are large and are well distributed throughout the reserve. Although the census methodology used by the reserve does not provide statistical estimates of uncertainty, the numbers they have obtained (3700 gazelle and 1600 urial in 2013) do not seem unrealistic. We observed comparatively few kulan, and only a few fresh tracks or signs of presence such as dung. We had 59 observations, but we almost certainly saw the same individuals several times. The census methodology used by the reserve indicates a population of more than 400 kulan using the reserve in spring. Based on our extensive survey of the reserve it is almost certain that the majority of individuals must have been somewhere else (outside the reserve) at the time of our visit.

There were relatively few signs of human disturbance within the reserve (and the proposed extension to include the Yeroyulandez depression). One older rifle cartridge, a shotgun shell, and nails placed in the road (to puncture the tires of ranger vehicles) indicate the presence of poaching, which is confirmed by reserve records. However, there was a relatively large amount of plastic litter in the pistachio forest following the annual harvest activities. Furthermore, we observed more than 50 free-ranging horses in the pistachio forest. In addition, at least one

domestic sheep flock was observed just inside the border of the reserve. In contrast, the areas that we saw within the Chemenabat wildlife sanctuary (both existing part and proposed extension), the Gyzylyar wildlife sanctuary, and the proposed ecological corridors connecting these sanctuaries to the Badhyz reserve seem to be heavily impacted by livestock grazing. Our observations of large flocks and the state of the vegetation indicate that grazing pressure is very heavy. The almost total lack of any wildlife observations in these sanctuaries reinforces the impression of heavy human pressure on the vegetation and disturbance on the wildlife directly.

Based on our rapid survey of the reserve and our discussions with reserve staff we are able to make some preliminary actions for further work that is needed to fill knowledge gaps and address important management needs. These recommendations cover the need for further research activity and surveys to clarify the functional ecosystem borders (by GPS collaring individuals from wide-ranging species), the impact of livestock grazing outside the strict reserve, and to improve analysis of monitoring data. There are also some clear management actions needed, including, removal of the feral horse population before it increases any more, the importance of securing access to water sources outside the reserve for the kulan and providing infrastructural and logistical support for the reserve staff by upgrading their equipment.

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Foreword

We are extremely grateful for the help and hospitality of the Turkmen team working for the nomination of Badhyz as a UNESCO world heritage site, namely Eldar Rustamov, Shirin Karryeva, and Atamyrat Veyisov. At Badhyz, Islam Ishanov and Nury Khudaykulyev were wonderful hosts and freely and patiently shared their knowledge and experience. We also want to thank Svetlana Kostik, head of Gyzylyar section, and the other nature reserve staff at the various ranger stations for their help and hospitality.

Mark Day, Stephanie Ward and Geoff Welch from the UK based Royal Society for the Protection of Birds helped with logistics and provided us with much needed background information. All travel costs for the expedition were covered by RSPB whereas personal costs for the authors were provided by the Research Institute of Wildlife Ecology, University of Veterinary Medicine, Vienna, Austria and the Norwegian Institute for Nature Research, Trondheim, Norway, for Petra Kaczensky and John D.C. Linnell, respectively. We are grateful to all of the above for giving us the possibility to visit this very special ecosystem.

John Linnell & Petra Kaczensky, March 2015

1 Introduction

The UK based Royal Society for the Protection of Birds (RSPB) is supporting the government of Turkmenistan in their effort to have Badkhyz State Nature Reserve recognized as a UNESCO World Heritage site (Rustamov et al. 2015). In order to gather data for the nomination dossier and give input to the update of the reserve's management plan we were contracted to conduct a rapid assessment of the mammalian community of the reserve.

Between 12th and 26th October 2014, we spent 12 days within the reserve and surrounding wildlife sanctuaries (Gyzyljar and Chemenabat Wildlife Sanctuaries). In addition, we spent 3 days in the reserve's office discussing with the reserve director and the head of the science department. Furthermore, we collated existing information from existing literature, the reserve's records as reported in their annual reports, and from recent (unpublished) camera-trapping studies that the reserve has conducted.

The main objective of the expedition was to conduct a rapid assessment of the status of the populations of wild ungulates – kulan (Asiatic wild ass, *Equus hemionus*), urial (wild sheep, *Ovis orientalis*), and goitered gazelle (*Gazella subgutturosa*). However, because of the need to view species conservation within an ecosystem context we also collated information on community structure and the presence of the other key species that make up the Badkhyz grasslands ecosystem.

This report consists of a summary of our activity, observations, and key findings resulting from this rapid assessment. In addition, we present some preliminary recommendations for important management actions and research activities that are needed to safeguard and improve the conservation status of the reserve.

Table 1: Travel itinerary in Turkmenistan, 10th - 29th October 2014.

Date	Activity	Night
09.10.2014	Leaving Vienna	Airplane
10.10.2014	Arriving Ashgabat and meeting with Shirin Karryeva (SK), Eldar Rustamov (ER) & Atamyrat Veyisov (AV) in office	Ashgabat - hotel
11.10.2014	Flight to Mary & drive to Serhetchi	Serhetchi - NP headquarter
12.10.2014	Office day at NP headquarters (talk with Islam Ishanov (II) & Nury Khudaykuliyeu (NK), GIS with AV, museum, animal enclosure)	Serhetchi - NP headquarter
13.10.2014	Leave for Badkhyz with SK, AV, and NK and drive through eastern corridor to Gyzeljar cordon and escarpment rim	Camp 1 on plateau at the edge of the escarpment
14.10.2014	Drive through Gyzyljar canyon and visit of water points	Camp 2 at Yeroyulanduz ranger observation point
15.10.2014	walk to easternmost of escarpment springs, drive back to Gyzeljar, talk with Svetlana Kostik (SK)	Gyzeljar ranger post
16.10.2014	Driving and walking along eastern edge of Gyzeljar canyon, back to NP headquarter	Serhetchi - NP headquarter
17.10.2014	Office day at NP headquarters (yearly NP reports, trying to understand animal count data)	Serhetchi - NP headquarter
18.10.2014	Office day at NP headquarters - at some point office is looked	Serhetchi - NP headquarter
19.10.2014	Heading with AV and NK for Badkhyz again, stop at Kuska and Islim river, and well in corridor	Gyzeljar ranger post
20.10.2014	Visit Dashguyi old and new well under construction, drive to Kepele	Kepele ranger post
21.10.2014	Drive to Yeroyulanduz and visit westernmost spring	Camp 3 on the way to spring
22.10.2014	Walk to all three springs along the escarpment, walk along escarpment edge on top, drive to Gyzeljar	Gyzeljar ranger post
23.10.2014	Walk along escarpment edge on top to look for khulan, drive to Kepele	Kepele ranger post
24.10.2014	Visit pipe waterpoints north of Kepele, drive to Agarcheshme	Agarcheshme ranger post
25.10.2014	Drive past Pulhatyn and walk to Kerlek spring, evening walk from cordon	Agarcheshme ranger post
26.10.2014	Leaving with AV for Ashgabat	Ashgabat - hotel
27.10.2014	Ashgabat - rest day	Ashgabat - hotel
28.10.2014	Ashgabat and meeting with SK & AV in office	Ashgabat - hotel
29.10.2014	Leaving for Vienna	Vienna

2 Badhyz State Nature Reserve

Badhyz State Nature Reserve (NR = *zapovednik* in Russian) was established in 1941 to protect the unique relict pistachio woodlands and Turkmen population of Asiatic wild ass or kulan. In 1951, the original area of the State Reserve was reduced from 800,000 ha to 75,000 ha. In 1962, and again in 1970, some adjacent areas were added to the west and south expanding the reserve to its current size of 87,700 ha (Rustamov and Rustamov 2007). The formal aims of the Badhyz reserve are the study, protection and rehabilitation of the unique ecosystems of the territory. Three Wildlife Sanctuaries (WS = *zakazniks* in Russian) are associated with Badhyz NR. These are the 15,000 ha Pulhatyn WS to the NW, the 30,000 ha Gyzylyar WS to the east, and the 12,000 Chemenabat WS to the SE (Figure 1).

A number of expansions have been proposed in connection with the site's nomination as a UNESCO World Heritage site. These include an extension of the Badhyz NR to a total of 140,430 ha (through the inclusion of the Yeroylanduz depression), an extension of the Chemenabat WS to a total of 26,000 ha, and the establishment of a 51,300 ha buffer zone; amounting to a total area of 262,730 ha under protection (Rustamov et al. 2015). In addition, two ecological corridors were proposed to functionally connect the Chemenabat WS with the Badhyz NR (Figure 1). Since the 1960s, a border fence runs parallel with the international borders with Iran to the west and Afghanistan to the south. This fence is located 3 to 5 km inside Turkmen territory meaning that c. 12,000 ha (14% of the total area) of the current Badhyz NR, all of the 29,000 ha of the planned extension of the Badhyz NR to the west, and 13,100 ha (87% of the total area) of the Pulhatyn WS; amounting to a total area of 54,100 ha (21% of the protected area complex) will be cut off by the fence.

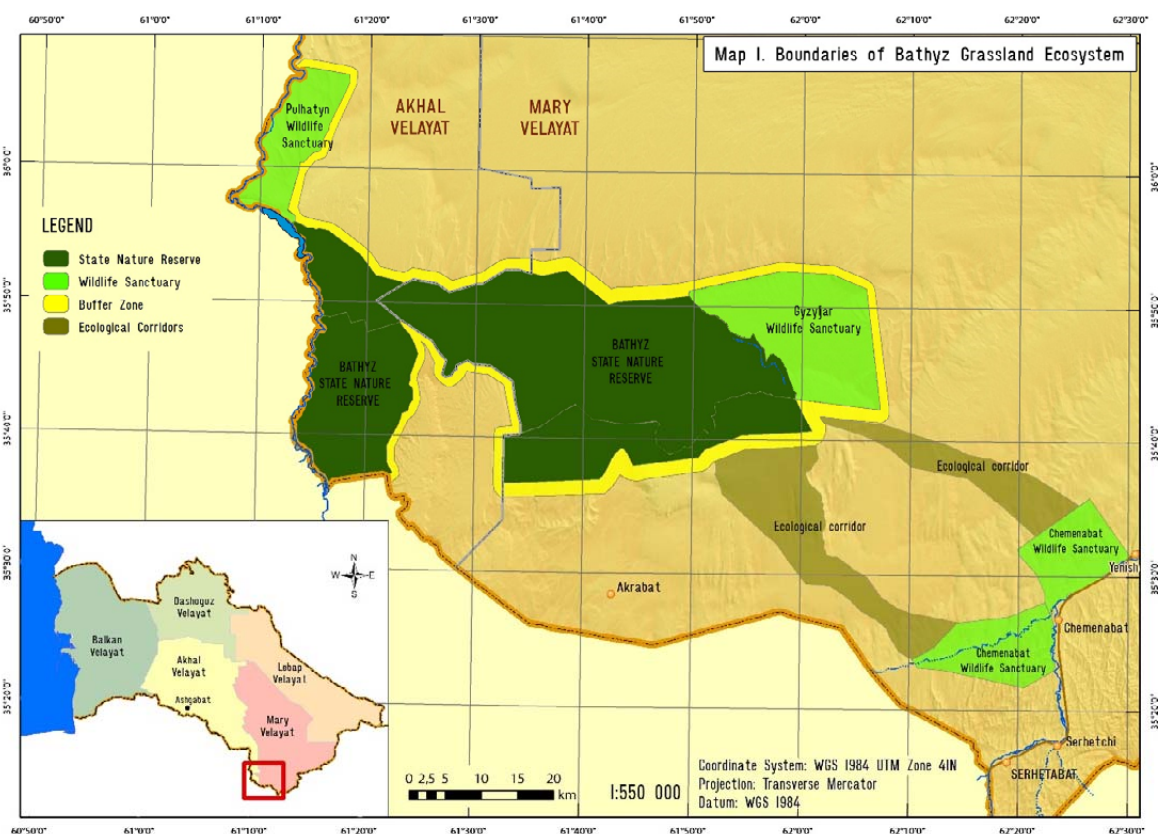


Figure 1: Map of Badhyz State Nature Reserve and delineation of the reserve's borders.
Source: Rustamov et al. 2015.

Badkhyz State NR is located in Mary and Akhal provinces (*Velayats* in Russian). Its natural borders are the Karakum desert in the north, the Tejen river and international border with Iran in the west, the Gyzylyjar canyon in the east and the Yerulanduz and Namakar depressions in the south. There are five main landscapes in Badkhyz NR: 1) the 18 km long Gyzylyjar canyon, 2) the Badkhyz plateau, 3) the c. 45 km long escarpment, 4) the Yeroylanduz and Namakar depressions, and 5) the Gezgadik hill range with its Pistachio savannah (Figures 1, 2, 3). There are approximately 13,000 ha of pistachio woodlands in Badkhyz NR, of which 9,000 ha are natural stands and 4,000 ha are planted.

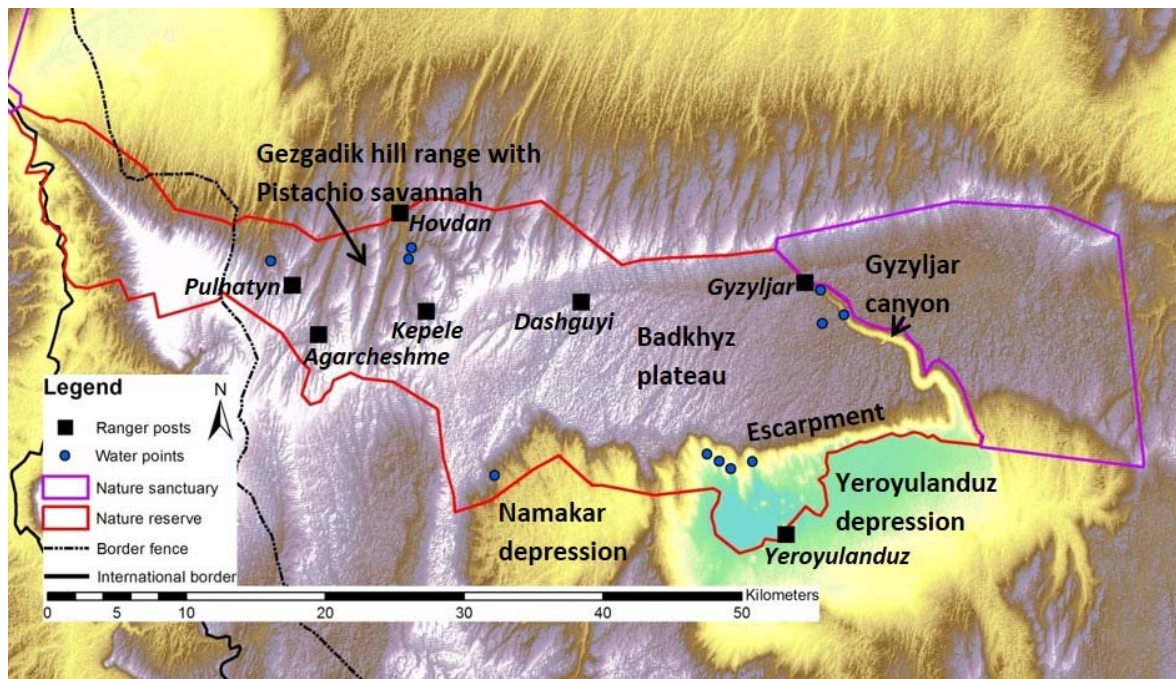


Figure 2: Main landscape types of the Badkhyz NR.

The steppe grasslands belong to the Turanian (Kazakh desert scrub-steppe) biogeographic province (Udvardy, 1975), with the main plant associations constituting a mixture of sedges and grasses, together with sagebrush and shrubs in places, such as glasswort (*Salsola spec.*) or black saxaul and white saxaul (*Haloxylon ammodendron* and *H. persicum*). The other important plant community is the pistachio savannah woodland (Fet and Atamuradov 1994).



Figure 3: Main landscape types in Badkhyz NR in October 2014. A) Escarpment and Yeroyulanduz, B) Gyzeljar canyon, C) Pistachio savannah, and D) Badkhyz plateau. Photos: P. Kaczensky

The climate in Badhyz is arid, continental and strongly seasonal. Annual precipitation averages 250 mm, with the largest amounts falling from October to May. The average annual temperature is 14.5°C; the absolute minimum recorded was minus 32°C and the absolute maximum was plus 46°C (Figure 4).

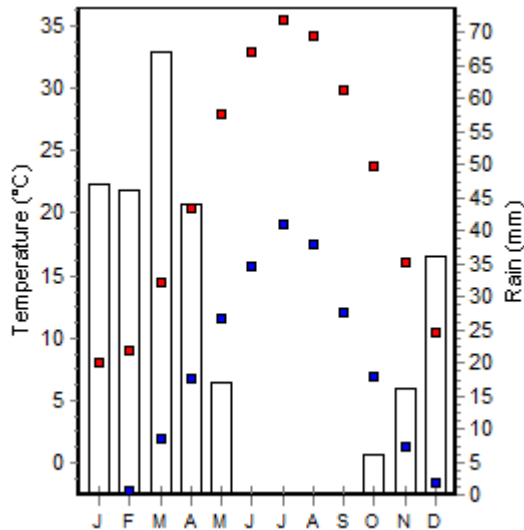


Figure 4: Average temperature and precipitation in Badhyz NR. Red dots = max. temperature, Blue dots = min. temperature. Source: DIVA GIS, point 61.77339 / 35.79628

Underground water resources in Badhyz are scarce, and much of this water is strongly mineralized (Table 2). There are only 12 permanent water points east of the border fence (Figure 5) ; 6 natural ones (4 small springs along the escarpment in the Yeroyulanduz depression, and one small spring along the escarpment in the Namakar depression, a spring with several pools at Kerlek) and 6 man-made ones (3 wells with pumps in the upper reaches of the Gyzyljar canyon, 1 in the pistachio forest at Agarcheshme, and a well at Kepele from which water is pumped a distance of 3 and 4 km to two watering point used by both livestock and wildlife). In the past there used to be another well with a pump at the Dashguyi ranger observation post. It is currently under repair with plans to create 3 new waterpoints at this location at a distance of ~1 km from each other. There are no rivers within Badhyz NR. The shallow Tejen River that flows along the western border of the reserve used to be an important water source for kulan and goitered gazelles. However, nowadays access to the river is cut off by the border fence thus making it largely inaccessible for ungulates living east of the fence. The Gushgy river is situated along the southern border of Chemenabat WS and the Islimcheshme river is inside the planned southern extension of Chemenabat WS. Both rivers largely dry up in summer time and only a few springs or deeper pools have water year round. All are heavily used by livestock (Figure 6). Nevertheless, both rivers constitute important drinking area for kulan in summer and were the main reason behind the designation of the ecological corridors and the extension of Chemenabat WS.

Table 2: Mineral content of various permanent and seasonal water points at Badhyz NR in spring 2011. Source: Badhyz NR Annual Dossier 2011.

Date	Spring	Region	pH	HCO ₃	SO ₄	Cl	Ca	Mg	K, Na	all minerals	mg-ekw/l
				in mg / l							
22.02.2011	Gyzyljar 1 km	Gyzyljar	7.78	248.9	3,580.9	3,017.5	621.2	389.1	2,314.5	10,172.2	63.0
22.02.2011	Gyzyljar 4 km	Gyzyljar	7.31	180.6	3,506.8	3,372.5	721.4	316.2	2,506.3	10,603.8	62.0
01.04.2011	Gyzyljar - ayak	Gyzyljar	7.67	1,220.0	8,306.1	11,892.5	761.6	1,082.2	9,658.4	32,940.8	128.0
01.04.2011	Gyzyljar - icinden	Gyzyljar	7.73	585.6	8,232.0	25,915.0	701.4	2,128.0	16,122.8	53,684.8	210.0
01.04.2011	Gyzyljar - 16 km	Gyzyljar	6.58	439.2	6,009.4	5,715.5	661.3	668.8	4,722.1	18,216.3	88.0
01.04.2011	Gyzyljar - 16 km	Gyzyljar	7.40	390.4	4,914.5	6,035.0	721.4	656.6	4,340.6	17,058.5	90.0
22.02.2011	Kepele - yokarky	Kepele	7.41	175.7	2,033.3	1,775.0	641.3	158.1	1,154.8	5,938.2	45.0
22.02.2011	Kepele - ortaky	Kepele	7.52	156.2	2,008.6	1,775.0	581.2	182.4	1,158.7	5,862.1	44.0
22.02.2011	Kepele - asaky	Kepele	7.38	224.5	1,819.3	2,130.0	641.3	167.8	1,282.5	6,265.3	45.8
31.03.2011	Agarcemesme	Agarcemesme	7.99	854.0	2,370.8	674.5	260.5	267.5	1,089.3	5,516.6	35.0
31.03.2011	Jänek	?	7.42	829.6	4,453.5	1,917.0	360.7	352.6	2,606.4	10,519.8	47.0
31.03.2011	Kerleg - asaky	Kerleg	7.70	2,391.2	6,075.2	2,847.0	541.1	1,033.6	3,079.5	15,967.7	112.0
31.03.2011	Kerleg - cesmeleri	Kerleg	7.19	878.4	4,395.9	3,372.5	601.2	693.1	2,620.2	12,561.3	87.0
01.04.2011	Gunbatar	Yeroyulanduz	8.08	439.2	5,943.5	4,813.8	601.2	583.7	4,336.4	16,717.8	78.0
01.04.2011	Merkezi	Yeroyulanduz	8.13	439.2	5,515.4	5,254.0	621.2	364.8	4,807.7	17,002.4	61.0
01.04.2011	Gundogar	Yeroyulanduz	7.19	463.6	5,540.1	4,558.2	581.2	449.9	4,263.1	15,856.1	66.0
	Basenko	?	8.05	248.9	1,761.7	5,964.0	64.1	800.1	3,214.5	3,214.5	12,053.3
30.03.2011	Namaksar	Namaksar	8.48	561.2	6,396.3	7,895.2	701.4	997.1	5,698.7	22,249.9	117.0
31.03.2011	Dasly	?	7.76	610.0	3,515.1	639.0	541.1	486.4	786.1	6,577.7	67.0
01.04.2011	Duzly	?	7.80	610.0	8,709.5	38,872.5	901.8	1,933.4	24,893.6	75,920.8	204.0

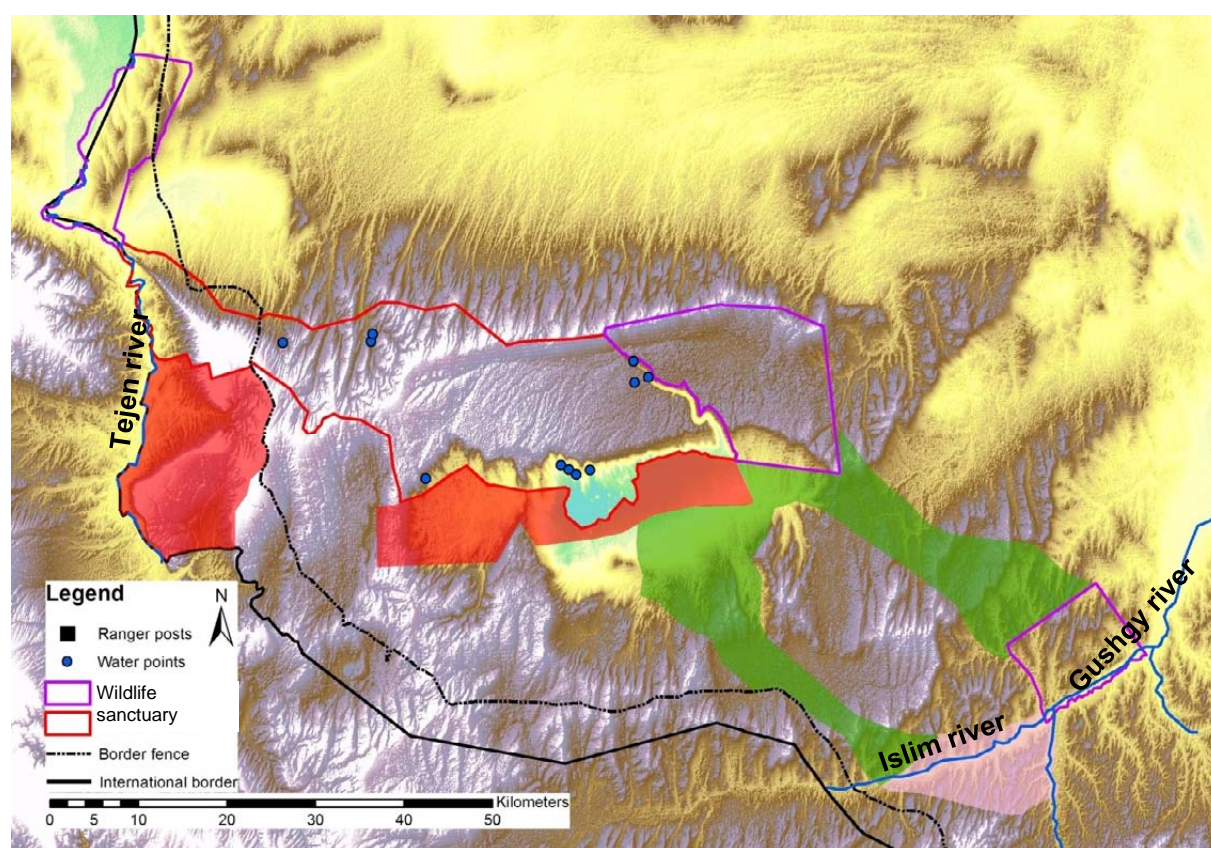


Figure 5: Permanent water sources in and around Badhyz NR. Planned additions to the protected areas are marked as transparent shapes.



Figure 6: Livestock resting in front of spring along the Gushgy river in the proposed extension of the Chemenabat WS. Photo: P. Kaczensky

Information on the mammalian community of the ecosystem was found in the reserve's annual reports (Rustamov et al. 2015). Badhyz NR was reported to contain the last autochthonous population of Turkmen kulan (*E. h. kulan*). Other ungulates in the system are goitered gazelle (*G. s. subgutturosa*), Urial (*O. o. cycloceros*), and wild boar (*Sus scrofa*). The predator community consists of a small but important population of Central Asian leopard (*Panthera pardus saxicolor*), caracal (*Caracal caracal*), corsac fox (*Vulpes corsac*) and honey badger (*Mellivora capensis*). Other more common predators in the system are wolf (*Canis lupus*), striped hyeana (*Hyaena hyaena*), red fox (*Vulpes vulpes*), and wild cat (*Felis silvestris*). The only species missing from the ecosystem are the Asiatic cheetah (*Acinonyx jubatus*), which has not been seen since the 1960's and the Bezoar wild goat (*Capra aegagrus*).

There are no permanent human settlements within Badhyz NR and the dirt roads are primarily used by the State Reserve staff and, to a lesser extent, shepherds from adjacent farms. The surroundings of Badhyz, including the wildlife sanctuaries, are sparsely populated, but the pastures show signs of very intensive livestock grazing by migratory flocks. Apparently, domestic livestock numbers have increased in recent years because of a national program to increase agricultural production in all sectors. Wild ungulates apparently used to spread out of the Badhyz State Nature Reserve onto surrounding lands, but these are increasingly over-grazed. Moreover shepherds guarding their flocks have dogs, and occasionally guns, and are believed to chase away or even kill wildlife species which they consider to be a threat (e.g. carnivores) or competitor (primarily kulan) for their livestock. There are 12 settlements with a total of 36,000 inhabitants within 50-70 km of Badhyz NR (Rustamov et al. 2015).

3 Focal species

3.1 Kulan / Asiatic wild ass

The Asiatic wild ass has become confined to less than 5% of its original distribution range, and is currently classified as Endangered by the IUCN. Autochthonous populations survived only in Mongolia, northern China, India, Turkmenistan and Iran. Except for the large and still more or less continuous population in the Mongolian Gobi, the other wild ass populations are small, fragmented and/or have undergone severe population bottlenecks (Feh et al. 2002, Kaczensky et al. *in prep.*). Some additional populations have been reestablished via reintroductions in Turkmenistan / Uzbekistan, Kazakhstan, Iran and Israel (Figure 7).

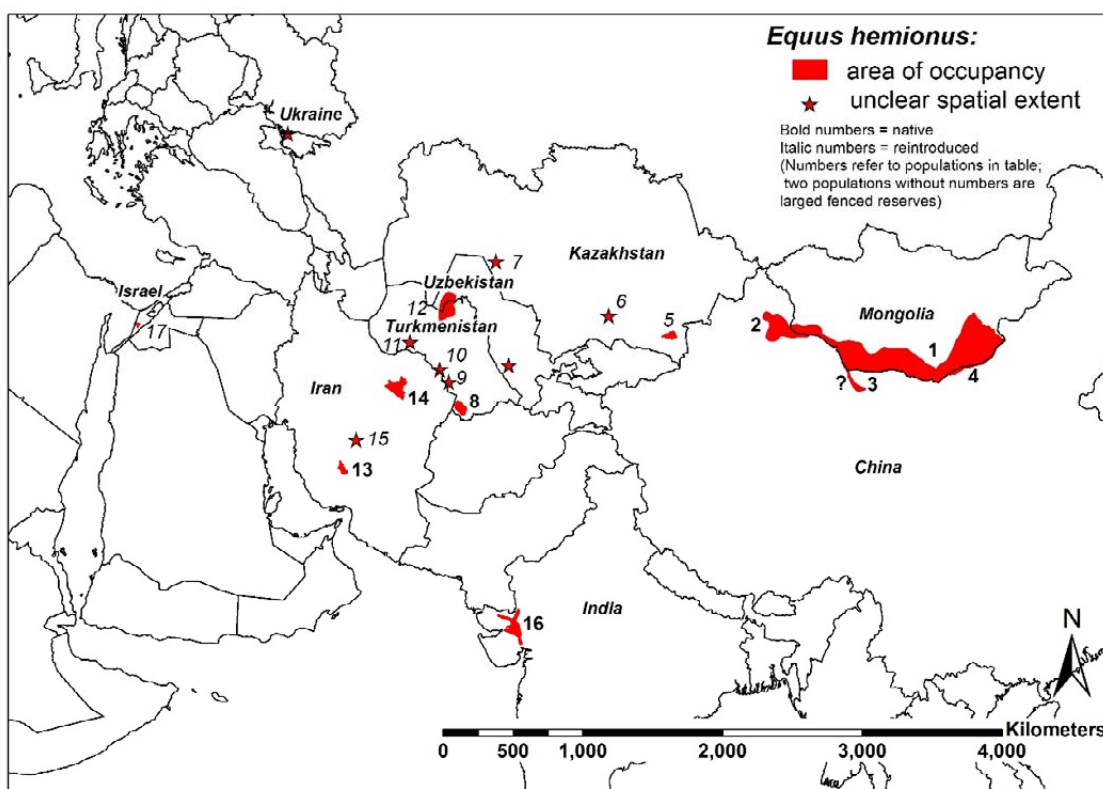


Figure 7: Global distribution of *Equus hemionus*. 1= Mongolian Gobi, 2 = Kalimaili, 3 = Mazongshan, 4 = Wulate Youqi, 5 = Altyn Emel, 6 = Andassay, 7 = Barsa-Kelmes, 8 = Badhzy, 9 = Meana Chaacha, 10 = Kuruhaudan, 11 = Western Kopetdag, 12 = Kaplankyr Reserve, 13 = Bahram-e-Goor, 14 = Touran, 15 = Kalmard, 16 = Little Rann of Kuch, 17 = Negev, 18 = Dzheiran Ecocentre (fenced), 19 = Birjutschii peninsula (fenced). Source: Kaczensky et al. *in prep.* Red list assessment of *Equus hemionus*

Currently, *Equus hemionus* is subdivided into 4 subspecies: *E. h. hemionus* = Gobi khulan (Mongolia, northern China), *E. h. khur* = khur (India), *E. h. kulan* = Turkmen kulan (Turkmenistan, re-introduced in Kazakhstan, Uzbekistan), *E. h. onager* = Persian onager (Iran). However, the phylogenetic status of the different populations and/or subspecies has not been definitively resolved. Asiatic wild asses are highly mobile and recent population genetic analysis suggests that the populations in Iran (Persian onager) and Turkmenistan (Turkmen kulan) actually belong to the same subspecies (Bennet et al. 2012). Kulan are classified as vulnerable in the Red Data Book of Turkmenistan (2011).

The southern parts of Turkmenistan were the only area in the former Soviet Union where the kulan survived until the 1930s. By the 1940s, kulan became entirely restricted to the Badkhyz area (Lukarevskiy and Gorelov 2007). The autochthonous population in Badkhyz has undergone many fluctuations, from as low as ~200 in 1942 up to a peak population of ~5,000 in 1993-1996 (Lukarevskiy 1999, Denzau and Denzau 1999). In 1996, poaching pressure increased dramatically and numbers dropped to 2,400 by 1998 and ~500 by the beginning of the 2000s. Conservation measures started in 2000 and the population grew back to ~850-900 individuals in 2005, but is believed to have dropped again to ~600 animals in 2010 and 420 by 2013 (N. Khudaykuliyyev pers. comm. 2014).

In the period 1979-1989, around 200 wild asses were transported from Badkhyz to six different reintroduction areas within Turkmenistan. Although population development in several of the reintroduction regions was initially positive, only the reintroduction to the Kaplankyr Reserve at Sarykamish Lake has been a true success with animals spreading into adjacent Uzbekistan (Kuznetsov 2014, N. Marmazinkaja unpubl. data 2012/2013). Several other sites are still likely home to small numbers of wild asses, but in three reintroduction areas wild ass went extinct, and for one area the state of the population is unknown. Consequently, population numbers of reintroduced wild asses may now outnumber the autochthonous source population in Badkhyz. Despite reintroduction projects, wild ass numbers in Turkmenistan are likely to be less than 900 individuals, only occupy a small fraction of their former range, and are still (or once again) threatened by illegal hunting.

The situation in the adjacent countries looks little better. The Asiatic wild ass became extinct in Kazakhstan at the end of the 1930s due to overhunting and competition with livestock (Heptner et al. 1988). However, reintroductions began in 1953 when wild asses from Turkmenistan were brought to the Barsa-Kelmes Island in the former Aral Lake (Bannikov 1981). The population increased, and provided the stock for further reintroduction initiatives to Altyn Emel National Park, Aktau-Buzachy Sanctuary on Buzachy Peninsula and Andassay Sanctuary. The Barsa-Kelmes population which started out as a heavily managed island population (Bannikov 1981) became free-ranging with the drying up of the Aral Lake, and the Altyn Emel National Park population grew rapidly and is currently the largest reintroduced equid population anywhere (Plakhov et al. 2012). The reintroduction to the Aktau-Buzachy Sanctuary eventually failed and the outcome of the Andassay Sanctuary reintroduction remains unclear (Table 3). Although reintroduction programs managed to re-establish the Asiatic wild ass in Kazakhstan, the species still only occupies ~0.25% of its historic range in the country.

Wild asses disappeared from western Iran in the 1930s, but were still widespread in the central and eastern arid and semi-arid plains until the 1950s (Denzau and Denzau 1999). By the 1980s only four populations were left. However, no wild asses have been reported from the Kavir National Park since 1986 and none in recent years from the former trans-boundary Sarakhs population along the border with Turkmenistan (Iranian Department of Environment (DoE) unpubl. data). The last time wild asses were observed on Iranian territory west of the Tejen river adjacent to Badkhyz NR was in 2010 (B. Shahriari, DoE, pers. comm. 2014).

Currently, Iran only contains two autochthonous wild ass populations, one in Touran Biosphere Reserve in northeastern Iran and one in Bahram-e-Goor protected area in southwestern Iran. Both populations are small, with the highly threatened Touran population being estimated at 145 individuals (M.-R. Hemami pers. comm. 2014) and is showing a decreasing trend, and the Bahram-e-Goor population estimated at 632 (M.-R. Hemami pers. comm. 2014) and recently showing an increasing trend (Hemami et al. 2012, Hemami and Momeni 2013, Iranian DoE unpubl. data 2013). There has also been one recent, although unintended, release of captive bred wild asses into the wild. In 2010, 11 Asiatic wild asses escaped from Gourab breeding centre into the 2290 km² Kalmard-Bahadoran protected area (Akbar et al. 2012, Hemami and Momeni 2013). Currently this population numbers 12, but there are plans to release additional wild asses (M.-R. Hemami pers. comm. 2014).

Table 3: Wild ass population in Turkmenistan and neighbouring countries. References: 1 = Plakhov et al. 2012, 2 = R. Habibrakhmanov pers. comm. 2014, 3= Levanov et al. 2013, 4 = Meldebekov et al. 2010, 5= N. Khudaykuliyeu pers. comm. 2014, 6 = V. Kuznetsov unpublished data 2012 & 2013, 7= Kuznetsov 2014, 8 = N. Marmazinskaja unpublished data 2012 & 2013, 9 = Hemami & Momeni 2013, 10 = M. Hemami pers. comm. 2014, 11 = Hamidi et al. 2012. Note: The Turkmen population on the Ustyurt plateau also extends in Uzbekistan.

Population	Size	Trend	Date of census	Origin	Refs
Kazakhstan					
Altyn Emel NP	2500 - 3000	increasing	2014	reintroduced	1,2
Andassay Sanctuary	35	data deficient	2012	reintroduced	3
Barsa-Kelmes Island	347	stable	2009 or 2010	reintroduced	4
Turkmenistan					
Badhyz	420	declining	2013	autochtonous	5
Meana Chaacha (Eastern Kopetdag)	100	data deficient	2014	reintroduced	16
Kuruhhaudan / Kalinin	10-15	data deficient	2014	reintroduced	6
Western Kopetdag	13	data deficient	2014	reintroduced	6
Kaplankyr Reserve at Sarakamysh lake / Ustyurt plateau	350-400	increasing	2012-2013	reintroduced	7,8
Iran					
Bahram-e-Gour	632	increasing	2014	autochtonous	9,10
Touran	145	declining	2014	autochtonous	10,11
Kalmand Protected Area	12	increasing	2014	reintroduced	10

Wild asses are highly mobile. In the Mongolian Gobi collared animals covered average daily straight line distances of 11.9 km (Kaczensky et al. 2008) or average cumulative distances of 21.8 km (Kaczensky unpubl. data) within 24 hours. Annual ranges are huge and in the Mongolian Gobi range from 6,000 km² in the SW Gobi to up to 70,000 km² in the SE Gobi (Kaczensky et al. 2011, Batsaikhan et al. 2014). Wild ass movements in the Gobi do not seem to follow easily predictable patterns (classical migration), but are rather nomadic. The latter is likely the result of the unpredictability in the availability of pasture and water in space and time (Kaczensky et al. 2008, Kaczensky et al. 2011, von Wehrden *et al.* 2012). Before the use of modern satellite-telemetry techniques, range sizes and movement pattern of kulan in Mongolia were greatly underestimated (Feh et al. 2001).

During the dry season, it is believed that approximately 70% of the Turkmen kulan population migrates approximately 50-70 kilometers between the Badhyz State Nature Reserve/Gyzyljar Wildlife Sanctuary and the Chemenabat Wildlife Sanctuary in search of drinking areas along the Gushgy River where there are numerous pools (Figure 8). However, the assumed migration to the west of the border fence seems questionable as in Mongolia fences have been shown to

constitute absolute barriers to wild ass movements (Kaczensky et al. 2011, Batsaikhan et al. 2014).

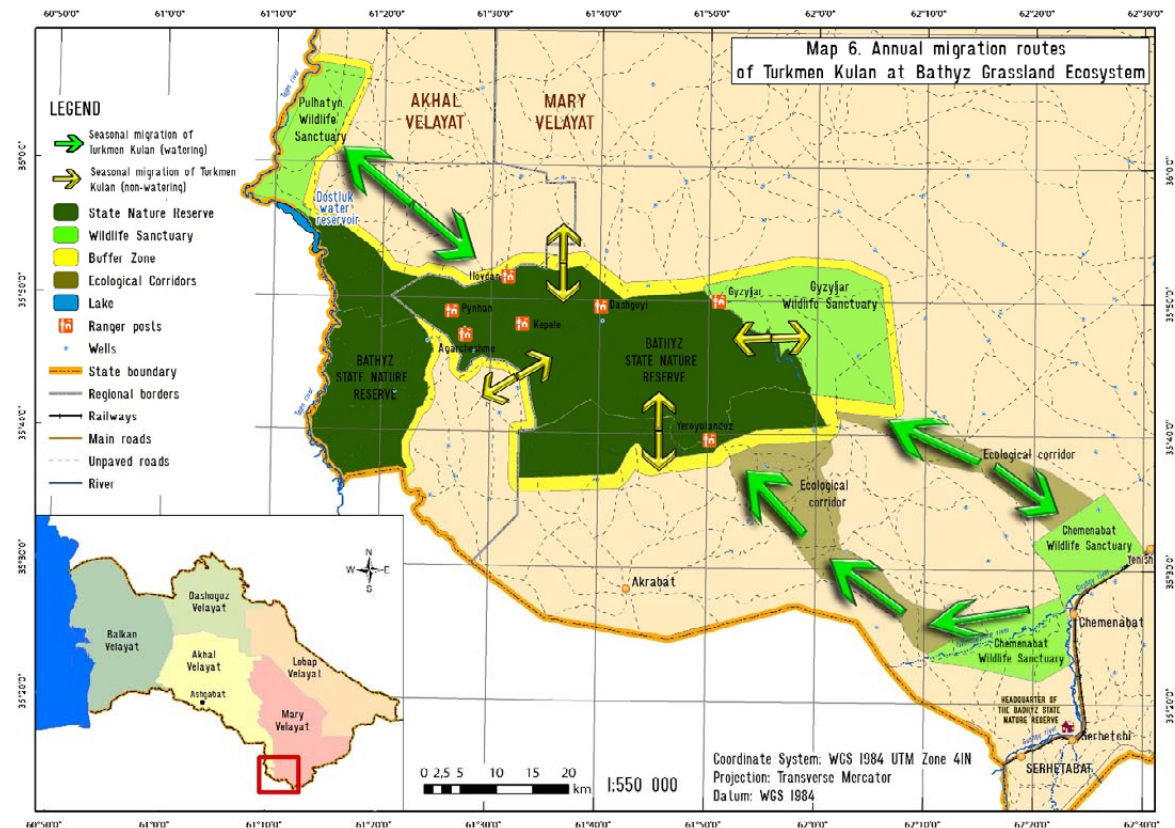


Figure 8: Assumed spring and autumn migration of kulan in and out of the Badhyz NR. Source: Rustamov et al. 2015.

The Badhyz kulan population has been monitored for a long time, using a sequence of different methods including direct observations, track counts at water points, and since 1957 aerial counts were also conducted (Denzau and Denzau 1999). Since 2004, the park staff has been counting kulan simultaneously from 10 observation points in an area of ~15,000 ha on the Badhyz plateau on three consecutive days in spring (Figure 9). Furthermore, they opportunistically record all wildlife observations along several predefined transect routes, some of which are driven by car and others are walked on foot. These transects vary in length from 7 to 38 km (Figure 9). How the final numbers are calculated from the different datasets for reporting in the annual NR dossiers (Figure 10) is not become entirely clear due to linguistic difficulties. However, the raw data is stored in in the rangers' annual paper notebooks (Figure 10) and could potentially be re-analysed. The reserves official estimate for the kulan population in spring 2013 was 420 individuals (N. Khudaykuliyeu pers. comm. 2014).

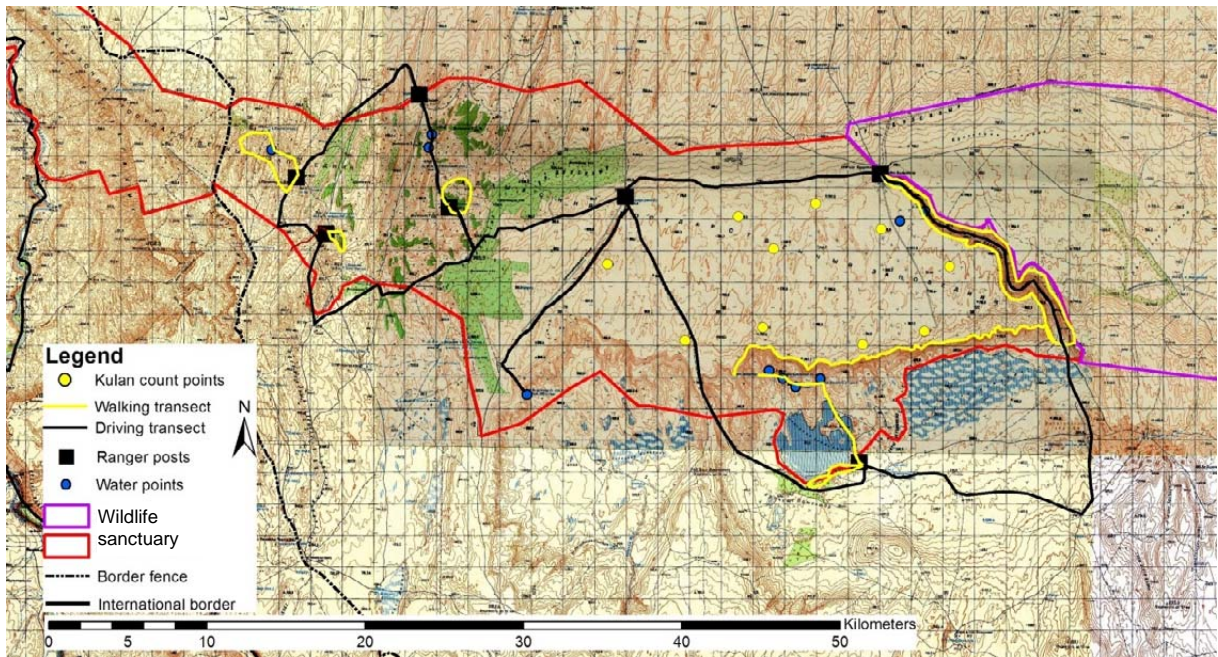


Figure 9: Spring kulan monitoring points and transects driven/walked opportunistically throughout the year in the Badkhyz NR.



Figure 10: Nury Khudaykuliiev with the nature reserve's annual reports from 2006 & 2008 and one year of the staff's notebooks containing the raw data. Photo: J. Linnell

3.2 Goitered gazelles

This species is widely distributed from the south of the Arabian Peninsula, across the Middle East, Central Asia and northern China to Mongolia (Figure 11). It is variously referred to as the goitered gazelle, Persian gazelle, or black-tailed gazelle. A number of subspecies have been recognised, but their validity has not been confirmed. It is even possible that the Arabian sand gazelle subspecies may belong to the slender horned gazelle (*Gazella leptoceros*). The gazelles present in Turkmenistan are of the designate form *Gazella subgutturosa subgutturosa*.

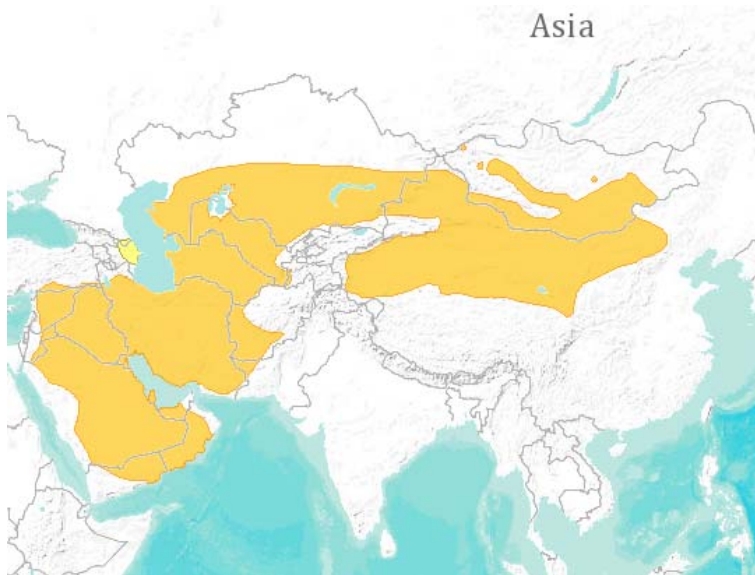


Figure 11: Global distribution range of goitered gazelles. Note that present distribution within this range is more fragmented.

Source: Mallon, D.P. 2008. *Gazella subgutturosa*. The IUCN Red List of Threatened Species. Version 2014.3

The species appears to have a broad habitat tolerance, including semi-desert and steppe.

The IUCN currently list the species as Vulnerable. Despite having a wide distribution almost all populations are believed to have declined during the early 2000's due to uncontrolled hunting and poaching. There are almost no accurate estimates of distribution, population density or size, but the best guesstimate places the current global population below 100,000 individuals (Mallon 2008). The data from neighbouring countries is poor, but the general picture appears to be of a fragmented population with reasonable densities being limited to protected areas.

Goitered gazelle are listed as Vulnerable in the Red Data Book of Turkmenistan (2011). They are widely distributed in the south, east and north of the country, but generally absent from the central and west. Best guesstimates are for less than 10,000 individuals. The population is generally believed to have declined by 90% during the 20th century. In contrast to this general negative trend, the population in Badkhyz NR has been reported to be increasing since the late 1990's. The current estimate is for around 4000 individuals. This estimate is made based on counts from fixed points in spring. Unfortunately, we were not able to access the raw data to understand the details of the estimation process used by the reserve's staff. However, based on our observations the number does not appear to be unreasonable.

3.3 Urial

Discussions about the status of urial are greatly confused by the lack of clarity in their taxonomy, and lack of conformity in how different authors refer to them. They are part of a complex of wild sheep populations present across the Eastern Mediterranean and Middle East as far east as Pakistan (Figure 12). Most authors now consider them to be different species from the mouflon (*Ovis aries*) that are found on the Mediterranean islands of Cyprus, Corsica and Sardinia. However, while some authors refer to the wild sheep found in parts of Turkey and western Iran as mouflon (*Ovis gmelini*), others refer to these as urial (both *Ovis orientalis* and *Ovis vignei* are used). The IUCN and CITES use different species names (*O. orientalis* vs *O. vignei* respectively), to add to the confusion. For the sake of conformity with IUCN classification, we shall use the *orientalis* designation. This uncertainty about species naming makes it hard to conduct a global assessment for the species as it concerns the designation of units for assessment. Even further confusion exists on the subspecies level concerning the boundaries between *O. orientalis arkal* and *O. orientalis cycloceros* with various authors placing Badkhyz urial in different subspecies (Valdez 2008, Damm and Franco 2014).

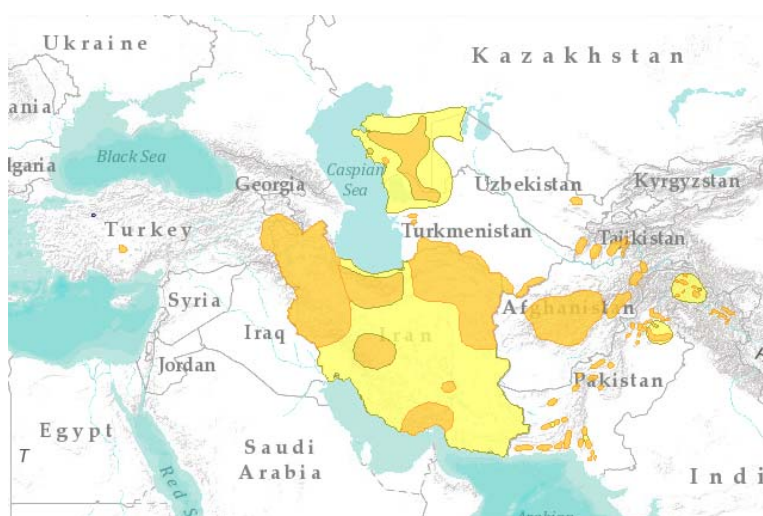


Figure 12: Global distribution of urial. Note that present distribution within this range is more fragmented. Source: Valdez, R. 2008. *Ovis orientalis*. The IUCN Red List of Threatened Species. Version 2014.3.

Based on the last IUCN threat assessment in 2008 urial were listed as Vulnerable based on a perception of a general decline across their range due to unregulated hunting. There are no reliable estimates of population size or distribution from most parts of their range, but guestimates place the global population in the order of some tens of thousands of animals. Their distribution is highly fragmented, and mainly limited to protected areas. Their ecology is poorly studied throughout the range, but the species seems to have relatively broad habitat tolerance from semi-desert to savannah and low mountains. They seem to require access to cliffs or hilly terrain, but can forage at some distance from escape terrain.

Urial are listed as Endangered in the Red Data Book of Turkmenistan (2011). In Turkmenistan, urial (of uncertain subspecies designations, but potentially representing three different subspecies) are found in the northwest (Ustyurt plateau), the west (Balkan range), the southwest and south (along the Kopetdag range bordering Iran and extending south to Badkhyz), and the southeast (Koytendag). Reliable estimates do not exist for any part of their range, but it appears that the largest populations are in Kopetdag and Badkhyz. Monitoring conducted in Badkhyz indicates a steady increase in numbers since 2002 – with present estimates at 1600 animals. This estimate is made based on counts at waterpoints during summer. Unfortunately, we were not able to access the raw data to understand the details of the estimation process. However, based on our observations the number does not appear to be unreasonable. Only the Kopetdag population may be larger (Red Data Book of Turkmenistan 2011), but the quality of this data is uncertain.

4 Wildlife observations during the survey

During 12 days in and around Badhyz reserve driving 763 km and walking 68 km (Figure 13), we saw a total of 464 urial, 346 goitered gazelles, 59 kulan, 31 red foxes, 2 wild cats and 1 group of 5 wolves Figures 14 to 17. These numbers are at best indices for relative abundance as (1) they do not exclude double counts as several places (e.g. overview points) and routes were revisited, (2) other priorities made it necessary to frequently stop and investigate points of interest thus making it difficult to keep track of different animal groups, (3) our routes largely followed convenient tracks rather than random or systematic transects, and (4) effort varied between different landscapes (Figure 13).

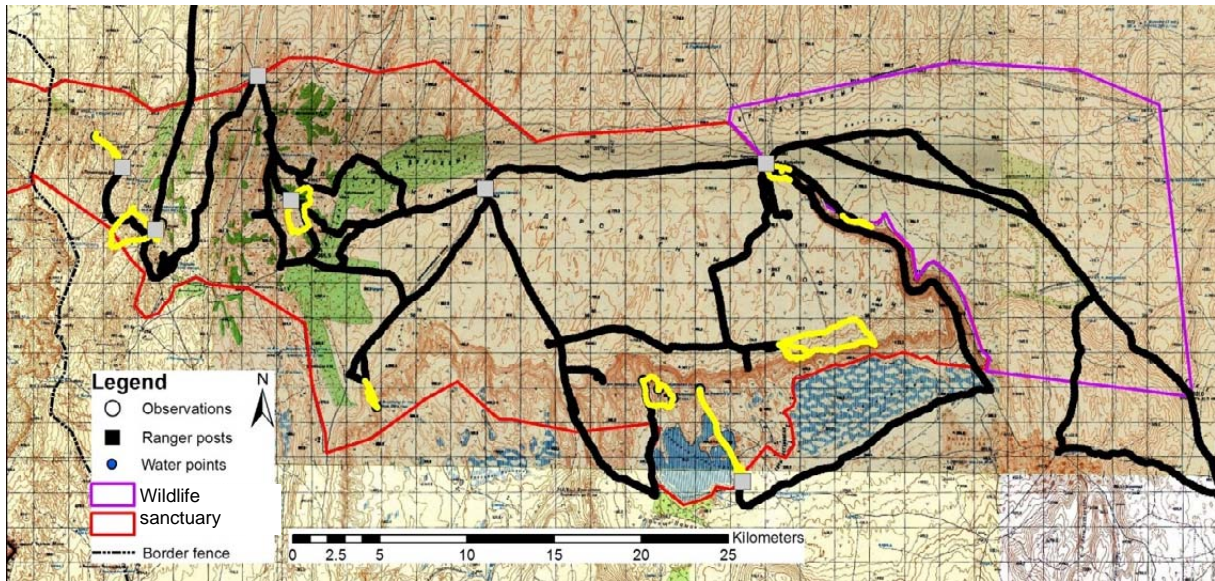


Figure 13: Track driven (black) and walked (yellow) in Badhyz reserve in October 2014.

Despite these shortcomings, some important patterns emerged:

(1) The only larger wild mammals we saw outside the reserve were red foxes, two in the Gyzeljar sanctuary, three in or near the proposed northern corridor, and one outside the reserve near Yerulanduz. Red foxes seemed to be common and distributed throughout all landscape types (Plateau, Gyzeljar Canyon, Yerulanduz depression, Pistachio rolling hill savannah; Figure 14). The other carnivores we saw were two wild cats and of one pack of five wolves (Figure 14).

(2) We primarily saw urial from the rim or the bottom of Gyzeljar canyon, along the escarpment ridge and in, or near, steeper terrain in the Pistachio forest (Figure 15).

(3) Gazelles seemed common throughout most of the park and their tracks could be found “en mass” at all water points with the exception of Kerlek in the very western part (Figure 16).

(4) Kulan were rare and the 59 animals seen likely contain double counts. Fresh kulan signs (dung piles and tracks) were only common around the three water points in and near Gyzeljar canyon. A few moderately fresh dung piles were found on top of the escarpment and near the four springs at the bottom of the escarpment (Figure 17). No recent kulan presence was apparent in the Pistachio savannah. However, we encountered several groups of up to 40 free-ranging horses in this habitat type. We collected 32 kulan dung samples for potential genetic analysis at the Molecular Zoology laboratory of Prof. Ralph Kühn at the Technische Universität München, Germany.

Table 4: Distances driven and walked by the authors in Badhyz NR 13th - 26th October 2014.

Date	Fox	Gazelle	Kulan	Urial	Wild cat	Wolf	Distance (km)		Viewing activity
							driven	walked	
13.10.2014	2	42	21	18			111		From Nature Reserve (NR) headquarter through eastern corridor to Gyzeljar ranger station and escarpment rim overview in the evening
14.10.2014	5	15	1	152			60		Escarpment rim overview in the morning, driver over plateau and through Gyzeljar canyon to Yerulanduz ranger observation post
15.10.2014	1	53	9	82	1		39	12	Short morning walk to hill above camp, walk to easternmost of escarpment springs, drive back through Gyzeljar canyon
16.10.2014	5	4	1	55			79	5	Early morning walk to canyon rim, driving and walking along eastern edge of Gyzeljar canyon, drive back to NR headquarter
19.10.2014				13			102		From NR headquarter through eastern corridor to Gyzeljar ranger station, short evening walk to canyon rim
20.10.2014	3	19		21			55	8	Short morning walk to canyon rim, drive over plateau to Dashguyi, escarpment rim and walk along edge, and continuing to Kepele
21.10.2014	3	31					64	4	Drive to escarpment and walk down to visit Namaksar spring, back to Dashguyi and down to Yerulanduz to Gunbatar spring
22.10.2014		39					54	11	Morning walk to Gunbatar, Merkezi & Gundugar spring, back up on plateau, walk along the rim, drive back to Gyzeljar cordon and into canyon to 2nd water point
23.10.2014	8	123	27	26			70	12	Drive to 2nd water point, drive to and walk along escarpment edge, continue to Kepele
24.10.2014		20		25			66		Visit pipe waterpoints north of Kepele, drive to Agarcheshme, short evening walk to hill next to ranger station
25.10.2014	4			39	1	5	16	13	Short early morning walk from ranger station, drive past Pulhatyn and walk to Kerlek spring, evening walk from Agarcheshme cordon
26.10.2014				33			48	2	Short morning walk around Agarcheshme and drive back to Ashgabat
Sum*	31	346	59	464	2	5	763	68	

*counts between and even within days may include double counts

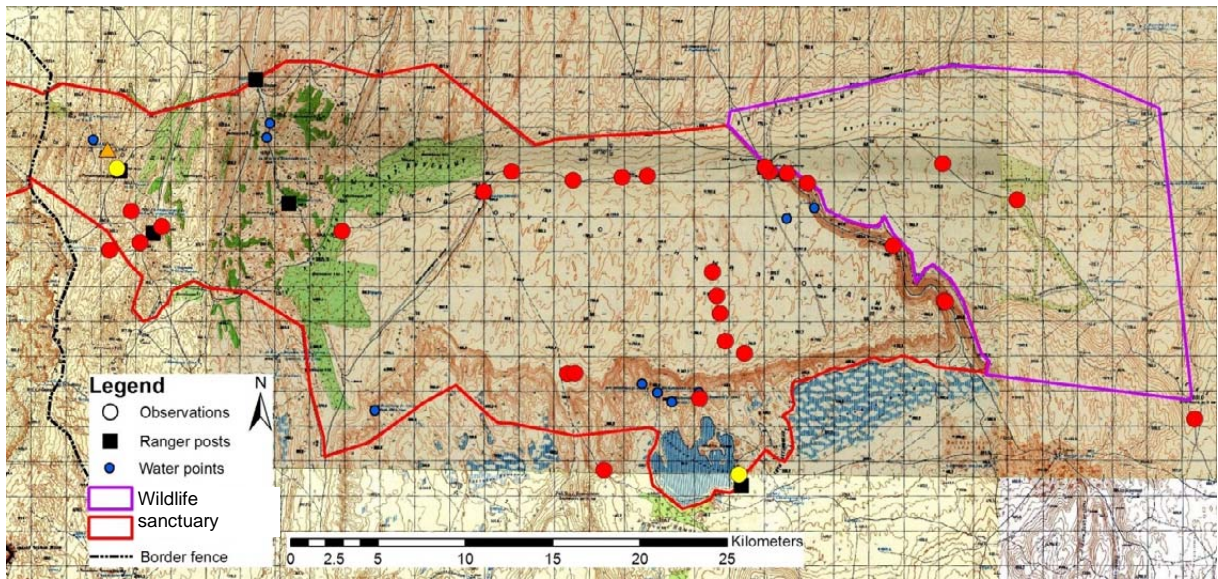


Figure 14: Sightings of foxes (red circles), wild cats (yellow circles), and wolves (orange triangle).

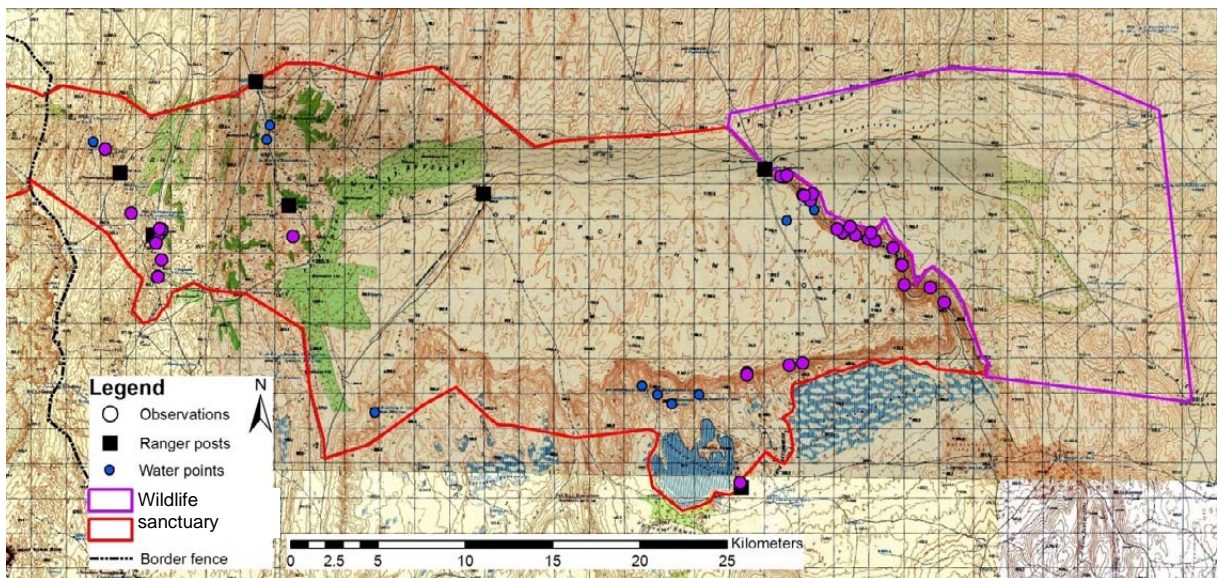


Figure 15: Sightings of urial wild sheep (purple circles).

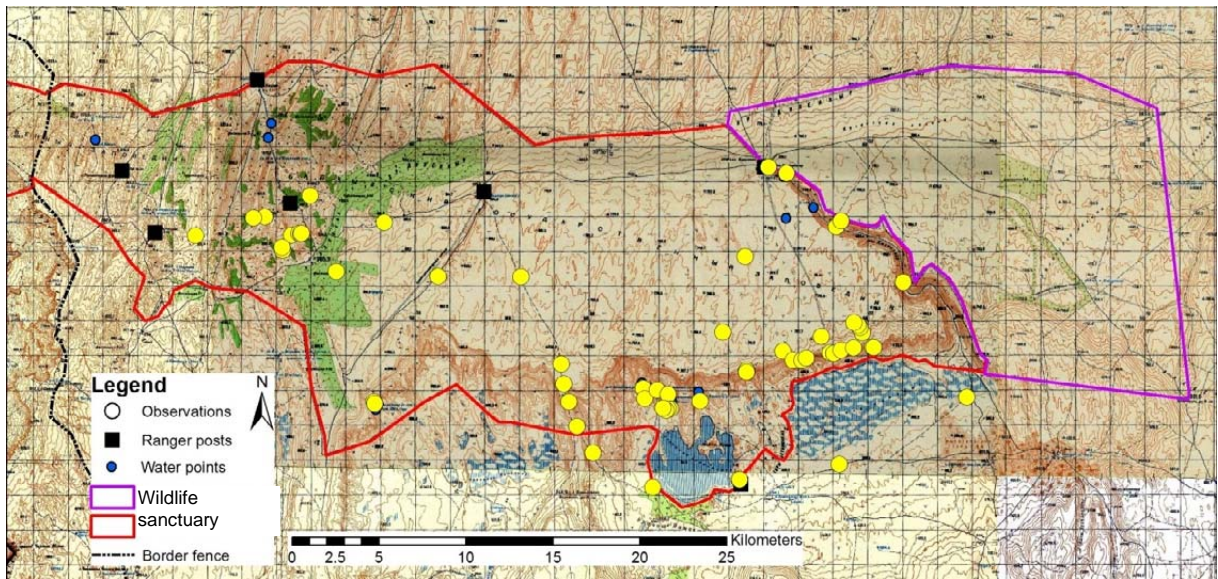


Figure 16: Sightings of gazelles (yellow circles).

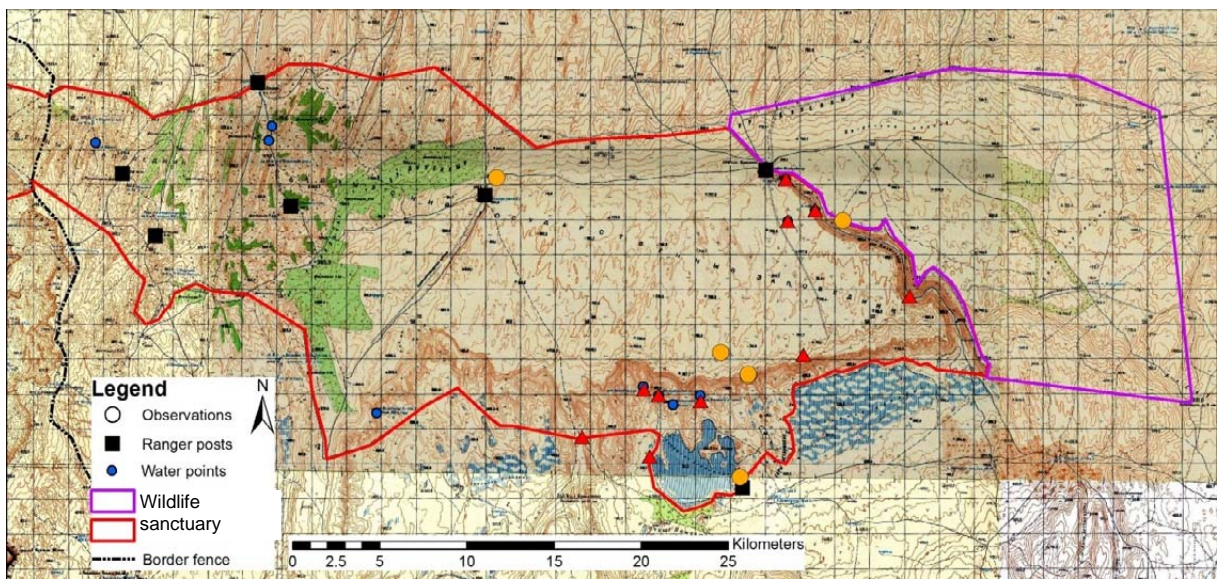


Figure 17: Kulan sightings (orange circles) and dung samples collected (red triangles).

5 Preliminary interpretation of sightings & other signs

The Badkhyz ecosystem represents a complex and relatively intact ecosystem. Our general impression is that a variety of rodents (e.g. sousliks, gerbils, voles, jerboas) exist at very high densities (Figure 18), supporting a large community of mammalian (red fox, wildcat), avian (raptors and owls) and reptilian (snakes, monitor lizards) predators and scavengers. Rodents may well be the dominant herbivores in this ecosystem and deserve further investigation. A first step would be to clarify species identities and relative abundances.



Figure 18: Gerbil at Gyzeljar ranger station. Photo: P. Kaczensky

Our visit confirmed the presence of all of the expected large mammals. We personally saw urial (464 observations), goitered gazelle (346 observations), kulan (59 observations), wolves (5 individuals), red foxes and wildcats along with many fresh tracks from striped hyaena, wild boar, some older leopard tracks and one potential observation of caracal tracks. Porcupine quills were also found. The reserve's camera trapping also provides confirmation of the presence of leopards (Figure 19), striped hyaenas (Figure 19) and wolves, kulan, gazelles and urial. Visual observations by reserve staff also indicate the presence of corsac fox, caracal and honey badger.

Among the carnivores, our own observations of tracks and the reserve's records (visual observations and camera trapping) confirm the presence of multiple leopard individuals, including adult males and reproductive females (Figure 19). Striped hyaena and wolf signs (including confirmed reproductions) were widespread throughout the reserve. Caracal and honey badger appear to occur at very low densities, and only in limited parts of the reserve.

Asiatic cheetahs have not been seen in the reserve since the 1960's (Breitenmoser 2002). Although there are cheetahs close to the border on the Iranian side, the Turkmen border fence is likely to act as at least a partial barrier to their recolonization. The wild goat or bezoar (*Capra aegagrus*) is also reported as extinct with the ecosystem (Red Data Book of Turkmenistan 2011), however, we were not able to visit the most suitable habitat areas in the western part of the reserve.



Figure 19: Screen shots of camera trapping video sequences. Left: Female leopard with cub. Right: three striped hyaena cubs. Photo: N. Khudaykuliyeu

Our own observations support the picture obtained by the reserve's censuses that the populations of gazelle and urial are relatively large and well distributed throughout the reserve (Figure 20). Although the census methodology used by the reserve does not provide statistical estimates of uncertainty, the numbers they have obtained (3700 gazelle and 1600 urial in 2013) do not seem unrealistic. However, we were unable to assess the raw count data and could not reconstruct how final population numbers were calculated. Only a reassessment of past surveys will allow a judgment concerning the robustness of the current estimates, and suggestions for potential improvements.



Figure 20: Urial (left image) were frequently encountered in steeper terrain, whereas gazelles (right image) were encountered throughout the reserve. Photos: P. Kaczensky

During our survey, we directly observed comparatively few kulan, and only a few fresh tracks or signs of presence, mainly around the three water points in and near Gyzeljar canyon (Figure 21). We had 59 observations but we almost certainly saw the same individuals several times. The census methodology used by the reserve indicates a population of about 420 kulan that use the reserve primarily in late winter / early spring. Based on our extensive survey of the reserve it is almost certain that the majority of individuals must have been somewhere else (i.e. outside the reserve) at the time of our visit.



Figure 21: Kulan dung pile at a water point above the Gyzyljar canyon. Photo: P. Kaczensky

There were relatively few signs of human disturbance within the reserve (and the proposed extension to include the Yerulanduz depression). One older rifle cartridge, a shotgun shell, and nails placed in the road (to puncture tires on ranger vehicles) indicate the presence of poaching which is confirmed by reserve records. However, there was a relatively large amount of plastic litter in the pistachio forest as a result of the annual pistachio harvest activities that had just ended at the time of our visit. Furthermore, we observed more than 50 free-ranging horses in the pistachio forest. In addition, at least one sheep flock was observed just inside the border of the reserve (Figure 22).



Figure 22: Left Domestic horses feeding on and around Pistachio trees in Badhyz reserve, Right: domestic sheep flock within the reserve at the NW edge. Photo: P. Kaczensky

In contrast, the areas that we saw within Chemenabat Wildlife Sanctuary (both the existing part and the proposed extension), the Gyzyljar Wildlife Sanctuary, and the proposed ecological corridors seem to be heavily impacted by livestock grazing. Our observations of large flocks and the state of the vegetation indicate that grazing pressure is very heavy. The lack of any observations of medium or large sized mammals, apart from 5 foxes, in these sanctuaries reinforces the impression of heavy grazing pressure on the vegetation (Figures 23 and 24) and potential direct disturbance on the wildlife.



Figure 23: Pasture condition in the proposed northern corridor. Photo: P. Kaczensky



Figure 24: Large flock of sheep in or near the proposed corridors. Photo: P. Kaczensky

6 Recommendations

Based on our survey of the reserve, our summary of existing reports, and our discussions with reserve staff we are able to make some preliminary recommendations for further work that is needed to fill knowledge gaps and actions to address important management needs.

(1) **Kulan movements.** Kulan are the single most iconic species for the Badhyz ecosystem. However, there is considerable uncertainty about their population size and where they travel beyond the reserve's borders in summer to look for water. Mapping these movements and understanding what is driving them is the single most important action needed to begin to develop actions to safeguard and increase their numbers. It requires the live capture of a number of individuals and instrumenting them with GPS-collars with satellite download to monitor movements.

(2) **Monitoring methods.** The reserve has well established routines for monitoring kulan, gazelles and urial. These methods likely provide a good index of population change over time. However, a few simple modifications to the way data is collected and analyzed could permit a more robust statistical analysis of the data to allow more confidence to be obtained concerning the extent to which they represent the actual numbers of animals in the population. In order to do this there is a need to access the raw data from the counts and reanalyze it using modern statistical methods. Furthermore, GPS-collar movement data on a small sample from all three species would greatly help in the interpretation of the census data.

(3) **Predator numbers.** Leopards and striped hyaena both occur in Badhyz, but it is highly uncertain how many. Conducting an intensive camera trapping session to determine the exact number – using the individual spot / stripe patterns to recognize individuals, should be a priority research activity.

(4) **Access to water.** The reserve and surrounding sanctuaries have very little surface water. Urial and gazelles appear to be able to survive on the existing water sources, but there are very few water sources suitable for kulan. Their access to year round sources in the Tedzhen river is blocked by the border fence. The Islim river often dries up in summer, and the spring in the Gushka river near Chemenabat is heavily used by livestock. The five springs along the Yeroyulandez escarpment have very limited water flow and likely do not provide enough water for a larger group of kulan during summer and autumn. The spring at Kerlek seems heavily laden with minerals and may be largely unsuitable as a water source over a longer period of time. All existing springs have salinity levels making the water unsuitable for human consumption and potentially increasing salinity as a result of extensive drought conditions may in the future further reduce the quality of the existing springs. We therefore support the reserves efforts to establish a new water source at Dashguyi. Furthermore, we recommend an evaluation of the possibility to reduce disturbance around the Gushka river sources during summer so that the kulan can drink in peace (at least at night).

(5) **Border fence.** Present knowledge of kulan movement patterns strongly suggests that the border fence is an absolute barrier to their movements. The Tedzhen river is therefore no longer available as a water source for the Badhyz kulan population. The absence of kulan observations on the Iranian side of the border (west of the Tedzhen river) since 2010 strongly suggests that kulan have become absent from west of the fence. The barrier effect for gazelles and urial can be expected to be almost equally strong, whereas predators may be able to cross the fence occasionally.

(6) **Ecosystem boundaries and livestock.** Our present knowledge on movement patterns of large carnivores, large herbivores and raptors / vultures indicates that individuals of all these species probably have ranges so large that they all move beyond the reserve's boundaries on a regular basis. This implies that there is a need to adopt a conservation view for Badhyz that goes beyond the borders of the reserve and adjacent sanctuaries and considers the wider ecosystem.

GPS-collar data from wide ranging species like kulan, gazelles and vultures can help to identify these ecological borders. In the meantime, it is essential to begin looking at issues related to livestock densities in the surrounding areas, and especially within the wildlife sanctuaries, to determine to what extent they are having negative impacts on the vegetation and wildlife. Furthermore, it would be desirable to investigate the extent to which shepherds are experiencing conflicts with wolves, leopards, hyaenas and raptors and determine if it is possible to improve their protective measures (livestock guarding dogs, night-time corrals) so as to reduce the chances of retaliatory killing of these predators.

(7) **Domestic horses.** The existence of free-ranging domestic horses in the reserve is a source of concern. Numbering around 100 at present, these will inevitably increase and can become a serious problem for the habitat and many species. Being equids they can be expected to compete for forage and water with the endangered kulan, one of the focal wildlife species of the reserve. We strongly recommend that action be taken now while numbers are small and the animals are relatively tame and easy to round up and handle. Ideally, they should all be rounded up and removed from the reserve. If this is not possible then a process of injecting female horses with a contraceptive medicine, potentially combined with surgical sterilization (under anesthesia) of the males will prevent further increases, and lead to a decline of the horse population over time.

(8) **Research.** Ecological knowledge concerning Badhyz is limited and rather outdated and there is a need to stimulate cooperation with national and international researchers to support reserve staff in studying the ecosystem. There has been very little research on the key species found in Badhyz in any other sites in the wider region, limiting the potential to transfer data. In fact, these Central Asian are among the less studied ecosystems on Earth. Ideally, a research agenda should be developed to prioritise and coordinate this work within the Badhyz ecosystem.

(9) **Equipment and infrastructure.** The protected area staff are obviously highly motivated and very dedicated to the conservation of Badhyz reserve and its wildlife. However, they are limited in their work due to a lack of modern equipment (such as vehicles, communications, clothing, weapons), compromising both their personal safety and their effectiveness in patrolling the reserve and monitoring its wildlife. The need for establishing new ranger posts in Yeroyulandez and in the Chemenabat sanctuaries should also be evaluated to increase their presence in these areas.

(10) **Disturbance.** The kulan, urial and gazelles that we observed were extremely shy, sometimes fleeing at over a kilometer from us. This shyness makes them extremely vulnerable to disturbance. As a consequence, it is important that any potential ecotourism development is conducted in a careful manner that minimizes negative impacts, especially close to water sources.

(11) **Reintroductions.** There have been discussions concerning the reintroduction of bezoar wild goats. Because of uncertainty concerning both the quality of the habitat in the western part of the reserve and of the size and status of the potential source population it is recommended that all such plans be put on hold until the necessary background knowledge and logistical issues are evaluated.

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