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Feasibility study for kulan (*Equus hemionus kulan*) reintroduction into the central steppe of Kazakhstan

Petra Kaczensky, Ruslan Doldin, Dag Enke, John D. C. Linnell, Oleg Lukanovsky, Albert R. Salemgareyev, Tetyana V. Sidorova, Sergey Sklyarenko, Talgat Kisebaev, Chris Walzer, Stephanie Ward & Steffen Zuther

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Abstract

Kaczensky, P., Doldin, R., Enke, D., Linnell, J. D. C., Lukanovsky, O., Salemgareyev A. R. Sidorova, T. V., Sklyarenko, S., Kisebaev, T., Walzer, C., Ward, S., Zuther, S. 2017. Feasibility study for kulan (*Equus hemionus kulan*) reintroduction into the central steppe of Kazakhstan. - NINA Report 1366. 68 pp.

Asiatic wild ass, or kulan (*Equus hemionous*), were once a key species in the assemblage of large herbivores (along with saiga antelope, several gazelle species and wild horses) that ranged the Eurasian steppes, stretching from the eastern shores of the Mediterranean to Mongolia. Overhunting and habitat conversion has since decimated their populations and nowadays they can only be found on less than 3% of their historic global distribution range.

While it is still possible to see large herds of kulan in the Gobi desert of Mongolia, the species only persist in tiny fragments in the rest of Central Asia. The end of the USSR resulted in dramatic socio-economic changes in the region. While some of these changes have been negative for species conservation, e.g. through the breakdown of management structures that prevented overhunting, others have created new opportunities for landscape-level biodiversity conservation and species recovery.

In Kazakhstan, large parts of the central steppe – an area equal to the size of France – became almost devoid of people and livestock. This situation has created the rare opportunity for landscape-level biodiversity conservation and species recovery in a steppe ecosystem. In 2005, the Altyn Dala Conservation Initiative (ADCI), a large-scale joint initiative of the Association for the Conservation of Biodiversity of Kazakhstan (ACBK), the Committee of Forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan, and international partners was initiated. The ADCI aims to conserve and recover nationally and internationally important flagship species and their habitats in the steppe and semi desert zones of Kazakhstan.

This project links into the ADCI vison and aims to 1) Re-establish kulan as part of the historic large herbivore assemblage on the Torgai steppe, 2) Double the range of kulan in Central Asia, 3) Significantly increase the global population, 4) Provide a catalyst for kulan and Przewalski's horse conservation actions across the region. This feasibility study focusses on the first fully funded three-year pilot phase, which is meant to establish a solid basis for the future conservation and management of kulan on the central steppe of Kazakhstan. The project involves a cooperation between several international partners (Norwegian Institute for Nature Research, Royal Society for the Protection of Birds, Nuremberg Zoo, Frankfurt Zoological Society) and a Kazakh NGO (Association for the Conservation of Biodiversity of Kazakhstan).

In October 2017 & 2018, we will capture a total of 32-36 kulan in Altyn Emel National Park in south-eastern Kazakhstan and airlift them to the Torgai steppe using a large transport helicopter. There, kulan will be initially held in two large acclimatization enclosures ("soft release") to familiarize them with the new environment and suppress excessive dispersal. The release site is strategically located in a network of protected areas and ecological corridors covering 40,000 km². All adult kulan will be released with GPS-Iridium collars to allow post-release monitoring. Post-release monitoring will be integrated in ongoing monitoring and patrolling routines by protected area and state rangers.

Training of local staff and the implementation of an additional ranger patrol team will increase capacity to include kulan on top of existing duties. Health screening, post-mortem analysis, and genetic monitoring will be used to establish baselines and inform the adaptive management process. A socio-economic survey will establish pre-release attitudes towards kulan recovery and identify potential conflicts. This information will be integrated in ongoing outreach programs, while we will explore opportunities to generate revenues for local people and more actively involve them in species recovery and steppe conservation in the long term.

This document aims to set the frames for a reintroduction project of kulan to the Torgai region of the central steppe of Kazakhstan. It is meant to provide: 1) Background information on the status quo, 2) A reference for the initial design in an adaptive management process, and 3) guidance

for both the implementing organizations and the national management authorities. The feasibility study can only provide a general outline of issues and will be constantly readapted based on newly emerging realities and evidence.

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Sammendrag

Kaczensky, P., Doldin, R., Enke, D., Linnell, J. D. C., Lukanovsky, O., Salemgareyev A. R. Sidorova, T. V., Sklyarenko, S., Kisebaev, T., Walzer, C., Ward, S., Zuther, S. 2017. Gjeninnføring av kulan (*Equus hemionus kulan*) til den sentrale steppen i Kasakhstan – en gjennomførbarhetsstudie. - NINA Report 1366. 68 pp.

Asiatisk villesel, eller kulan (*Equus hemionus*), var tidligere en nøkkelart blant de store planteeterne (sammen med saigaantilope, flere gasellearter og villhester) som var utbredt på de Eurasiske steppene fra Middelhavet til Mongolia. Overbeskatning og habitatendringer har siden ført til en sterk bestandsreduksjon av kulan, som nå kun lever i mindre enn 3% av det historiske utbredelsesområdet. Mens det fremdeles er mulig å se store flokker av kulan i Gobiørkenen i Mongolia, finnes arten kun i ørsmå bestander i resten av Sentral-Asia. Sovjetunionens fall førte til dramatiske sosio-økonomiske endringer i regionen. Mens noen av disse endringene har vært negative for bevaring av arter, slik som kollapsen i forvaltningsstrukturer som hindret overbeskatning, har andre skapt nye muligheter for bevaring og restituering av biodiversitet. I Kasakhstan ble store deler av den sentrale steppen – et område på størrelse med Frankrike – nesten fri for folk og buskap i denne perioden. Dette har skapt en sjelden mulighet for bevaring av biodiversitet på landskapsnivå og for tidligere undertrykte arter til å vende tilbake til et steppeøkosystem.

I 2005 ble Altyn Dala Conservation Initiaitve (ADCI) igangsatt. Dette er et storskala felles initiativ på vegne av Association for the Conservation of Biodiversity of Kazakhstan (ACBK), Committee of Forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan og internasjonale partnere. ADCI har som mål å bevare og gjenopprette nasjonalt og internasjonalt viktige flaggskip-arter og deres habitat i områdene med steppe og halvørken i Kasakhstan. Dette prosjektet er knyttet til ADCIs visjon og har som mål 1) å reetablere kulan som en del av den historiske gruppen med store planteetere på Torgai-steppen, 2) å doble utbredelsesområdet til kulan i Sentral-Asia, 3) å betydelig øke den globale bestanden, og 4) å være en katalysator for bevaring av kulan og Przewalskis hest over hele regionen. Denne gjennomførbarhetsstudien fokuserer på den første fullfinansierte treårige pilotfasen, som er ment å etablere et solid grunnlag for den fremtidige bevaringen og forvaltningen av kulanen på den sentrale steppen i Kasakhstan.

Prosjektet involverer et samarbeid mellom flere internasjonale partnere (Norsk institutt for naturforskning, Royal Society for the Protection of Birds, Nuremberg Zoo, Frankfurt Zoological Society) og en kasakhisk ikke-statlig organisasjon (Association for the Conservation of Biodiversity of Kazakhstan). I oktober 2017 og 2018 vil vi fange totalt 32-36 kulan i Altyn Emel nasjonalpark sør-øst i Kasakhstan og frakte dem til Torgai-steppen med et stort transporthelikopter. Etter ankomst vil dyrene bli holdt i to store innhegninger for akklimatisering («soft release») i det nye miljøet, og for å hindre overdreven spredning. Stedet for utsetting er strategisk plassert i et nettverk av verneområder og økologiske korridorer som dekker 40 000 km2. Alle voksne individer vil bli sluppet løs med GPS-Iridium halsbånd for å kunne overvåke dem etter slipp. Siden vil dyrene bli overvåket som en del av pågående overvåkings- og patruljeringsrutiner for statlige oppsynsmenn i verneområdet. Opplæring av lokale ansatte og opprettelsen av et nytt lag med oppsynsmenn vil bli gjennomført for at kulanovervåking kan innlemmes blant eksisterende arbeidsoppgaver. I tillegg vil helseovervåking, post-mortem analyser og genetisk overvåking av dyrene bli gjennomført for å etablere referanseverdier og grunnlagsdata for en adaptiv forvaltning. I forkant av utsetting vil vi gjennomføre en sosio-økonomisk undersøkelse for å kartlegge holdninger til reintroduksjon av kulan og for å identifisere potensielle konflikter med lokalbefolkningen. Kunnskap fra denne undersøkelsen vil bli innlemmet i et pågående kommunikasjonsprogram. I tillegg vil vi undersøke muligheten for å øke inntektsgrunnlaget lokalt, og for å mer aktivt involvere lokalbefolkningen i prosessen med å gjeninnføre arter og bevare steppelandskapet over tid.

Dette dokumentet har som formål å sette rammene for et prosjekt for gjeninnføring av kulan til Torgai-regionen på den sentrale steppen i Kasakhstan. Dokumentet er ment å fungere som 1)

kilde til bakgrunnsinformasjon om nåværende status, 2) et referansegrunnlag for en adaptiv forvaltningsprosess, og 3) en veiledning for utførende organisasjoner og nasjonale forvaltningsmyndigheter. Gjennomførbarhetsstudien vil tjene som et tidlig rammeverk, og vil bli tilpasset ny kunnskap og erfaring som opparbeides underveis.

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Contents

Foreword

For more than a decade a group of NGOs have been partnering with the government of Kazakhstan to conserve an enormous area of steppe in the centre of the country. This project has been dubbed the Altyn Dala Conservation Initiative. The saiga antelope has long been the flagship species of this initiative and has drawn international attention to the unique conservation responsibilities and possibilities that the region can offer. Now thanks to funding provided by the Fondation Segre and Nuremberg Zoo for the period 2016-2020 we are able to present plans for a project which intends to begin the process of restoring another flagship species to the ecosystem, the Asiatic wild ass or kulan, which has been absent for more than a century. This report summarises our feasibility study, presents background information on the species and the region, and details our plans for the first phase of the reintroduction process. The structure of the report generally follows the guidelines provided by the IUCN Reintroduction Specialist Group.

Various drafts of this report have been extensively commented on by chairs and co-chairs of several IUCN specialist groups. These are Axel Moehrenschlager (Reintroduction Specialist Group), Kirk Olson (Grasslands Specialist Group), Sarah King and Patricia Moehlman (Equid Specialist Group) and David Mallon (Antelope Specialist Group). We are very grateful for their valuable inputs. We are also grateful to the Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (UNEP/CMS) for their support. This report has been read and commented on by NINA’s animal welfare and biosecurity officers, also representing NINA’s animal welfare body, and is accepted to be within NINA’s standards with regard to biosecurity and animal welfare

May 2017
Petra Kaczensky and John D. C. Linnell

1 Introduction

1.1 Vision and scope

Temperate grasslands are home to a unique assemblage of large, charismatic mammals, many of which are migratory and endangered. These habitats are also considered the most altered and endangered biome on the planet (Hohhot Declaration 2008, IUCN / WCPA Protected Areas Grasslands Group). While the Serengeti system of east Africa is familiar to most people, the equivalent ecosystems from Central Asia are far less known, but equally endangered (Mallon and Zhigang 2009). The combination of a rich wildlife fauna and increasing threats has motivated the Convention on Migratory Species (CMS) to launch a Central Asian Mammals Initiative (CAMI; http://www.cms.int/cami/).

Up until recent centuries, large herds of migratory Asiatic wild ass (*Equus hemionus;* variously known as kulan, khulan, dziggetai, onager, or khur in different parts of their range) roamed the Eurasian Steppe from the eastern shores of the Mediterranean Sea in the west to the Mongolian-Manchurian Steppe in the north-east, and as far south as the Rann of Kuch in Gujarat, India (Fig. 3.1). Nowadays, only fragments of this once vast distribution range remain; today the species is found on <3% of its historic range. The situation is particularly critical for the subspecies / ecotypes (*E. h. kulan* and *E. h. onager*) once found throughout the hot deserts and temperate steppes of Central Asia - both are currently listed as “Endangered” on the IUCN Red List (Bennett et al. 2017, Hemami et al. 2016, Kaczensky et al. 2015 & 2016a).

There is currently a window of opportunity to secure and restore parts of one of the largest grassland systems in Central Asia. With the breakdown of the Soviet system at the beginning of the 1990s the socio-economic situation of Central Asian countries changed dramatically. Some of these changes have been negative for species conservation, for example through the breakdown of management structures that prevented overhunting. However, other changes have opened new opportunities. In Kazakhstan, large parts of the central steppe – an area equal to the size of France – have become almost devoid of people and livestock. This situation has created an opportunity for landscape-level biodiversity conservation and recovery of a steppe ecosystem. The Altyn Dala Conservation Initiative (ADCI) was founded in 2005 and is a large-scale joint initiative of the Association for the Conservation of Biodiversity of Kazakhstan (ACBK), the Committee of Forestry and Wildlife of the Ministry of Agriculture of the Republic of Kazakhstan, and international partners to conserve nationally and internationally important flagship species and their habitats in the steppe and semi desert zones of Kazakhstan (http://database.acbk.kz/index.php).

This project aims to initiate the process of reintroducing a kulan population to the Torgai steppe region within the wider Altyn Dala ecosystem. As such it will make a contribution to both conserving this species and restoring the full species compliment to the herbivore community of the steppe ecosystem. Currently funding has been secured for three years of activity, which will cover two transports of 16-18 animals each. We are still seeking funding for a third transport. If these individuals survive and reproduce as expected they should provide a solid nucleus for rapid population growth. Although it is likely that further transports of animals will be needed to secure a broad genetic foundation and accelerate growth our intention in this report is to describe the goals and procedures for this first phase of the project. Experience gained in this phase will be used to design and fund-raise for longer term activities. As such, this phase can be viewed as a pilot project which will form the basis of an adaptive management approach.

Species reintroductions are always high profile and controversial activities where questions about animal welfare are becoming increasingly common. We fully acknowledge that all capture, handling and transport of wild animals will involve stress and a certain risk of injury or even death. To reduce this risk to a minimum, we are going to use our combined years of experience with this and relate species and will be operating with the state of the art practices. We will continue to document and study our practices – using a level of follow-up monitoring and investigation that is rarely done for other species. We strongly feel that the expected and concrete conservation gains of the planned reintroduction by far outweigh the potential (but probably low) risks involved for the wellbeing of the individual kulan (Harrington et al. 2013, Moehrenschlager 2017).

Although kulan have been reintroduced to multiple places during the last half century, the documentation of these efforts is very poor and post release monitoring has been minimal (Kaczensky et al. 2016b). Our understanding of kulan ecology has greatly improved in recent years (Ransom and Kaczensky 2016), but there remain many open questions, including such basic things as social organization, population composition, or the prevalence and dynamics of various disease vectors. We will work in an adaptive way, learning from each step, and modifying practices as we go based on what we learn. This makes it unproductive to lock ourselves into too many detailed plans at this stage as our procedures will constantly evolve as we learn from experience. Accordingly, this feasibility study can only provide a general outline of issues. As the program goes ahead we will have to adapt to the reality as it emerges and this will have to be done based on the knowledge and improvisation of the experts involved. In an ideal world, everything could be foreseen and planned for – but we must consider the wild nature of the animals being caught, uncontrollable issues like weather, and the many logistical elements that need to be addressed.

1.2 Nature of this document

This document aims to set the frames for a reintroduction project of Asiatic wild asses, or kulan (*Equus hemionus kulan*), to the Torgai region of the central steppe of Kazakhstan. It is meant to provide: 1) Background information on the status quo, 2) A reference for the initial design in an adaptive management process, and 3) Guidance for both the implementing organizations and the national management authorities. In presenting this document we are following the structure given in the *IUCN Guidelines for Reintroduction and Other Conservation Translocations* (IUCN/SSC, 2013).

The document is intended to be translated into Russian/Kazakh language and is aimed at project partners that include NGOs and GOs – rather than academics. It would therefore be impractical and inappropriate to discuss every aspect of every decision in full detail. Interested readers can refer to the cited literature.

2 Definitions and classification

Restoring kulan to the Torgai steppe in central Kazakhstan involves the intentional movement and release of kulan to an area of its indigenous range from which it has been absent for more than a century, and thus constitutes a “reintroduction” according to IUCN/SSC (2013; Fig. 2.1) definitions.

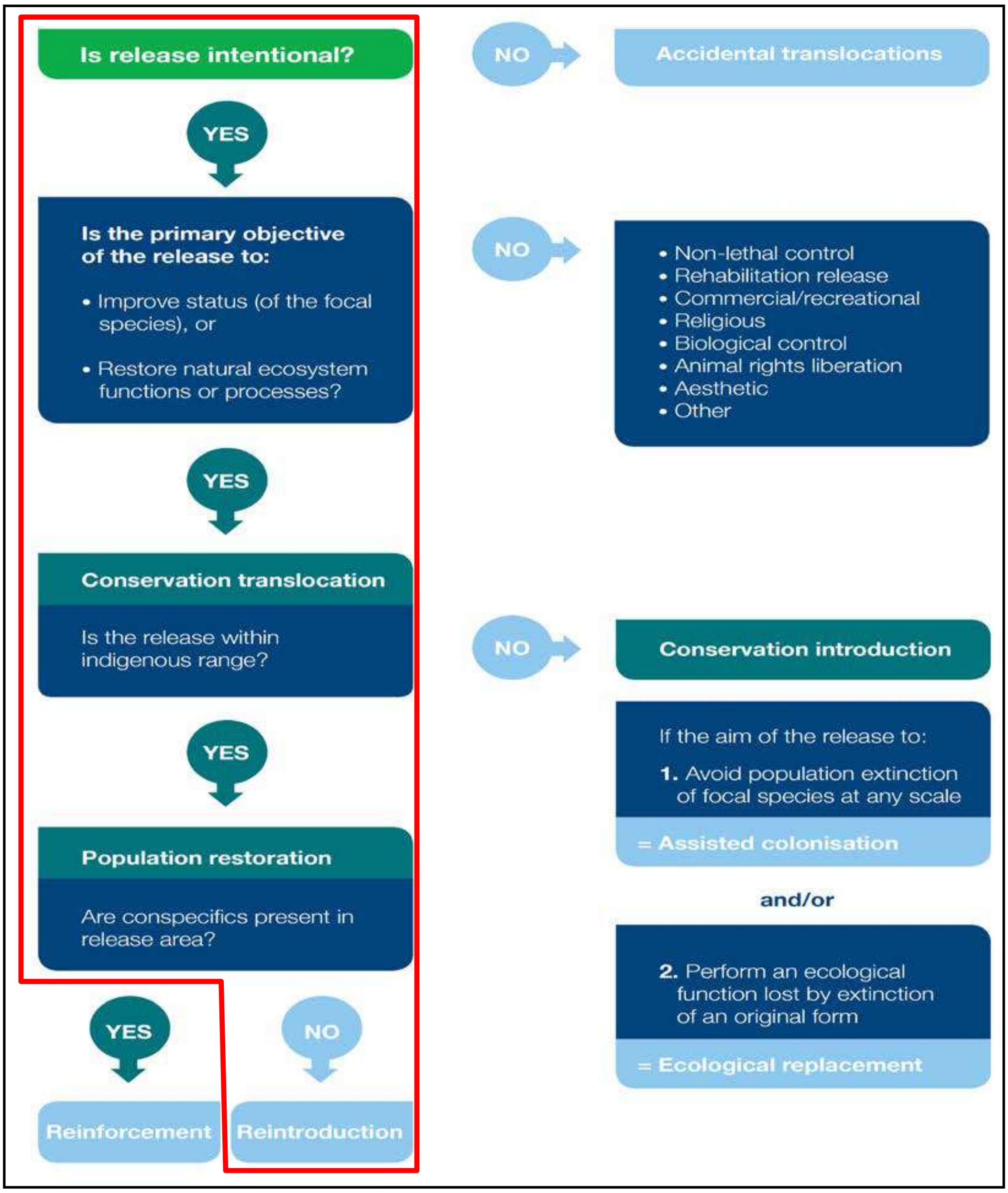

Fig. 2.1. The red outline shows why returning kulan to the Torgai region of the central steppe of Kazakhstan is a reintroduction based on the IUCN/SSC (2013) classification framework.

3 Deciding when translocation is an acceptable option

3.1 Kulan reintroduction as part of temperate grassland restoration in Kazakhstan

In Kazakhstan, kulan became extinct in the 1930s, as a result of overhunting and competition with livestock (Heptner et al. 1988). The first kulan were reintroduced to Kazakhstan with wild caught individuals transported from Turkmenistan in 1953. Today the species is present in Kazakhstan in three isolated locations (Fig. 3.1):

(1) Around the former Barsa-Kelmes Island in the Aral Sea. This population is currently estimated at around 350 individuals.
(2) In Altyn Emel National Park (NP) in the southeast. With 3417 kulan counted in February 2017, the reintroduced Altyn Emel population is by far the most successful wild equid reintroduction globally, and now constitutes the single largest free-ranging population of *Equus hemionus kulan* (Kaczensky et al. 2016b).
(3) Some additional kulan are also present in the Andassay Sanctuary, from reintroduction attempts during the last decades, but the status of this population is currently unknown.

Although kulan are again present in Kazakhstan they have reclaimed less than 1% of their former range and remain totally absent from the central steppe. Natural expansion from Altyn Emel NP cannot be expected due to the combination of large distances (straight line distance from Altyn Emel NP to the Torgai steppe is ca. 1800 km) and the presence of natural and anthropogenic barriers. The planned kulan reintroduction project will translocate kulan from the large population in Altyn Emel NP to a release site on the ~60,000 km² Torgai region of the central steppe, strategically located in a network of protected areas, ecological corridors, and hunting areas (Fig. 3.1, Fig. 3.2).

The Torgai steppe contains a near intact large mammal fauna, representing key habitat for the largest saiga (*Saiga tatarica*) population in addition to supporting species like wolves (*Canis lupus*) and wild boar (*Sus scrofa*). The large equids, kulan and Przewalski's horses (*Equus przewalskii*), are the only missing species. The Torgai steppe currently has the greatest potential to re-establish regionally extirpated wild equids – the kulan and Przewalski's horses – in what probably once used to be their original habitat (Kaczensky 2011). Starting wild equid recovery in Kazakhstan with kulan has several advantages: 1) the species has a clear legal status in the country (whereas the Przewalski's horse is still awaiting listing in the Red Data Book of Kazakhstan), 2) there are locally adapted and free-ranging animals suitable for reintroduction in Kazakhstan, and 3) experience with kulan capture is available in-country (Flint et al. 1988, Levanov et al. 2011). Experience gained from kulan reintroduction to the Torgai steppe within the framework of this project will be used to plan and optimize Przewalski's horse reintroduction in an eventual follow-up project. The return of these two species will re-establish the complete large mammal fauna of the steppe, which is a prerequisite for restoring the full ecological functionality of the ecosystem.

Fig. 3.1. Kulan will be reintroduced to the Torgai steppe in central Kazakhstan with animals from the large reintroduced population in Altyn Emel NP. The release site at Alibi is strategically located in a network of protected areas, ecological corridors, and ACBK managed hunting areas.

3.2 Conservation activities on the Torgai steppe

The importance of the Torgai steppe for wildlife conservation is justified by its vast size, wilderness character, and its importance as core habitat for the Betpak Dala saiga population. Although the area was historically used as pasture land, with the breakdown of the Soviet Union and the subsequent drying up of funds to maintain even basic infrastructure, people left for larger settlements and towns. By the 1990s, many villages and farms had been abandoned (Lenk 2008) and the Torgai steppe now represents one of the largest tracts of relatively undisturbed native grasslands of Central Asia (Fig. 3.2).

Consequently, the Torgai steppe played a key role within the ADCI conservation strategy. In 2007, the government of Kazakhstan designated the Irgiz-Turgai State Nature Reserve (SNR; http://www.rferl.org/a/1075716.html). In 2008, documents for the proposed Altyn Dala SNR were approved, and in 2012, this second protected area was officially designated in the Torgai steppe (http://www.acbk.kz/en/pages/550.html).

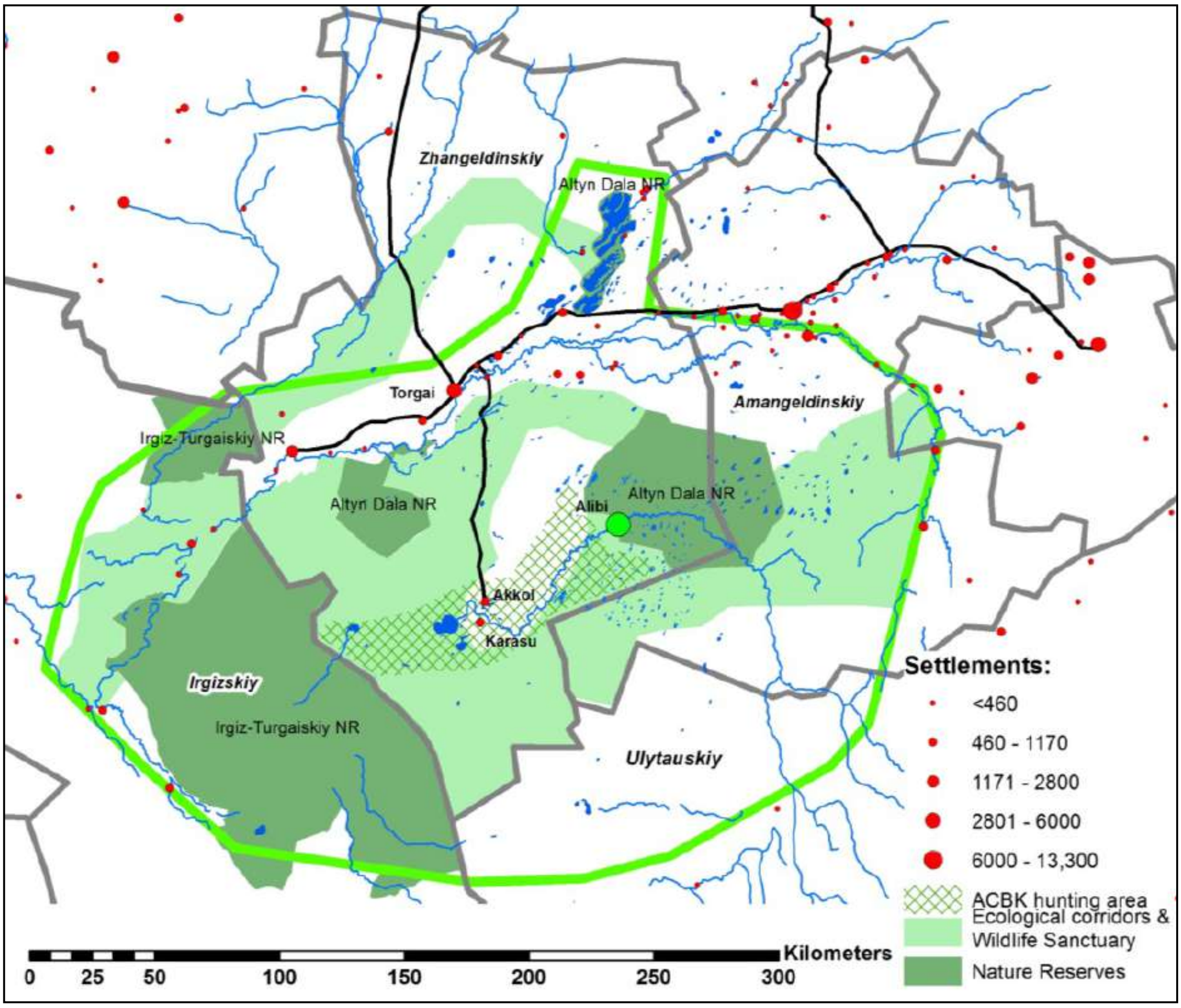

Fig. 3.2. The Torgai steppe (light green polygon) in central Kazakhstan. Grey outlines depict district borders.

The ADCI selected the Torgai steppe as a focal area for restoring a functioning grassland ecosystem including its native large, migratory herbivores. Since 2008, regular ADCI ranger patrols have collected wildlife observation data, organized meetings with local people, and conducted anti-poaching activities. A separate team has worked with local schools and organised information events for local people and local administrations. This latter activity lasted for 3 years and visited all villages within the ADCI project area. Since its initiation, the ADCI has been supporting the Irgiz-Turgai and the Altyn Dala SNRs; advising with management planning, providing training for wildlife monitoring, and supporting research.

From 2009-2010, a land-use planning project was conducted for the Zhangeldy district (with ~40,000 km^2, the largest district of the Torgai steppe; see Fig. 3.2). This district is especially important for saiga, and therefore the goal was to produce a plan that specifically takes into account the needs of saiga and other steppe wildlife. From 2008-2013, the GEF/UNDP funded project "Steppe Conservation and Management" was conducted (http://www.kz.undp.org/content/dam/kazakhstan/docs/prodocs/EE/Steppe/ProDoc.pdf). The role of ACBK in this project was to develop a steppe monitoring and protected area development plan. The latter resulted in proposals to: 1) extend the existing Irgiz-Turgai SNR to include important saiga habitats and 2) create an ecological corridor to connect the Altyn Dala SNR with the Irgiz-Turgai SNR. The ecological corridor was designated in 2014, and the extension of the Irgiz-Turgai SNR in 2016.

In autumn 2009, ACBK leased two hunting areas ("Saga" and "Altybai") to improve wildlife protection in the Torgai steppe. These areas are now managed as private protected areas without hunting, but with regular ranger patrols to prevent poaching. They cover important migration routes of saiga and supplement the protection function of the ecological corridor.

ACBK also launched several research projects. In 2009, the first saiga antelope were captured and tagged with satellite collars to track their movements and support patrolling. This telemetry project was started in the Torgai steppe, has become an important component of the national saiga conservation work in Kazakhstan, and is supported by the responsible governmental agencies (http://www.acbk.kz/en/pages/755.html). Other large mammal work focussed on the ecology of steppe wolves, with initial monitoring and collaring activities implemented in the ACBK hunting areas and in the Irgiz-Turgai SNR (ACBK 2015a, Shmalenko and Salemgareyev 2016). Furthermore, several expeditions have been organised to the Torgai steppe to investigate and map biodiversity resulting in a good knowledge base on plant communities, birds, and mammal distribution.

4 Planning the translocation

4.1 Goals, objectives and actions

4.1.1 Goals

Goal #1: Create a new population nucleus in Kazakhstan, thereby doubling the range of kulan in Central Asia.

Goal #2: Significantly increase the global kulan population.

Goal #3: Provide a catalyst for kulan conservation actions in the region.

Goal #4: Contribute to the conservation and restoration of the full steppe fauna of central Kazakhstan, including preparing for Przewalski's horse reintroduction and helping conserve the largest saiga antelope range.

4.1.2 Objectives and required actions

1. Obtain/prepare all legal documents necessary so that the kulan reintroduction follows national and international standards.
    1.1. Get approval for the “National biological background document” by the Committee of Forestry and Wildlife of the Ministry of Agriculture of Kazakhstan.
    1.2. Complete the “Feasibility study for kulan reintroduction” and send it out for comments to relevant IUCN Specialist Groups.
    1.3. Get approval for the “Specific biological background document” for project areas by relevant state organs & local landusers.
2. Improve the national knowledge base on kulan.
    2.1. Conduct interviews with local people about their attitudes towards steppe recovery and wild steppe ungulates (kulan, saiga, Przewalski’s horse) restoration.
    2.2. Evaluate the Kulan situation in Barsa Kelmes as a basis for a National Kulan Action Plan.
    2.3. Initiate late summer kulan counts to estimate foal rates in the source populations, Altyn Emel NP.
3. Develop a national kulan action plan as a part of a wider regional conservation strategy.
    3.1. Draft a national kulan action plan for approval by the government of Kazakhstan.
4. Raise awareness for kulan and steppe conservation & restoration.
    4.1. Produce information material on kulan and steppe conservation for regional, national, and international use.
    4.2. Refurbish the “Steppe ungulate education bus” as a communication tool.
    4.3. Obtain international recognition for the project by CMS / CAMI, IUCN, and through international conferences and publications.
5. Provide the infrastructure necessary for kulan reintroduction to the Torgai steppe using a soft-release strategy.
    5.1. Upgrade existing infrastructure at the Alibi field station to allow housing translocated kulan for up to 5 months, aiming for a release in early spring.
    5.2. Prepare and store sufficient hay for 18 kulan for 5 months each summer before transports.
    5.3. Obtain the necessary veterinary equipment, train local caretakers, and the national veterinarian.
    5.4. Find two international veterianrian interns to support kulan monitoring in the acclimatization enclosures.

6. Capture a minimum of 32-48 kulan in Altyn Emel NP and transport them to the acclimatisation enclosure at Alibi in the Torgai steppe.
    6.1. Organize corral capture in Altyn Emel NP for November 2017, 2018, and 2019[1].
    6.2. Build suitable transport boxes according to international standards.
    6.3. Recruit international wildlife veterinarian for anaesthesia, disease screening, sampling, and radio-collaring of captured kulan and supervision during transport.
    6.4. Organize helicopter transport from the capture site in Altyn Emel NP directly to the acclimatization enclosure at Alibi in November 2017, 2018, and 2019 (Fig. 3.1).
7. Release a minimum of 32-48 kulan in the Torgai steppe in Central Kazakhstan to build up a self-sustaining population aiming for 100 animals by 2027.
    7.1. Maintain translocated kulan in good health and body condition (with guidance and capacity building provided by Nuremberg Zoo and international wildlife veterinarian) for up to 5 months in the acclimatisation enclosure in Alibi until release.
8. Monitor post-release movements, survival, reproduction, and genetic diversity of reintroduced kulan and their offspring to guide adaptive management.
    8.1. Ranger monitoring guided by GPS locations of released kulan.
    8.2. Fecal samples of foals and unmarked kulan are collected and are the basis for genetic monitoring.
    8.3. Site inspections and post-mortem sampling of deceased kulan will be used to determine cause of death.
    8.4. Analysis of GPS locations provides inside into how kulan reclaim a new habitat and what movements they will show along the steppe – desert-steppe continuum on the Torgai steppe.
9. Support ongoing anti-poaching patrols to minimize uncontrolled human-caused mortality of wildlife, including kulan.
    9.1. Anti-poaching activities will be intensified by funding an additional ranger team once kulan are released.

4.2 Monitoring program design

All reintroduced kulan ≥3 years will be collared with GPS-Iridium collars programmed to collect 1 GPS location per hour over a 2.5-3-year period (previous experience has shown that collars physically tend not to last any longer due to wear and tear and damage caused by the animals). GPS data will be further analyzed within a movement-ecology framework to add to a better understanding of the species habitat use and movement patterns. Subsequent efforts to re-collar reintroduced kulan will only be made if ground based ranger monitoring proves insufficient in monitoring population development.

Currently 137 rangers belonging to the Irgiz-Turgai State SNR, the Altyn Dala State SNR, and the ACBK hunting reserves patrol the Torgai steppe. In addition, 2-6 teams (each group has four rangers and two vehicles) of state rangers “PA Okhotzooprom” patrol the surrounding areas. Rangers monitor wildlife presence and look for signs of poaching activity currently targeted primarily at saiga antelope. The ultimate cause for saiga poaching is the demand and the high prices paid for saiga horn used for traditional Chinese medicine (TCM). However, the value of saiga meat is also considerable, even if the main motivation is the harvest of horns (Kühl et al. 2009). Patrolling to prevent saiga poaching is facilitated by providing rangers with weekly maps of saiga distribution from animals wearing GPS satellite collars. The same system will be used for the kulan and an additional ranger team (4 men and a 4x4 vehicle) will be funded to increase patrolling capacity.

[1] Full funding for the 2017 and 2018 transports are secured, but we will have to still raise additional funding for the 2019 transport

All observations of kulan by the anti-poaching teams will be recorded with GPS points and a short comment on group size, group composition, and potential injuries or other signs of poor health. All locations of stationary collars will be investigated to check for premature collar drops or mortalities. All carcasses will be examined for cause of death using a simplified field post-mortem protocol, and samples will be collected for subsequent pathological investigations. Furthermore, annual aerial saiga surveys (see ACBK 2016) will in the future also count and map kulan presence. Rangers will also collect faeces of foals and unmarked kulan to allow genetic monitoring.

4.3 Adaptive contingency planning

If natural or human-induced mortalities remain high, or reproduction remains low, or if the combination of these factors does not allow for an annual increase of at least 10% after the first 10 years (and despite additional transports to counterbalance initial losses), the reintroduction project will be reevaluated. If assessment of the natural and socioeconomic factors negatively influencing kulan survival or reproduction show that it is highly unlikely that the situation will improve, the project will be terminated. If feasible, remaining kulan will be used for translocation elsewhere in the region; otherwise, their fate will be monitored within the framework of other wildlife monitoring programs.

5 Feasibility and design

5.1 Biological feasibility

5.1.1 Basic biological knowledge

Asiatic wild ass (kulan in Russian) are large herbivores adapted to a cursorial life on open plains. In the past, large herds of migratory Asiatic wild ass roamed the vast Eurasian Steppe from the eastern shores of the Mediterranean Sea in the west to the Mongolian-Manchurian Steppe in the north-east and as far south as the Rann of Kuch in Gujarat, India. Nowadays, only fragments of this once vast distribution range remain, with the largest intact area found in the Mongolian Gobi. Free ranging kulan populations currently occur in eight countries in 17 more or less isolated populations with an estimated global population of 55,000 animals. The largest remaining kulan population is found in southern Mongolia (42,000 or 75% of the global population) and parts of adjacent China (5,000 or 9% of the global population). The main causes for the overall population decline are the combination of direct killing, habitat loss and fragmentation, and competition with humans and their livestock over access to pasture and water (Kaczensky et al. 2015, Kaczensky et al. 2016a).

Kulan, like all equids, have hypsodont teeth and are hindgut fermenters and thus able to process large quantities of low quality food (Schoenecker et al. 2016). When grass is plentiful, kulan are predominately grazers. When forage is scarce or in marginal habitats, kulan will supplement their diet with shrubs and switch to become mixed-feeders during certain seasons (Bannikov 1981, Xu et al. 2012, Burnik Šturm et al. 2016 *EarlyOnline*). In the cold and temperate steppes of Central Asia and Mongolia, grazing competition between different herbivores can be expected to be highest during the long and cold non-growing season in winter. During this time food is not only of low energy content, but it is also dry, and once grazed does not regrow before spring (Burnik Šturm et al. 2016 *EarlyOnline*, Kerven 2004). Furthermore, with temperatures regularly falling to -20°C and lower, animals need to spend considerable energy in maintaining body heat.

In the Mongolian Gobi, median range sizes vary, depending on region, between 6,000 to 30,000 km² and maximum ranges can be up to 60,000 km² (Kaczensky et al. 2011a, Kaczensky et al. unpubl. data). In the Mongolian Gobi, kulan do not migrate between distinct summer and winter ranges, rather movements appear to be nomadic and overall movement coordination between individuals is low (Calabrese et al. in prep.). Kulan seem to show little preference for any particular plant community type, but avoid steep slopes, pastures of very low productivity and areas with high livestock densities (Kaczensky et al. 2008, Kaczensky et al. 2011a, Buuveibaatar et al. 2016a). All equids are water dependent and kulan need regular access to water, drinking between 12-15 litres / day and up to 24 litres on hot days (Bannikov 1981, Kaczensky et al. 2010a, Zhang et al. 2015). Water availability is a key resource and in summer months the species primarily occurs within commuting distance (15-20 km) of standing water (Kaczensky et al. 2008, Nandintsetseg et al. 2016).

Like other arid adapted equids, kulan seem to live in fission-fusion groups, with the only stable unit being females and their foals (Sundaresan et al. 2007, Kaczensky et al. 2008, Rubenstein et al. 2015). Females give birth in mid or late-June to a single foal and come into estrous 1-2 weeks post-partum. Females are polyestrous with estrous recurring every 21-25 days until conception or the end of the breeding season (Asa 2011, Schook et al. 2013). Peak mating season is somewhat climate dependent, happening earlier in Turkmenistan (April/May) and later in the Gobi (June/July) (Kaczensky unpubl. data). Stallions seem to occupy temporary mating territories, often returning to the same locations in consecutive years (Kaczensky *unpubl. data*, Neumann-Denzau and Denzau 2007); a system at least superficially similar to “lekking” which is also observed in the Tibetan antelope (*Pantholops hodgsonii;* Buzzard et al. 2008).

Very little data on demographic rates and population dynamics are available from large natural populations. Age at first reproduction in the wild seems to be three years for mares and five years for stallions. Mares can produce a foal annually under favorable conditions up to at least 15 years of age. Sex-ratio at birth seems close to 50:50 (Bannikov 1981, Saltz and Rubenstein 1995, Volf 2010). For the reintroduced and intensively studied population on Barsa Kelmes Island average fertility of adult mares was estimated at 66.6%, but varied depending on pasture conditions and winter severity (Bannikov 1981). Foal survival in the wild is can be expected to be in the order of 50% and yearling survival is lower than adult survival (Feh et al. 2001, Kaczensky pers. obs.). Age determination of 350 skulls of Asiatic Wild Ass carcasses from the Mongolian Gobi documented a mean age of 9.1 years (for animals ≥3 years) and a maximum age of 29 years (Lkhagvasuren et al. 2013, Lkhagvasuren et al. submitted).

5.1.2 Expected population growth

There is not enough demographic data on kulan to permit the development of complex models predicting population growth. However, there is monitoring data from the two previously reintroduced kulan populations in Kazakhstan. Analysis of these data suggests an initial annual exponential growth rates of 13% for kulan on Barsa Kelmes island (period 1953-1983 until a plateau was reached) and of 15% in Altyn Emel NP (period 1982-2015; Kaczensky et al. in prep.). Because of the massive size of the reintroduction site, it is not expected that density dependence will be observed in the short to medium term, making the assumption of lack of density dependence realistic.

Assuming an annual population growth between 10-15% and 2-3 transports of 16 kulan with subsequent release in early spring the following year, we expect to see a population of ~100 kulan 10 years from now in 2017 (Table 5.1; this is a conservative estimate as we did not include reproduction during the transport years).

Table 5.1: Expected population development of the reintroduced population based on experiences from previous reintroduction to Barsa Kelmes Island and Altyn Emel NP in Kazakhstan. The table illustrates two growth rate scenarios (10 or 15%) for two different starting points (2 or 3 transports).

Calender year	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**
Cummulative release into the wild																				
	16	32	48																	
Assumed population growth after transports stop																				
10%	16	32	**48**	53	58	64	70	77	85	94	103	113	124	137	151	166	182	201	221	243
15%	16	32	**48**	55	63	73	84	97	111	128	147	169	194	223	257	295	340	391	449	517
10%	16	**32**	35	39	43	47	52	57	62	69	75	83	91	100	110	122	134	147	162	178
15%	16	**32**	37	42	49	56	64	74	85	98	113	129	149	171	197	226	260	299	344	396

If kulan are lost due to unexpected mortalities in the early phase of the population establishment, the losses will be compensated for with additional transports. The same is true if released animals seem to have lost contact to each other (e.g. due to long-distance dispersal), if reproduction is poor, or genetic monitoring suggests high levels of inbreeding.

Depending on the underlying causes of the unexpected high mortality or low reproduction we will address the relevant socio-economic factors or ecological factors by working with the local communities and/or by changing the selection of animals or modify the release regime.

5.1.3 Habitat

5.1.3.1 Evidence of past kulan presence in the steppe of central Kazakhstan

Rock carvings and observations confirm past kulan presence in the central steppe of Kazakhstan, including the Torgai (Turgay), Dzhezkazgan, and Betpak-Dala areas. In the early 19th century kulan still inhabited the Torgai steppe, but were gone by the end of the century. From Betpak-Dala, the kulan disappeared in the late 19th or early 20th century. The last known kulan in Kazakhstan was killed on the north-western shore of lake Balkhash between 1930 and 1935 (Bannikov 1981). Kulan are believed to have migrated between the steppes of northern Kazakhstan

(Akmolinsky region and the Barabin steppe) in summer to the desert areas of southern Kazakhstan (Betpak-Dala) in winter forming herds of up to a thousand animals (Bannikov 1981). We expect that reintroduced kulan will show large scale movements equaling those of saiga (Fig. 5.1).

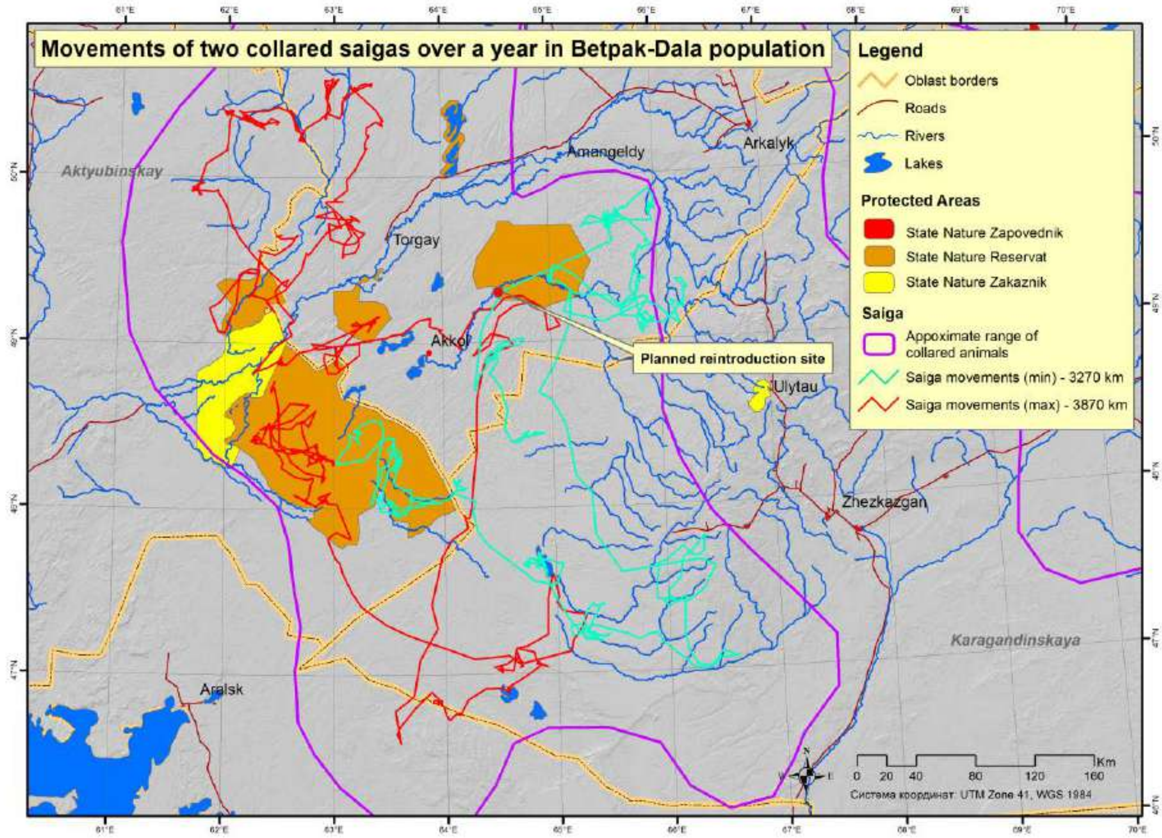

Fig. 5.1: Movements of two selected GPS collared saiga over a 1-year period; from the upper and lower extreme of annual saiga ranges (red = 73,900 km²; light blue = 48,600 km²).

5.1.3.2 Protection status of the Torgai steppe and Alibi release site

The release site is located at the abandoned village of Alibi at the southern edge of the Altyn Dala SNR along the river Uly-Zhylanshyk. The site is located at the transition zone between the steppe and the semi-desert zone (see chapter 5.1.3.4.). Alibi is located in the south of the Kostanay province (oblast) in the Zhangeldinskiy district (rayon), the administration of which is based in Torgai, about 130 km from the reintroduction centre. Alibi is strategically located in a network of protected areas, ecological corridors, and the two hunting areas managed by ACBK with a combined current staff of 137 rangers (Fig. 5.2, Table 5.2). In addition, 2-6 groups (each group has four rangers and two vehicles) of state rangers “PA Okhotzooprom” patrol the surrounding areas.

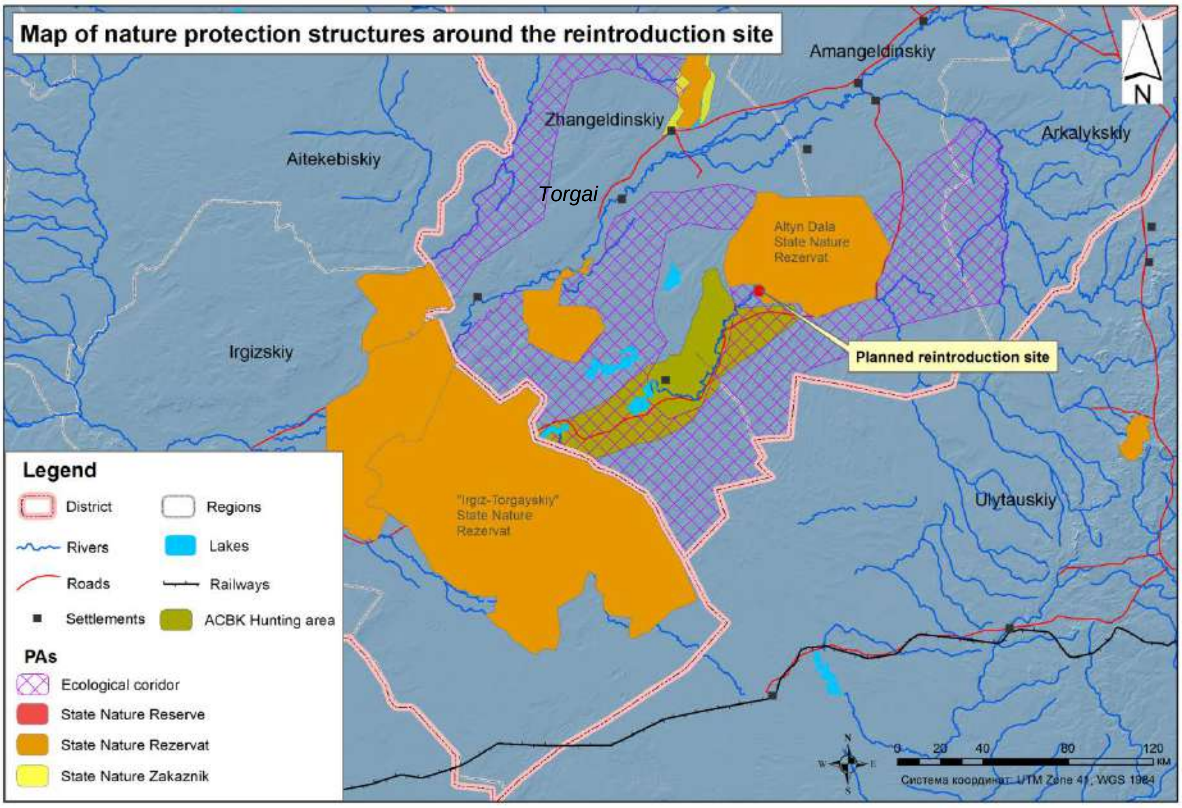

Fig. 5.2. Location of the Alibi release site on the Torgai steppe.

Table 5.2: Protected area network around the reintroduction site at Alibi.

Name	Area (km²)	Status	Designation year	Number of rangers
Altyn Dala SNR	4,898	State protection	2012	61
Irgiz-Torgayskiy SNR	11,735	State protection	2007	65
Ecological corridors	20,040	State protection – managed by Altyn Dala SNR	2014	-
ACBK hunting areas “Saga” and “Altybai”	3,400	Hunting concession managed by ACBK	Leased since 2009	11
Total	**40,073**			**137**

5.1.3.3 Water resources

Geologically the Torgai steppe is part of the Torgai basin, which stretches towards the Aral Sea basin in the south. The terrain is flat and elevations rarely exceed 200m. Two larger perennial rivers flow through the area; the Torgai river in the north and the Uly-Zhylanshyk river in the center (Fig. 3.2). There are also several permanent large lakes, a multitude of small ones, and many artificial ponds which were created as livestock watering places during Soviet time (and most of which retain water year-round). There is less water available in the southern areas, however kulan are free to move between drier areas in winter and wetter areas in summer. The entire area contains more water than other parts of the species distribution in Mongolia, Iran, and Turkmenistan, such that water availability is not expected to be a constraining factor for kulan survival in this region.

5.1.3.4 Ecoregion and plant community types

According to the *Terrestrial Ecoregions of the World* (TEW) classification (Olson et al. 2001), the Torgai steppe is located in the *Semi-Desert Zone*. A recent classification of the world's grasslands categorized the region as *Eastern Eurasian Cool Semi-Desert Scrub & Grassland* (Dixon et al. 2014; http://www.worldwildlife.org/publications/world-grassland-types). Local researchers have categorised the northern part as steppe (desertified steppe) and the southern part as semi-desert (Sklyarenko et al. 2009). There is a clear north-south gradient in precipitation and pasture productivity. While in the north steppe plant communities dominate, there is a gradual shift towards desert communities, typical for semi-desert vegetation, towards the south. The vegetation cover in the area is not homogeneous, and in many places sharp boundaries between vegetation communities can be found, caused by the meso- and microrelief in combination with varying soil conditions and the influence of wildfires. The richest vegetation communities are along the Uly-Zhylanshyk river valley. To the southwest of the reintroduction site, dams retained water from the Uly-Zhylanshyk river during Soviet times. Although these constructions have largely fallen into disrepair, the remaining dams still retain water resulting in rather lush vegetation, including Russian olives (*Elaeagnus angustifolia*). Overall, some 400 plant species have been found in the area around the Alibi release site, indicating a high diversity (Assylbekov 2013).

The region around Alibi has been mapped within the framework of the GEF/UNDP project "Steppe conservation and management" (Rachkovskaya et al. 2012). Based on vegetation communities and soil types, five main ecoregions and 55 subregions were identified (see Fig. 5.3 and Appendix 1).

5.1.3.5 Pasture productivity

Assessing carrying capacity of the Torgai steppe for kulan is rather difficult as we don`t know the magnitude of their movements in the *Cool Semi-Desert Scrub & Grassland* zone. However, the Torgai steppe still falls into the grassland belt as defined by Dixon et al. (2014) and has a much higher mean net primary production (based on a 20 year mean 1981–2000 measured as gram Carbon/m²/year; Prince and Goward 1995) than the Mongolian Gobi (Fig. 5.4). Pastures in large parts of the Torgai steppe are grass dominated (see above) and thus provide excellent grazing conditions for equids. The remaining local herders still consider the region highly suitable for horse breeding and the area around the Alibi release site alone once supported over 700 domestic horses although very few remain (Kishkentai Ordabaev pers. comm. 2011).

Annual pasture yield has been estimated to be 200–900 kg per hectare of dry food (nutritional value of which is 70–80 feed units per 100 kg) for sandy deserts, 200–500 kg per hectare (40–86 feed units per 100 kg) for clay, detrital and salt-marsh deserts and 200–700 kg per hectare semi-desert pastures (Kurochkina et al., 1986 cited in Bekenov et a. 1998). With only a fraction of the previous livestock left and a decreasing human population there is little evidence that pasture productivity could become a limiting factor for kulan presence in the region.

Given the large size of the ecosystem, the higher productivity of steppe and desert steppe pastures as compared to semi-desert pastures (also see Fig. 5.4), and the low human and livestock densities, one can expect kulan densities in the range of those found in the Mongolian Gobi (ca. 0.5 kulan/km^2; see Ransom et al. 2012 and Buuveibaatar et al. 2016b EarlyOnline). This translates to a potential kulan population in the magnitude of 30,000 animals on the ~ 60,000 km^2 Torgai steppe.

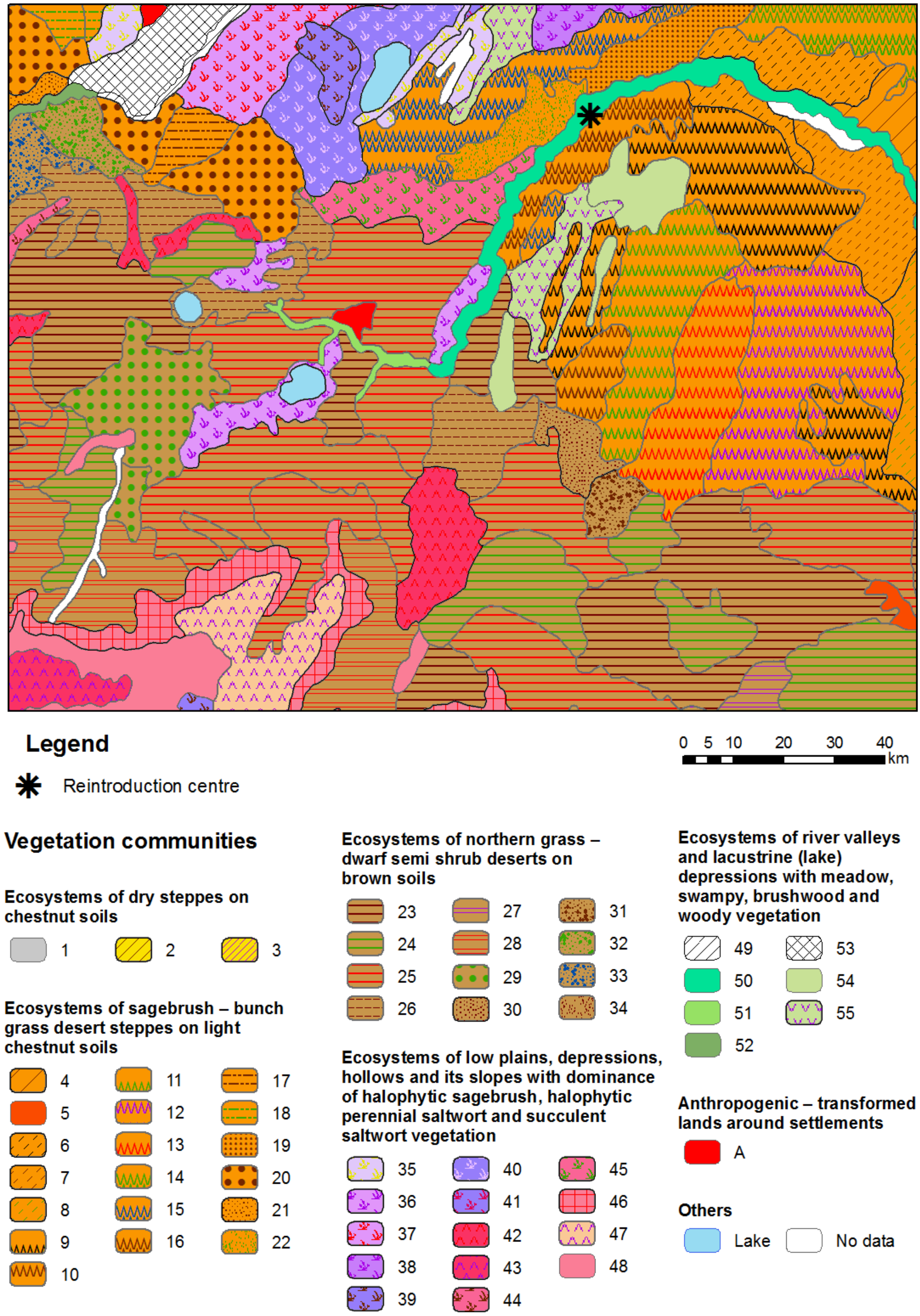

Fig. 5.3. Plant community types around the Alibi reintroduction site.

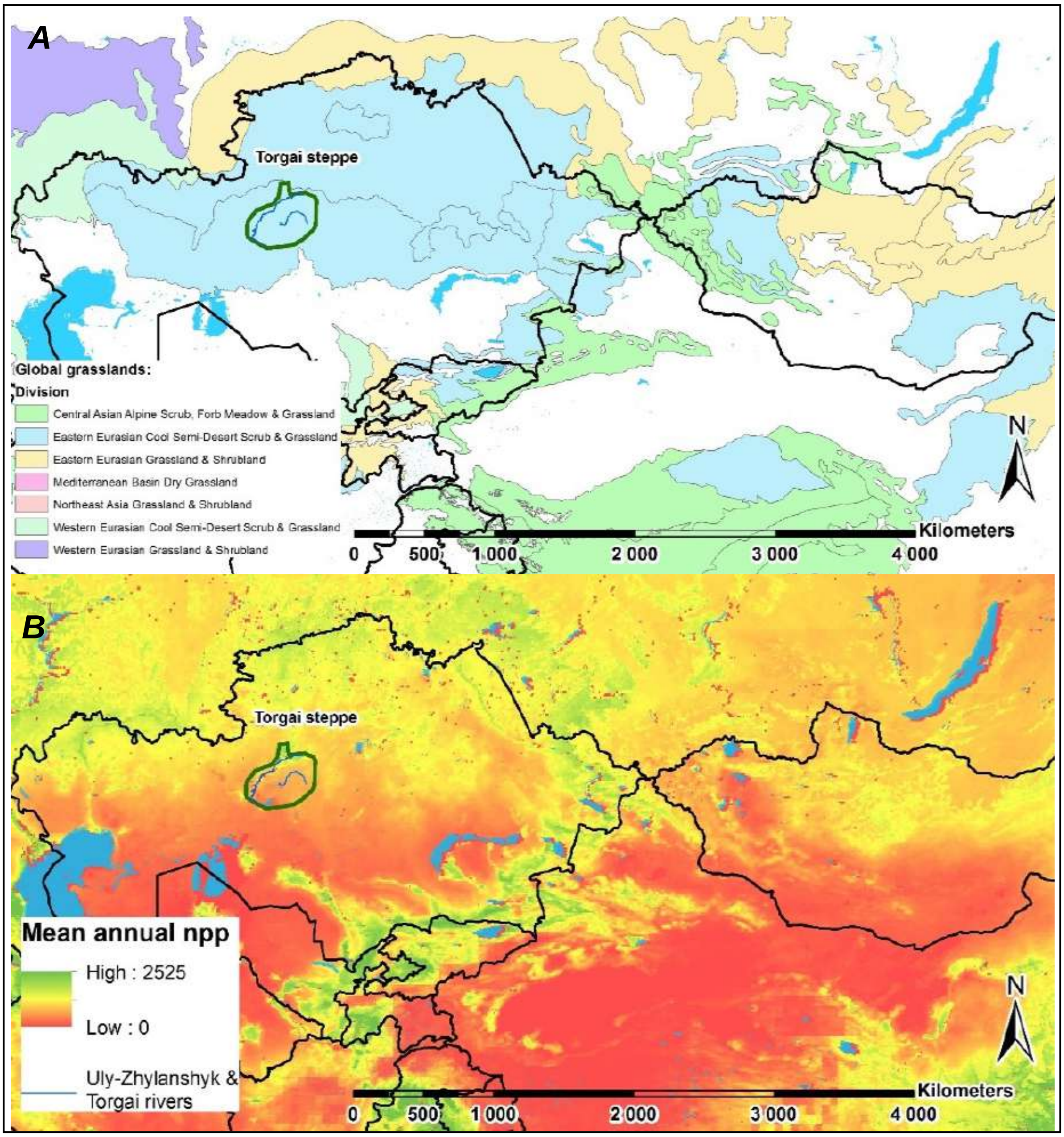

Fig. 5.4. A. Grassland characterisation according to Dixon et al. 2014, B: Estimate of net primary production (npp; in gC/m²/year) for the 20-year period 1981-2000 (Prince and Goward 1995).

5.1.3.6 Human population and livestock presence

Human population density in the region is extremely low, ranging from 0.05-0.32 inhabitants/km², and declining, and many settlements have become abandoned (Fig. 5.5; see Lenk 2008). The closest villages to the reintroduction center are ~100 kilometers away; Akkol with a population of 581 and Karasu with a population of 730. The district center Torgai is ~130 km away and has a population of <6000.

No major roads dissect the Torgai steppe, but a new single-track railway (Zhezkazgan-Saksaulskiy corridor) was built in 2013/14 near the southern edge and has been operational since 2015 (Olson 2014, Olson and van der Ree 2015). This railway is not fenced and the barrier effect of the steep embankment has been mitigated in 66 locations using earth ramps. GPS tracking data from collared saiga has shown that the new railway track is crossed during migration, even though the movements of the saiga herds are often stopped at the railway and the animals cross it only after some time (Zuther et al. unpubl. data). For kulan we do not expect the railway to constitute more of a barrier than for saiga, but we will monitor the situation and if necessary make recommendations on how to mitigate the railway.

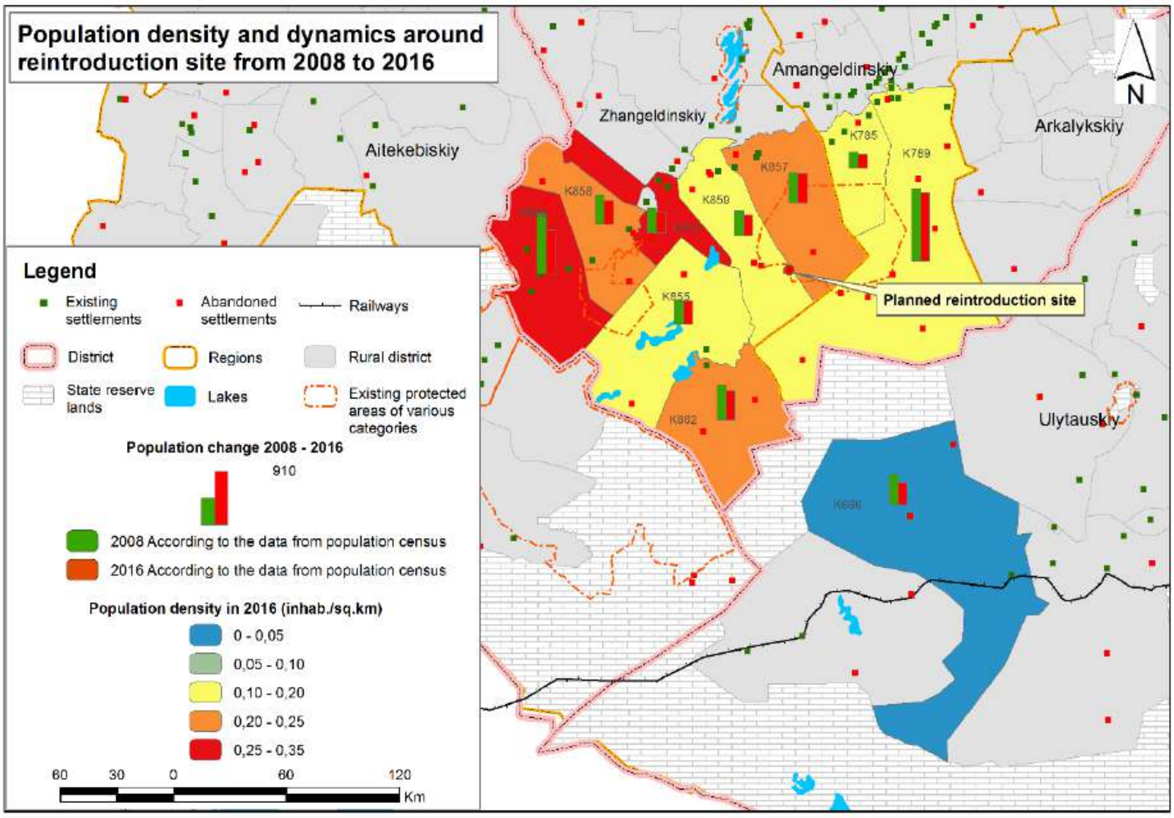

Fig. 5.5. Human population density and trend from 2008 to 2016 in parts of the three districts in the vicinity of the release site in Alibi.

Livestock present in the districts around the release site at Alibi in winter amounts to a total of 114,000 head of which 69% are sheep and goats, 22% are cattle, 9% are horses, and less than 1% are camels (Table 5.3). For the near future, an increase in agriculture is very unlikely as people are still leaving the rural areas for bigger towns, or areas closer to towns, to have access to better living conditions and be closer to relatives. Existing governmental programmes, which aim at improving living conditions in rural areas and support the local population in their agricultural and livestock husbandry activities with loans, are obviously not effective in this region. Consequently, there is currently no indication that livestock grazing will significantly expand in the near future and cause conflicts over pasture and water with kulan.

These development scenarios are based on present trends continuing. Horizon scanning reveals several potential threats to wildlife conservation in the future. These could take the form of (1) Increases in mining, (2) Construction of transport infrastructure, and (3) Redevelopment and intensification of agriculture for export markets. The likelihood of these scenarios coming about will very much depend on global trends in commodity prices, trade agreements and international funding making it impossible to predict. Countering these threats are other potential positive developments such (1) An increase in attention and value placed on the conservation of this habitat and its species, and (2) Potential for using carbon storage as an argument to conserve the steppe. The reintroduction of kulan to the region can only help increase its conservation value and thus serve as an additional argument for its conservation. Most land in the region is owned by the state, with complex leasing arrangements for the various resources and landuses, which implies that all future development is under government control.

Table 5.3: Human population numbers and livestock in 2016 in communities of the three districts shown in Fig. 5.3

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Community	ID	District	Area	Human	Cattle			Horses			Small stock (sheep & goats)			Camels
			(km²)	population	Yearround	Wintering	Total	Yearround	Wintering	Total	Yearround	Wintering	Total	
Albarbogetskiy	K857	Zhangeldinskiy	3 227	732	2 684	2 338	5 022	303	1 259	1 562	6 157	7 895	14 052	50
Zhangeldinskiy	K859	Zhangeldinskiy	3 064	512	1 346	981	2 327	177	921	1 098	2 555	4 111	6 666	0
Kalam-Karasuskiy	K861	Zhangeldinskiy	1 733	532	793	210	1 003	538	124	662	2 466	1 357	3 823	0
Amangeldinskiy	K858	Zhangeldinskiy	2 469	603	1 543	820	2 363	223	212	435	3 725	2 556	6 281	0
Akkol	K855	Zhangeldinskiy	4 826	581	1 026	544	1 570	297	148	445	4 145	3 268	7 413	0
Akshiganakskiy	K856	Zhangeldinskiy	3 419	1 080	2 647	1 105	3 752	903	379	1 282	8 520	6 313	14 833	21
Karasu	K862	Zhangeldinskiy	3 471	730	1 114	38	1 152	452	10	462	3 698	107	3 805	0
Urpekskiy	K789	Amangeldinskiy	9 184	1 714	2 033	1 394	3 427	77	745	822	3 719	2 878	6 597	46
Kabyrginskiy	K785	Amangeldinskiy	1 781	338	734	137	871	515	80	595	1 699	375	2 074	0
Zhankeldinskiy	K666	Ulytauskiy	10 034	550	713	2 672	3 385	390	2 384	2 774	815	12 868	13 683	-
Total			43 208	7 372	14 633	10 239	24 872	3 875	6 262	10 137	37 499	41 728	79 227	117

Veterinary serological surveys collect samples from livestock twice per year. A search on the OIE-WAHIS website revealed that none of the reportable equid diseases had been reported in Kazakhstan in the past seven (or more) years. For considerations on disease transmission between kulan, livestock and humans see *6.5. Health and disease risk*.

In recent years, equine brucellosis (*Brucella abortus or Brucella suis*) has been raised by some parties as an issue of concern and we therefore approached district veterinary authorities to obtained data. Based on these statistics, 1 - 2.8% of cattle and 0.01 - 0.08 % of sheep & goats, but no horses, tested positive for brucellosis (*Brucella abortus* or *B. melitensis*) in the Zhangeldinskiy and Amangeldinskiy districts (unpubl. records of the regional and local veterinary institutions, official veterinary services of the Ministry of agriculture of Kazakhstan). Survey results further suggest that infection levels may have decreased in cattle from 2012-2013 (Table 5.4), although there remain doubts about testing and reporting which cannot be overcome within the framework of this project (Beauvais et al. 2015).

Table 5.4: Percentage of cattle and sheep & goats that tested positive for Brucella abortus and B. melitensis in the Zhangeldinskiy and Amangeldinskiy districts.

	2012		2013	
Livestock species	**N samples**	**% infection**	**N samples**	**% infection**
Amangeldinskiy district				
Cattle	27,200	2.85	18,850	1.00
Sheep & goats	44,500	0.01	52,081	0.01
Zhangeldinskiy district				
Cattle	36,543	1.55	21,200	1.32
Sheep & goats	54,000	0.08	63,024	0.07

5.1.3.7 Kulan interactions with saiga

Kulan can potentially serve as both competitors and / or facilitators for saiga. Unfortunately, little comparative work on the feeding ecology of kulan with sympatric wild and domestic ungulates has been undertaken in the wild. Work focusing on kulan, Przewalski's horse, and domestic horse (*Equus caballus*) suggests that all three are predominantly grazers, but that kulan use a higher portion of shrubs (Xu et al. 2012, Burnik Šturm et al. 2016 EarlyOnline).

Diet overlap using faecal analysis of droppings from the Kekexili region in China revealed that the small Tibetan gazelle (*Procapra picticaudata*) has a low food overlap with the larger wild ungulates. Relationship among the larger species is more complex, as Tibetan antelope (*Pantholops hodgsoni*), kiang (*Equus kiang*), and wild yak (*Poephagus mutus*) have different levels of diet overlap in different seasons (Cao et al. 2009). In the Kalamaili reserve in the Gobi of northern China, kulan and domestic horses fed primarily on *Stipa* spp. in winter (48% and 50%, respectively), which sympatric goitered gazelles (*Gazelle subgutturosa*) used to a lesser extent (33%) (Chu et al. 2008).

Saiga are known to eat a broad variety of more than 80 species of plant and lichen in Kazakhstan. The staples of saiga diet are selected grasses, Chenopodiaceae, Compositae, and legumes (Bekenov et al. 1998). Abaturov et al. (2005) describes desert-steppe pasture with an abundance of dicolytedonous plants as optimal year-round pastures for saiga, and sod grass-forb pastures with abundant *Stipa* spp. as of little value for saiga from mid-summer on. Heptner et al. (1988) also describe that grasses primarily play a role in spring and are of little to no importance in winter. Abaturov et al. (2005) even suggests that cattle grazing may be needed to improve the suitability of steppe pastures for saiga, whereas intensive grazing by sheep/goats is known to lead to grazing competition (Lushchekina and Struchkov 2001).

Consequently, moderate grazing by kulan can be expected to improve pasture quality for saiga in their summer range in the steppe zone, by creating a mosaic of short and long vegetation, removing *Stipa* spp. and triggering highly nutritional regrowth. A mosaic of different grazing intensity can be expected to enhance bird biodiversity as it would allow species adapted to different degrees of grazing intensity to coexist (Milchunas et al. 1998). Grazing by kulan can also be expected to increase habitat for grazing dependent bird species like the globally threatened Sociable Lapwing (*Vanellus gregarius*), but without the disturbance associated by livestock under human management (Kamp et al. 2009).

5.1.3.8 Nutrient redistribution and seed dispersal

Equid faeces are large and not as digested as ruminant faeces, and thus provide more nutrients for decomposers. Equid faeces also contain more intact seeds capable of germination and thus allow seed dispersal over the activity radius of the involved species. In Iran, Asiatic wild ass faeces contained a higher variety of seeds than ruminant faeces (Ghasemi et al. 2012). In Israel, Peled (2010) found that Asiatic wild ass, Arabian oryx (*Oryx leucoryx*), and dorcas gazelle (*Gazella dorcas*) faeces contained seeds of plants from different communities, with Asiatic wild asses transporting the greatest number of species.

5.1.3.9 Kulan as a prey base

Wolves are the only predators on the Central Asian steppes that are large and strong enough to prey on kulan. However, the quantitative effects of wolf predation on kulan have never been studied and it is generally believed that wolves primarily prey on foals, old or sick kulan. Nevertheless, kulan can be expected to provide an additional prey base for wolves, while their carcasses (be it from predation or other causes) will be available for scavengers (e.g. vultures, foxes). However, the importance of kulan as prey will be a function of the population size and distribution range. Initially high levels of wolf predation could theoretically constitute a threat to a successful reintroduction, but have not been described as a concern in past kulan reintroductions. A pilot wolf study was initiated in 2012, using track counts, den site inventories, camera traps, radio-tagging of a few wolves, and interviewing local people. In 2014, seven active wolf dens were documented in an area of 6,800 km² in and around the ACBK hunting areas, suggesting a wolf density of ~1 pack per 1000 km² (ACBK 2015a; Shmalenko and Salemgareyev 2016). However, in 2015, only three active dens were recorded (Fig. 5.6). The range size of a female wolf followed from February to December 2015 was 1,441 km² (95% Kernel UD and excluding a long-distance excursion).

Analysis of 25 wolf scats collected in summer-autumn documented primarily rodent (60%), bird (10%), small predator (10%), and vegetation (15%) remains. Only one scat contained saiga remains; but the sample size was too small and seasonally restricted to draw any wider conclusions about the importance of an ungulate prey base.

In 2016, interviews of more than 100 hunters and inspectors of hunting areas were conducted in the Kostanay, Karaganda, Akmola and East Kazakhstan regions. The questionnaire included questions about wolf numbers, den site locations, food habits, and movement patterns, as well as numbers of wolves killed and wolf depredation on livestock. Preliminary results suggest that the number of wolves has sharply declined in the plains of the Karaganda and Kostanay regions over the past 10 years (Shmalenko and Salemgareyev 2016) – which is in contrast to the official figures.

At present, wolf hunting is not regulated at all and no quota limits exist, which keeps the wolf population at a low level in regions which are easily accessible to vehicles. The current high level of persecution within the framework of a pest eradication program makes it highly unlikely that wolf predation will pose a serious threat to kulan reintroduction.

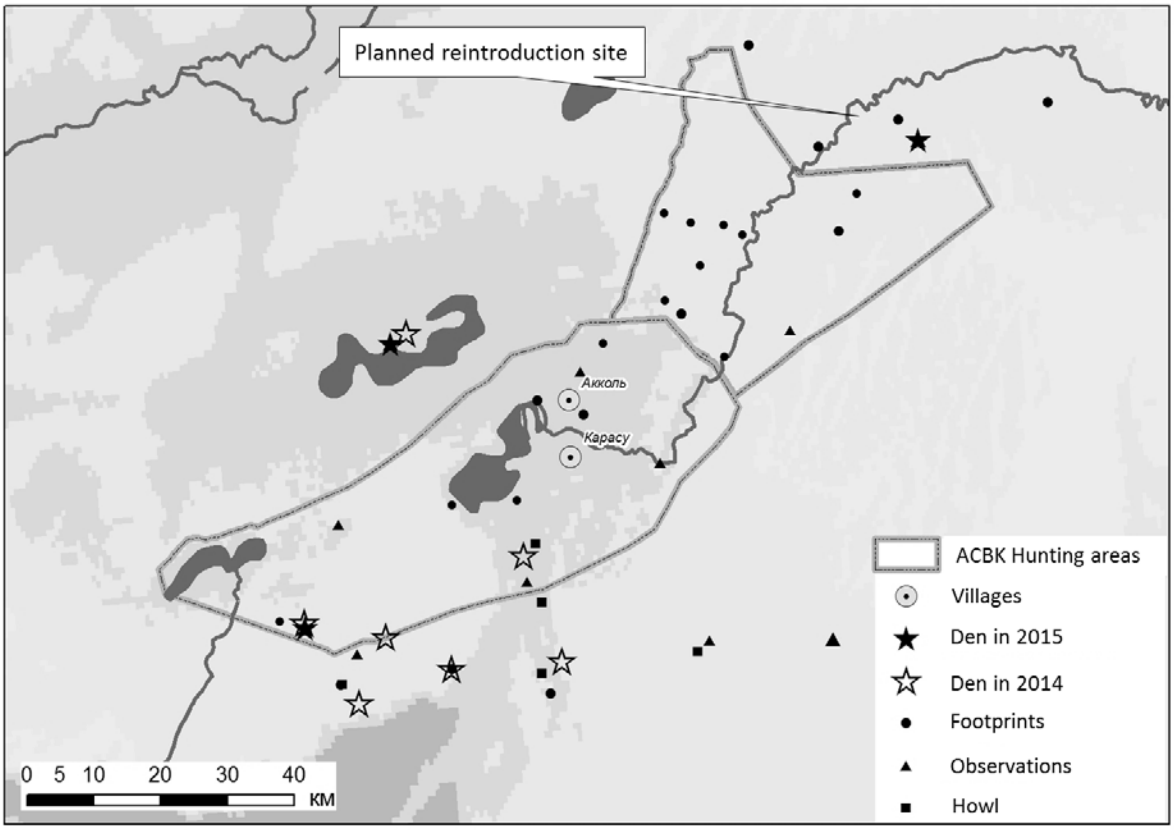

Fig. 5.6. Wolf presence in and around the ACBK hunting areas in 2014 and 2015.

5.1.4 Climate

The climate is strongly continental with hot summers and cold winters, the average annual temperature is 4.1˚C with an average monthly temperature of -17˚C in January and an average monthly temperature of 24.1˚C in July; extremes can range from -44˚C in winter to 43˚C in summer. Annual precipitation is 202 mm and is rather evenly distributed over the year with a slight peak in spring and fall/winter. About 25% of the precipitation falls as snow; snow cover on average lasts from December through March and reaches up to 20 cm, but varies considerable among years (from 7 to 30 cm; all climate data from the meteorological station in Torgai). Temperatures and precipitation are well within what kulan experience in other parts of their current range.

Central Asian drylands are prone to extreme winter events, locally called "*dzhut*" and there is evidence that ungulate numbers in Kazakhstan were predominantly limited by severe winters until the 20th century (Robinson and Milner-Gulland 2003). *Dzhut* winters are characterized by a varying combination of unusually low temperatures over long periods (resulting in higher metabolic demands to thermoregulation), high snow cover (limiting mobility), and icing events forming a crust on top of the snow (making access to vegetation difficult and energetically costly). According to Bekenov et al. (1998) *dzhuts* occur every 3-4 years and extreme *dzhuts* every 10-12 years in Kazakhstan.

Kulan are taller and stronger than saiga and seem able to move so as to avoid *dzhuts* of limited spatial extent as has happened in the Dzungarian Gobi in Mongolia in 2009-2010 (Kaczensky et al. 2011b). However, fragmented or small kulan population may fall victim to *dzhuts and s*everal of the remnant kulan populations in the former Soviet Union are believed to have succumbed to *dzhut* events. “The winter of 1879-80 and 1891-92 after which kulan disappeared from Ustyurt, around the Aral Sea, the lower course of the Sarysu, and at other places in Kazkhstan” (Sludskii 1953 cited in Heptner et al. 1988). However, details on how these winter events killed off kulan are not available (also see chapter 6.3). The last heavy *dzhut* winters (lots of snow, icing events) around Alibi apparently occurred in 1964 and 1983 (Sarsen Kasymov, ACBK ranger, pers. comm.).

Climate change projections for Kazakhstan suggest the following trends (Shah et al. 2013), which will likely also affect the Torgai steppe:

- An increase of the average mean annual temperature of 1.4°C by 2030, 2.7°C by 2050, and 4.6°C by 2085.
- An increase in winter and spring precipitation by 9 percent and 5 percent, respectively by mid-century.
- A possible northward shift of the humid zone which may mean that all the northern areas will be in a semi-drought zone by 2085.
- Parts of Kazakhstan (higher latitudes) could benefit from improved climatic conditions for agriculture. However, the potential for gain is unclear, since it could be offset by increased variability and extreme events.
- The frequency of forest and steppe fires is expected to increase due to global warming.
- Climate change is projected to significantly influence Kazakhstan’s water resources, exacerbating existing water shortages and placing greater pressures on agricultural activity.

These trends are in line of what has been predicted also for other parts of Central Asia, including Mongolia. However, the Torgai steppe is located in the *Eastern Eurasian Cool Semi-Desert Scrub & Grassland* (see 5.1.3 Habitat) and the predicted shift towards more arid conditions can be expected to be less severe than for all other remaining kulan populations which already live under more arid conditions. Climate change predictions are actually a strong argument for why we feel it is important to attempt to return kulan back into more mesic habitats to increase the overall resilience of the species.

5.1.5 Source population

5.1.5.1 Origin and size of the source population

The kulan population in Altyn Emel was established with founders from a reintroduced population established 20 years earlier on Barsa Kelmes Island in the Kazakhstan part of the Aral Sea (Pavlov 1996). From 1982-1984 a total of 32 kulan were released and the small population grew rapidly, increasing by ~15% annually (Fig. 5.7). Attempted total counts in February 2016 and 2017 recorded 3254 and 3417 animals, respectively (K. Bayadilov unpubl. data; see also http://www.acbk.kz/ru/news/7892/). Altyn Emel NP currently constitutes the single largest population of Turkmen kulan globally but is also believed to be reaching carrying capacity. The interest by park authorities in providing kulan for reintroductions elsewhere in Kazakhstan is high (Levanov et al. 2013).

5.1.5.2 Robustness of population estimates

Annual wildlife counts in Altyn-Emel NP are conducted by staff of the regional branch of the Committee of Forestry and Wildlife of Almaty region, the Institute of Zoology, state rangers (PA Okhotzooprom), and staff of Altyn-Emel NP. The surveys attempt total counts by driving parallel survey routes during two days in February each year.

During the first day, 10 parallel routes totaling ~390 km cover the western part of the NP and on the second day, 6 parallel routes totaling ~300 km cover the eastern part of the NP (Fig. 5.8.). The teams driving transects on the outer edges count animals on both sides, while those in the middle only count animals to the north of the transect line. The majority of kulan are encountered in the western plains and here the count is coordinated via radio communication from the northernmost transects from where all other vehicles can be seen.

Although there may be room for improvement in the survey design, observations of large groups of kulan and total counts of >3000 kulan, confirm the presence of a large population. An annual removal of up to 18 animals accounts for less than 1% of the population and does not represent a risk to the viability of the source population.

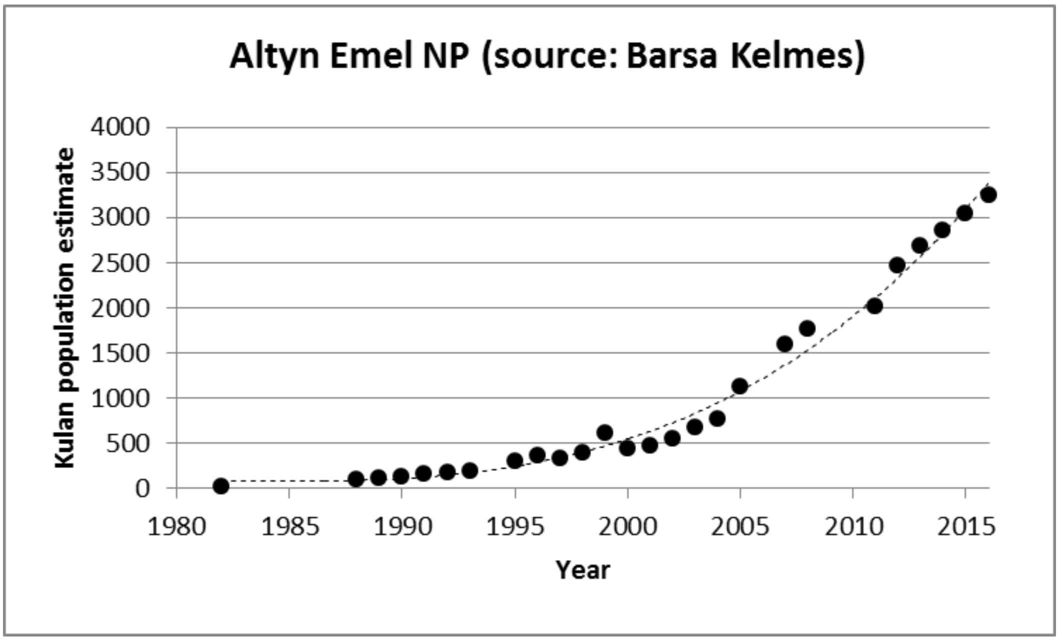

Fig. 5.7. Population development of the kulan population reintroduced to Altyn Emel NP (Kaczensky et al. in prep.).

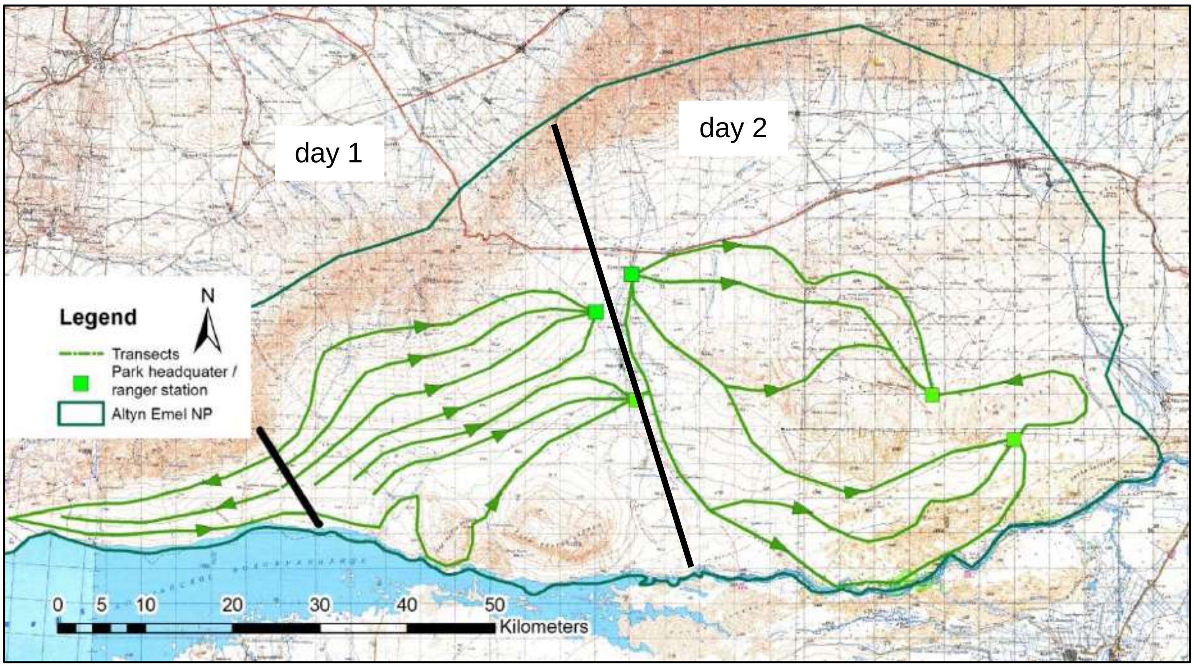

Fig. 5.8. Survey design for the annual total kulan counts in Altyn Emel NP.

5.1.5.3 Genetic variability of the source population

The kulan population in Altyn Emel NP originates from the reintroduced population in Barsa Kelmes and thus has undergone at least two recent bottlenecks; which raised some concerns about their genetic variability. In 2014, we collected non-invasive samples (dung) from kulan in Altyn Emel and compared their population genetic characteristics with those of the original source in Badkhyz, Turkmenistan and the large population in the Mongolian Gobi (Kaczensky et al. in prep.).

Kulan from Altyn Emel had lower levels of heterozygosity and a high inbreeding coefficient than the animals from the large Mongolian population; a clear reminder of the populations' recent past with two serial founder events followed by rapid population growth. However, expected heterozygosity is only slightly lower than that in the original source population in Badkhyz, Turkmenistan (Table 5.5). The Altyn Emel population seems to have retained the majority of the genetic diversity of the original source population and is also well within the variability observed from other reintroduced or small equid populations. Inbreeding is not an immediate threat to be expected.

Genetic sampling of all translocated kulan and subsequent genetic monitoring of animals born on the Torgai steppe (using non-invasive dung samples) is planned and will be the basis for future release strategies (e.g. the need to release more individuals or obtain kulan from other sources than Altyn Emel). We also will conduct a genetic assessment of the kulan population in Barsal Kelmes to explore the value and potential as a future, additional source of kulan for reintroductions (trip and sampling scheduled for June 2017).

Table 5.5: *Population genetics variables for kulan from Altyn Emel NP, the original source population in Badkhyz, Turkmenistan, and the large population in the Mongolian Gobi (Kaczensky et al. in prep.).*

Population	Country	Sample size	N Loci typed	Unbiased Hz		Observed Hz		N Alleles		Allelic richness	Privale alleles[1]	Fis[2]	Mean ind. inbreeding
				mean	SD	mean	SD	mean	SD				
Altyn Emel	KAZ	67	9	0.73	0.03	0.39	0.02	8.89	2.67	4.30	0	0.47	0.48
Badkhyz	TKM	32	9	0.76	0.04	0.39	0.03	8.56	3.00	4.81	1	0.49	0.49
Great Gobi B	MNG	19	9	0.84	0.02	0.78	0.03	9.67	2.29	5.73	2	0.08	0.20
Great Gobi A		18	9	0.83	0.02	0.69	0.04	8.56	3.00	5.43	3	0.17	0.24
SE Gobi		43	9	0.82	0.02	0.74	0.02	10.67	2.92	5.34	1	0.10	0.23

[1]Private alleles with >5% occurrence; [2]F_{is} expresses the proportion of the variance in the subpopulation contained in an individual; [3]Mean individual inbreeding coefficient (F) by computing the likelihood of the homozygote state p(homozygote) = F + (1− F)Σpi2 , were i represents the alleles and pi the frequency of allele i in a given genotype. We summed up the log-likelihood across loci for multilocus genotypes, using the adegenet R package (Jombart, 2008).

5.1.6 Capture, handling, and transport of kulan

A concern with all equid translocations and reintroductions is the physical capture of individuals. The need to use a helicopter to transport kulan the long distance to the Torgai steppe also imposes certain constraints on animal capture because we need to be able to capture a full consignment of animals within a few days to avoid holding them too long before transport. The capture method has to be safe for the capture team and the animals, while at the same time allowing the capture to happen within a predefined time window of 2-3 weeks and enable the capture 20+ animals within 1-3 days to allow for the selection of the most suitable individuals.

5.1.6.1 Timing

Capture will happen in a time window from mid-October to early November. This time period was chosen for animal welfare and logistical reasons:

Kulan have a gestation period of 11.5 months which means adult mares are either pregnant or have a newborn foal. In the temperate grasslands of Central Asia with their high seasonality, foaling is highly synchronized and peeks from late June to mid-July. By late October foals are on average four months old (which is the earliest weaning age recommended for horses and donkeys) and already reasonably big to stand a chance to survive without their mothers in case of capture induced separation.

Most mature mares, on the other hand, can be expected to be about four month (120 days) into a new pregnancy; a time when in horses early embryonic death (up to day 40; Baucus et al. 1990) is not a concern anymore and before abortions are most likely to occur (270-300 days; Tengelsen et al. 1997). Four month into the pregnancy is a time period when the foetus is well beyond the initial sensitive early phase, but still far from putting a heavy burden on the mare (also see *Anaesthesia*).
For stallions, late October is well after the peek breeding season so that testosterone levels should be at their lowest and consequently the potential for aggression is reduced.

From a logistic point of view late October still offers reasonable stable weather conditions as the likelihood of snow storms and extreme cold spills (making handling difficult and air transport impossible) is still reasonably low.

5.1.6.2 Capture

Expertise for kulan capture is available in-country. Kulan in Barsa Kelmes were captured using corrals (Flint et al. 1988) and this method was further refined in Altyn Emel NP. For translocation of kulan from Altyn Emel NP to the Andassay Sanctuary, round-ups were performed at night using cars and strong lights to reduce the speed of fleeing kulan by impeding their ability to see the terrain (Fig. 5.9). During 2006-2011, four out of seven capture attempts were successful and resulted in the capture of 105 kulan. No fatalities or injuries occurred during capture (for details see: Levanov et al. 2013). To fully profit from past experience we will work with Sergey V. Sokolov, LLP Okhotprojekt, Almaty, Kazakhstan, to oversee the capture logistics.

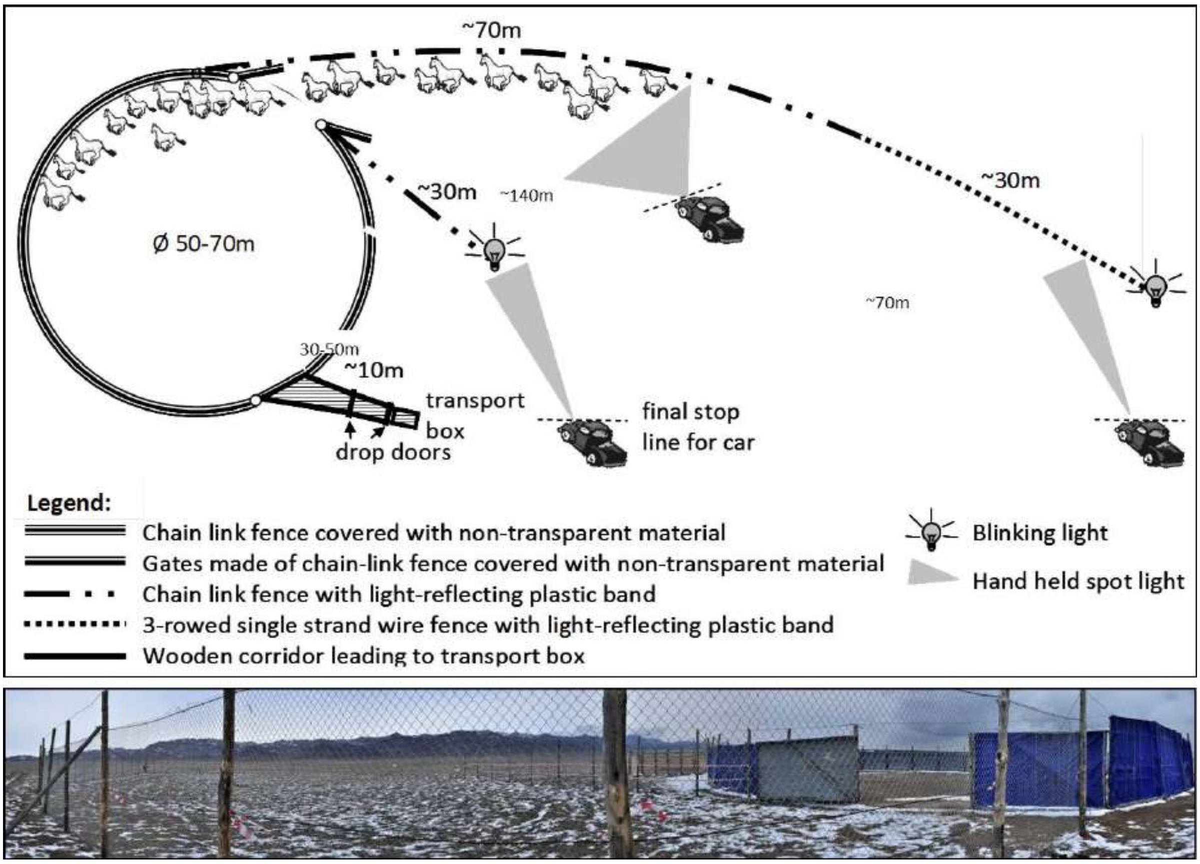

Fig. 5.9. Capture corral design at Altyn Emel NP, successfully used for kulan captures in the past (for details see Levanov et al. 2013).

In 2016 a similar corral approach was used to successfully capture, collar, and sample Persian wild asses or “onagers” in Qatrouiyeh NP in south-western Iran (Walzer, unpublished). In Iran animals were lured into the corral with hay, which is less stressful than the round-up used in Altyn Emel NP so far. To test the applicability of this alternative method, we will seek permission to build a second corral in which water and fodder is provided as a back-up capture option. However, local staff is highly sceptical that any larger number of kulan can be lured into such a coral in Altyn Emel as apparently, this method has been unsuccessfully attempted in the past.

5.1.6.3 Selection of animals

For each transport, we aim to transport 16-18 animals (the final number will depend on the possible spatial arrangement of boxes within the helicopter). We ultimately aim to transport 60-70% females and 30-40% males to allow for a rapid initial population growth. Furthermore, experience with kulan in captive facilities has shown that adult stallions can be very aggressive, particularly towards other stallions. Even all-stallion groups tend to have high levels of aggression, which can easily result in death (D. Enke pers. comm.). As we have only two acclimatization enclosures in Alibi, we will only transport two large and obviously dominant stallions per transport (each will be released in a separate enclosure with a group of mares and young animals).

If the number of stallions in the reintroduced population remains low (<30%), we will consider an all stallion transport with subsequent hard release (i.e. don’t use the acclimatization enclosures). This will allow female mate choice and reduce the risk of only a few males dominating reproduction, thus reducing effective population size.

Animals captured in Altyn Emel will be kept in the capture corrals for a period of a few days while we make our selection. This will provide time to match mares with foals, and identify any individuals that are in poor body condition, injured, or that show signs of undue stress or aggression.

Such animals, along with motherless foals, will be released back into Altyn Emel immediately. Kulan in the capture coral will be provided with water and hay once a day.

From the final pool of animals, we will select for two adult stallions, at least eight adult mares, and the remaining animals a mix of juveniles (foals and yearlings) of either sex. Foals will only be transported together with their mothers. Selection of animals in subsequent transports will be adjusted to the age and sex composition of the previous transports, and to their post-release survival.

If presented with a choice, we will always aim for young adults (ideally 3-6 years), rather than older adult (7-10), or very old animals (>10), or very young ones (1-2 years) based on their expected contribution to population growth. We will aim to include 1-2 older adult females per transport. Although data from Mongolia suggests very little group cohesion, having an older female in the group may help during the period the animals are in the adaptation enclosure.

We expect most adult females to be pregnant (also see *Timing*) and view these pregnant females as a resource both genetically and demographically (we can assume that 50% of the foals born in the 1st year will be stallions which will help to address sex ratio concerns; Volf 2010). Past reintroductions have also transported pregnant females and there are reports from past reintroductions of foals born in adaptation enclosures or in the year of release (Pavlov 1996), but overall documentation of these details is very poor. We will measure hormone levels of blood and fecal samples of all adult females to confirm pregnancy, while subsequent post-release monitoring by rangers will help confirm the presence or absence of a foal after release into the wild.

Genetic analysis of released animals and initial non-invasive genetic monitoring (using dung) of the reintroduced free-ranging animals in the Torgai steppe will be used to monitor genetic variability and assess the need for transporting supplementary animals to increase genetic variability. An assessment of the population in Barsa Kelmes (in respect to population size, possibilities to capture animals, and genetic variability) will be conducted in summer 2017 and if found suitable may provide an additional source for future releases.

5.1.6.4 Anaesthesia

Due to the size, strength and behavioural flight response in the wild ass, physical capture entails very serious handling and safety considerations to both the kulan and the handlers. This is particularly true as we need to attach radio-collars, age animals, and collect biological samples for diagnostic health and research questions (see *Health screening*). Short-term, reversible chemical immobilisation paired with anaesthesia monitoring is the method of choice when handling wild equids (Janssen and Allen 2015).

Data from multicenter studies cite the death rate for healthy domestic horses undergoing anesthesia at around 0.9% (Wagner 2008). The same study points out that the risk when employing *total intravenous anaesthesia* (TIVA) is associated with the lowest risk of all, but this may be due to the fact that TIVA is used for shorter procedures. TIVA procedures are very similar to the protocols successfully employed in Asiatic wild ass and other wild equids.

Foetal loss in domestic mares undergoing anaesthesia (long-lasting surgery) has been determined to be 12% and is linked to maternal endotoxemia and to hypoxemia and/or hypotension in mares <60 days into term. The mares and foetus are at the least risk during the middle trimester, i.e. after differentiation and development of the foetus but before rapid growth burdens the mare (Donaldson 2006). At the time of capture and short-term anaesthesia, pregnant kulan mares will be 120 days into term and the foetus will have the size of a small domestic cat. Compression, impaired gas-exchange etc. as potentially seen in near-term pregnant mares cannot be expected to be an issue. Similarly, endotoxemia is not an issue in the wild ass procedures and mild hypoxemia is at the most transient as all drugs are reversed. Pregnancy at 4-6 months was not associated with any increased risk in multicenter studies (Duke 2006).

The authors have extensive experience with the anaesthesia of wild equids in general, and Asiatic wild asses in particular. Over the past two decades, the authors have successfully performed 250+ short-term reversible wild equid anaesthesia procedures without the loss of a single animal during anaesthesia or within the first months post-release (Gerritsmann et al. 2016, Walzer et al. 2006, Walzer 2014).

In free-ranging wild asses, anaesthesia has been induced with a single 3-mL dart containing a combination of 4.4-mg ethorphine (M99, C-Vet Veterinary Products, Lancashire, UK), 10-mg Detomidine–HCl (Domosedan, Orion Corp. Farmos) and 10-mg Butorphanol (Torbugesic, Fort Dodge Animal Health). Anaesthesia was initially reversed with an intravenous combination of 200-mg naltrexone (Trexonil Wildlife Laboratories Inc.) and 20 mg of the alpha2-antagonist Atipamezole (Antisedan, Orion Corp. Farmos). All anaesthetized kulan were subject to continuous routine monitoring of breathing rate, rectal temperature, and pulse rate and oxygen saturation using a pulse oximeter. Reversal was rapid and generally smooth, but some signs of excitation related to radio collar placement—head shaking—were noted. Subsequently, the opioid antagonist-agonist diprenorphine (Revivon, C-Vet Veterinary Products) has been used. This eliminated head shaking and provided a smoother reversal. All animals were standing and alert approximately two minutes following administration of the antagonists (for a comprehensive review of wild equid anaesthesia see: Walzer et al. 2006; Walzer 2014).

We will continue to use this protocol for handling kulan in this project because of the success of this approach in Mongolia and Iran. All individuals that are being processed for transport will be anaesthetised.

5.1.6.5 Sampling and health screening

Not only has our environment changed in the past decades but so has our understanding of health and disease. Wildlife health can no longer be viewed as simply the absence of disease, as both disease and health are the outcome of complex interactions and systems. Today, consensus exists that wildlife health, like human health, must be viewed beyond parasites and pathogens, incorporating social, evolutionary and environmental factors while considering individual attributes and behaviours (Stephen 2014). An individual animal cannot be simple classified as “healthy” or “not-healthy” as we must recognize that wildlife health and resilience are the result of interactions between socio-economic and environmental factors, as well as the traits of individuals and populations (Deem 2015, Tabor 2002).

While a suite of new diagnostic tools allows us to detect antibodies or pathogens in animals and the environment (e.g. using eDNA) our understanding of the prevalence and dynamics of these in wild animal populations and the environment remains poor. Consequently, the majority of the health screening will be driven by an interest to derive baseline values for free-ranging kulan in Kazakhstan, but will not be used as selection criteria. The only exception from this rule is an on-site brucellosis test.

It is important to note that very few cases of infectious disease have been reported from Asiatic wild asses (Radcliffe and Osofsky 2002). For this reintroduction, kulan are being moved from one part of the country to another. Domestic horses are widely distributed and are transported freely throughout the country and must be regarded as the most important potential contiguous reservoir of equid diseases (see *Health and disease risk*). As stated previously, all animals in poor body condition, or obviously sick or injured, will be immediately released back into the Altyn Emel population (potentially after medical treatment if appropriate and possible) or euthanized if judged terminally ill or injured.

If the need to euthanize khulan arises, we will use etorphine and following the induction of anesthesia the i.v. application of a combination of Tetracainhydrochlorid 5,000 mg; Mebezoniumiodid 50,000 mg; and Embutramid 200,000 mg (T61®; MSD, Germany). Additionally, we also always stock a Pentobarbital solution (Narcoren, 16 g/100 ml, Narcoren, Merial GmbH, Germany). The latter will also be stored at the field station in Alibi in case a khulan needs to be euthanized due to fatal injury or disease in the enclosure.

During anaesthesia, the following samples will be taken to obtain baseline data; none of this information will result in rejecting animals for transport. Rather information will be banked for future reference and assessment of individual survival and fecundity:

- Blood samples will be drawn from the jugular vein to run an on-site health check based on an equine blood chemistry screen: ALB, AST, BUN, Ca, CK, CRE, GGT, GLOB, GLU, K+, Na+, TBIL, tCO2, TP (Abaxis, VetScan VS2) Fibrinogen (Abaxis VetScan VSpro). A complete blood count and differential blood count will also be performed (Abaxis, VetScan HM5).
- Blood samples will also be collected to subsequently determine pregnancy rates among the mares in the lab.
- Blood, hair and scat samples will be collected for subsequent genetic analysis in the lab.
- Blood samples will also be collected to measure the Leucocyte Coping Capacity (LCC) of each individual on-site to functionally assess the innate immune system as a proxy of the individual's stress level (e.g. Esteruelas et al. 2016).
- Nasal swabs will be collected for viral screening and analysed on-site using a portable RT-PCR based on the Biomeme Two3 device. We will screen for equine herpes viruses and equine influenza. If necessary, subsequent sequencing of DNA or RNA products can also be carried out on site.
- Faecal samples will be collected to perform a simple parasite screen (e.g. see Painer et al. 2010).

We will additionally do an on-site brucellosis test and release animals testing positive back into the Altyn Emel population. The brucellosis test is thus the only test used as a selection criteria.

A subset of samples will be exported to the laboratory at the Research Institute of Wildlife Ecology (FIWI) of the University of Veterinary Medicine, Vienna in Austria. The FIWI laboratories are internationally fully accredited and certified through the University of Veterinary Medicine in Vienna. Processing of international biohazards samples is carried out in close collaboration and in adherence to the certification rules and regulations of the Austrian Federal Ministry of Health and Women's Affairs. We will obtain the necessary CITES and veterinary permits and work within the frames of the Nagoya protocol.

5.1.6.6 Vaccinations and parasite treatment

Domestic equids (primarily horses) are distributed throughout the country and occur both at the source site in Altyn Emel NP and the translocation site on the Torgai steppe. Consequently, there is no specific risks of introducing or exposing translocated kulan to new infectious agents. Though a very minor risk, it appears prudent to vaccinate the translocated individuals for rabies, tetanus, and anthrax during the anaesthesia process. Other vaccines will potentially burden the immune system (elicit a response) but will provide no protection. In case of possible allergic reactions to vaccination under anaesthesia we will hold Prednisone (Solu-DecortinH 1000mg; Merck Serono GmbH, Germany) and Diphenhydramin (Benadryl®; Bela-Pharm, Vechta, Germany) in readiness.

The interactions between intestinal microbiota, the immune system, and pathogens make the equine gut a complex ecosystem, where all components play a relevant role in modulating each other and in the maintenance of homeostasis. Previous studies in the wild have shown that parasites are a normal component of the wild equine gastro-intestinal tract (Painer et al. 2010). Eliminating the parasites through de-worming could cause disruptions in normal gut homeostasis and constitutes an unnecessary risk for the animals; we will therefore not de-worm kulan pre-transport.

We will, however, collect regular dung samples to monitor parasite load of khulan in the acclimatisation enclosure at Alibi and if we see a dramatic increase in parasite load or loss in body condition (for example due to their confinement) we will treat animals with de-worming medication (Ivermectin).

5.1.6.7 Collaring

All adult (≥3 years) kulan will be collared with GPS-Iridium collars for post-release monitoring. Collars will be programmed to collect 1 GPS locations per hour and fitted with external pre-programmed drop-offs to release collars after 2.5-3 years. For experiences with radio collaring wild equids see Kaczensky et al. (2010b) and Kaczensky et al. (2006-2015; unpublished reports: https://www.vetmeduni.ac.at/de/fiwi/forschung/projects/projekte-der-abteilung-conservation-medicine/gobiprojekt/publikationen-zum-projekt/).

In addition, a total of 10 individuals will be collared and released back into the Altyn Emel NP to also gain insight in the movement pattern and habitat use of kulan in the source population.

5.1.6.8 Boxing

Once sampling and GPS-collaring is complete, anaesthesia will be reversed and the recovering kulan will be guided into the transport box. Transport boxes will follow the design of boxes used successfully in Przewalski's horse reintroduction, with foam padding around the head (Fig. 5.10) and will be built in two sizes to allow optimal fit for adult and young animals.

Kulan will be given long-acting neuroleptics (LANs) to reduce anxiety and stress during translocation and release into the acclimatisation enclosures. These neuroleptics have been used successfully in various zebra species (Swan 1993) and the Przewalski's horse (Atkinson and Blumer 1997, Walzer et al. 2000). Very rare extrapyramidal symptoms (EPS) constitute a potential neurological side effect (involuntary movements, tremors, changes in breathing and heart rate, and inappetence). The EPS can be treated with biperidine lactate (Akineton, Knoll, South Africa) and diazepam (Valium, Roche, Switzerland).

The use of LANs has greatly improved animal welfare during the in-crate phase during flights (36 hours) and reloading of Przewalski's horses. These authors presently recommend treatment with a combination of 0.2–0.3 mg/kg haloperidol (Haldol, Janssen-Cilag) and 150–200 mg/adult equid perphenazine (Decentan-Depot, Merck KgaA, Darmstadt, Germany). It is important to carry out this treatment at least 6-12 hours prior to transport or anticipated stressor influence. Consequently, kulan will be held in the transport boxes overnight. Animals will be offered water and hay through a flap at the bottom of the front door at regular intervals (every 3-4 hours pre-transport and during transport).

Any kulan showing strong signs of stress or destructive behaviour will be released back into Altyn Emel NP. Consequently, we anticipate capturing, collaring, and loading two extra kulan as "reserve animals" into transport boxes which will be released back to Altyn Emel NP and will subsequently collect movement data of kulan in the source population.

Fig. 5.10. Transport crate lying on its side. The head area of the adapted crates is reduced in order to limit the possibility of a horse turning onto its back in-flight. Additionally, the head area is lined with high-density foam to prevent injury.

5.1.6.9 Transport

The straight-line distance from the capture site at Altyn Emel NP to the acclimatisation enclosures in Alibi is 1800 km, making any ground transport very lengthy (3-5 days) and highly dependent on favourable road conditions. Such a long transport is not acceptable for wild equids and consequently, transport will have to happen via airlift. Air transport will be done using one of the two Mi-26T Halo helicopters available in Kazakhstan. The Mi-26T Halo is the largest and most powerful helicopter to have gone into series production (https://en.wikipedia.org/wiki/Mil_Mi-26). The Mi-26 has a payload of up to 20 metric tons cargo and is able to store 16-18 transport boxes. With a maximum range of 1920 km and a cruise speed of 255km/hour the transport time estimated to be 9 hours (7 hours for flight and 2 hours for refueling at two locations; for overview see Fig. 5.11).

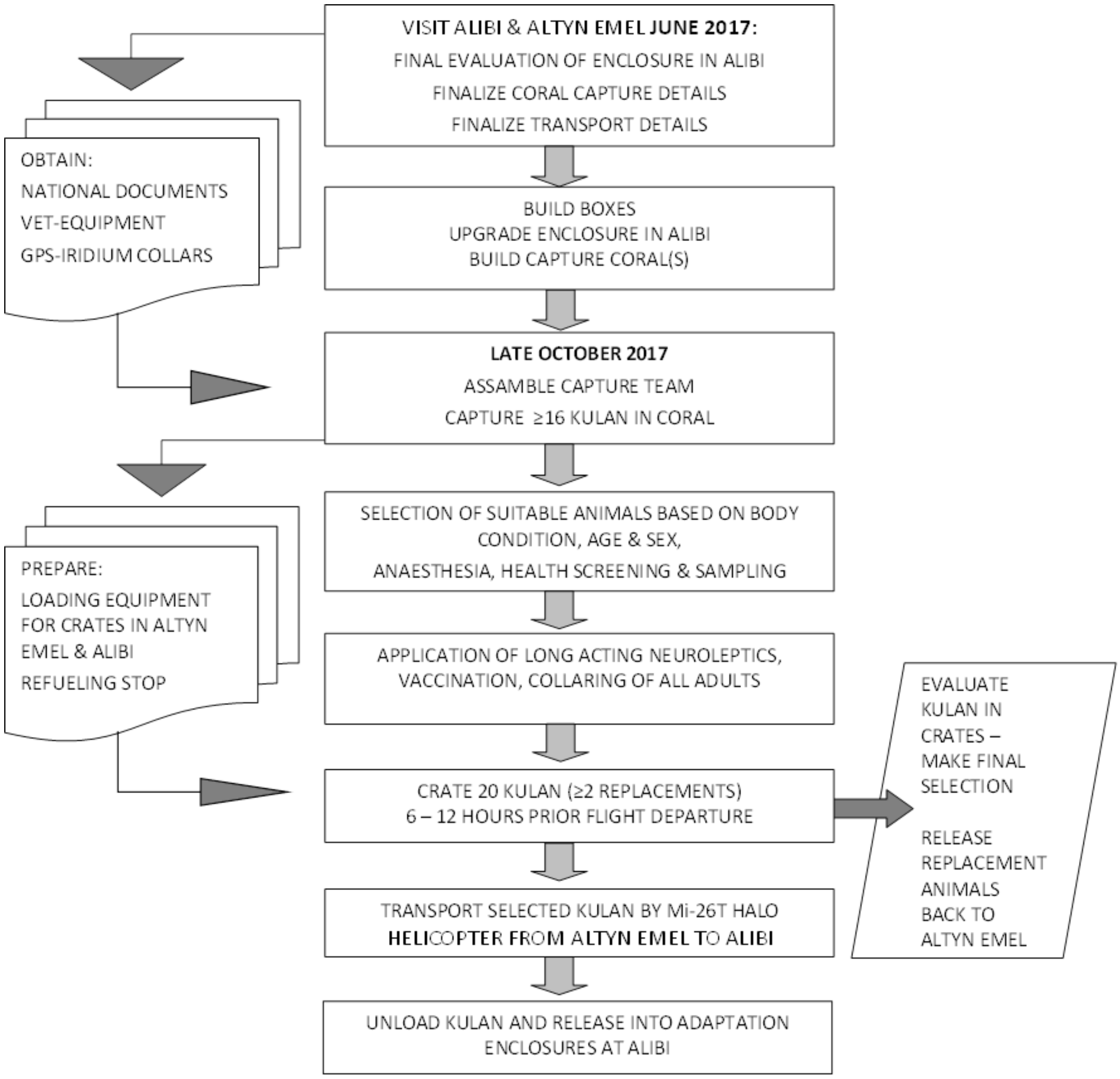

Fig. 5.11 Flow chart showing the most important steps in the transportation process for the first transport in November 2017.

5.1.6.10 Acclimatisation enclosure & emergency food

The facilities at Alibi consist of a field station, garage, and a storage place. Agricultural equipment for harvesting wild steppe grasses for hay and storing it are also available on the site. A full-time staff of local caretakers will be always present. They will be trained and supervised by ACBK veterinarian Ruslan Doldin. In addition, we will endeavor to maintain a presence of international veterinarian interns during crucial periods.

There are two enclosures of 55 ha and 15 ha in size which are located along an oxbow arm of the Uly-Zhylanshyk river with year-round water (Fig. 5.12). The adaptation enclosures each have a shelter, a large gate for access by vehicle, and a second smaller gate for pedestrian access (see also Flint et al. 1988). The enclosures are each equipped with a squeeze chute/crush to allow emergency handling or treatment.

The two enclosures allow subdividing kulan into two groups, each with only one adult stallion to minimize the risk of intra-specific fighting. Kulan will be held for a minimum of 6 weeks and up to

5 months (depending on winter conditions and social dynamics in the enclosures) in the adaptation enclosures as experiences from previous equid reintroductions in Asia (kulan and Przewalski's horses) have shown that a soft release reduces the chance of immediate large-scale exploratory movements.

Fig. 5.12. The two large adaptation enclosures and field station at Alibi.

Water availability will be monitored daily when animals will be fed with hay; if necessary (e.g. when the river is frozen and no snow is on the ground) water will be provided once a day via a pump. During feeding time, body condition and health status will be visually assessed and protocolled. If there are indications that; 1) animals are overly stressed, 2) loosing body conditions, or 3) aggressive intraspecific behavior is prevailing, all kulan will be immediately released. Subsequent release protocols will be adapted accordingly, including the consideration of hard-releases as a possible option. For kulan which get fatally injured or sick, we will have a stock of Pentobarbital solution (Narcoren, 16 g/100 ml, Narcoren, Merial GmbH, Germany) to allow chemical euthanasia.

Following release, the gates of the enclosure will remain open for kulan to return, and hay will be provided in or near the enclosure until green-up of the steppe vegetation. Enough hay will be prepared in the initial years to have an emergency stock to allow the provision of supplementary hay during extreme winter conditions ("*dzhut*"). However, experience from Mongolia has also shown that "*dzhut*" conditions with large amounts of snow, may greatly restrict the ability of humans to travel and provide emergency feed (Kaczensky et al. 2011b).

5.2 Social feasibility

5.2.1 Social science research and public outreach

Local support for the Altyn Dala Conservation Initiative appears to be high and the saiga antelope has become an ambassador of the steppe and a source of pride for Kazakhstan. Very little information is available about local people's perception of wild equids. In cooperation with Nicolas Lescureux, Centre for Functional and Evolutive Ecology (CEFE) in Montpellier, a survey will be conducted in April/May 2017 during which we plan to interview local people about their attitudes towards steppe restoration, including kulan and Przewalski's horse reintroduction.

Based on these results we will develop information material and incorporate these materials into ongoing outreach activities by ACBK currently focused on saiga. Depending on the level of perceived conflict with kulan by local people (which we currently assume to be very low) or the possible interest in consumptive use (e.g. recreational hunting, meat, or medical value of body parts; Linnell et al. 2016) we will initiate new activities tailored to address the issues. Follow up surveys on public perception and post-release monitoring of the reintroduced kulan population will allow us to assess success and identify newly arising conflicts. Depending on the nature of conflicts, we will reduce conflict (e.g. by providing mitigation measures like support for fencing vegetable plots), improve communication and local involvement, or invest more into awareness raising and anti-poaching activities.

Throughout the ADCI implementation, multiple outreach programs for saiga conservation and steppe restoration have been conducted. From 2009 to 2011, all villages of the ADCI project area have been visited to meet with local people, present the project, raise awareness about the situation of the steppe ecosystem, and work in schools to educate children. To the general public, information will be disseminated via the ACBK web-site (http://www.acbk.kz/en/), a quarterly electronic bulletin ”Green World” (in Russian) and the annual “ACBK News” (in English). Furthermore, news and events are posted on ACBK pages in social media networks (Facebook, Instagram, Youtube). The annual reports are posted on the ACBK web-site with special pages for the Altyn Dala Initiative (kulan will be added under the “Species” section). Two school “Saiga Friends” clubs are operating with regular ACBK support in Akkol and Karasu near the reintroduction site for public awareness. Regular meetings and talks with locals are conducted within the ACBK hunting areas. Regular contacts with the media are maintained via press-releases and direct contacts to interested journalists. More within-country activities are planned and will be coordinated by the ACBK public relations unit. The exact nature of these will depend on the results of the social science research and the feedback from the initial activities. In the future, kulan reintroduction will be incorporated in the various programs.

5.2.2 Nature based tourism

Kazakhstan is not a popular tourist destination yet, but has potential given its size and the variety of different landscapes. The ACBK has initiated several nature tourism trips (http://www.acbk.kz/en/articles/2758/). The biggest attraction of the central Kazakh steppe is certainly the endless space and the wildlife. Birds tend to be easy to see, and birders are a specific target audience. Non-birders tend to be more interested in large mammals, but these are much harder to “show” as they are often nocturnal (e.g. most large carnivores) or rather shy (e.g. ungulates) particularly when legal or illegal hunting pressure is high. In the central Kazakh steppe, the large ungulate community presently only consists of saiga and wild boar (*Sus scrofa*). Reintroduced kulan would be an additional charismatic faunal element that would enhance the touristic value of the region and we will also seek opportunities to promote community based wildlife tourism in the region.

5.3 Regulatory compliance

The kulan population in Altyn Emel NP originated from Turkmen kulan (*Equus hemionus kulan*) brought to Kazakhstan as early as 1953 from Turkmenistan (Kaczensky et al. 2016b). While on a species level *Equus hemionus* is listed as Near Threatened by the IUCN Red List (Kaczensky et al. 2015), the Turkmen kulan subspecies or ecotype *E.h. kulan* is listed as Endangered (Kaczensky et al. 2016a). In Kazakhstan, kulan are listed as an endangered species in the Red Data Book of the Republic of Kazakhstan (Meldebekov et al. 2010).

CITES has listed the subspecies *E. h. kulan* (Turkmen Kulan) on Appendix II since 1975. The full species is listed on Annex A of the EU Wildlife Trade Regulations since 2013. However, as kulan will only be transported within Kazakhstan, international trade regulations do not apply.

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) listed the species on Appendix II in 2002 (UNEP/CMS 2002b). The Asiatic Wild Ass is one of the key species in the Central Asian Mammals Initiative (CAMI) of CMS (Karlstetter and Mallon 2014; http://www.cms.int/cami/en/species). Consequently, expanding population size and range is within the interest of national and international organisations and agreements and CMS have provided this project with a letter of support (Appendix 2).

Restoring the full species assemblage as a necessary step in restoring full ecological functionality is one of the goals of the ADCI. A *National Biological Background Document*, [Биологическое обоснование для реинтродукции копытных в Казахстане] for the conservation of Bukhara deer, argali and kulan, has been submitted to the Committee of Forestry and Wildlife of the Ministry of Agriculture of Kazakhstan in 2016. The document includes the reintroduction of kulan to the central steppe of Kazakhstan. The information in the current document will be used to compile a *Specific Biological Justification Document* [Биологическое обоснование для отлова куланов в ГНПП Алтынемель и реинтродукции в ГПР Алтын Дала] for final approval for the capture in Altyn Emel and release in Alibi by the Government of Kazakhstan and the Committee of Forestry and Wildlife of the Ministry of Agriculture of Kazakhstan.

The kulan reintroduction component is firmly embedded in the ongoing wider conservation activities of the ADCI. The proposed kulan reintroduction therefore links into an existing large scale conservation initiative and can draw on staff, experience, and infrastructure investments already established. Involved project staff are closely working with CMS / CAMI, several IUCN specialist groups, and have extensive experience working on ungulates, including wild equids in Asia. The ADCI has been ongoing for more than 10 years, and it is highly likely to continue operating for many years to come, given the broad international cooperation, the capacity of the Kazakh NGO ACBK, and the massive international interest in saiga conservation. The ADCI will therefore provide a long-term framework to ensure continuity of site-based activities (protected area management and anti-poaching activities) that will be necessary to conserve the reintroduced kulan population. The great interest among European zoos to sponsor the reintroduction of Przewalski's horses to the ADCI area will also ensure continued external investment in the region, and will directly benefit from the experience gathered from kulan.

5.4 Resource availability

5.4.1 Monetary resources

Funding for the first 3 years of the project, covering the preparation phase and two transports, is guaranteed by a grant from the Foundation Segré (http://www.fondationsegre.org/reintroduction-of-kulan-to-the-central-steppe-of-kazakhstan/) and Nuremberg Zoo. The original project plan requested funding for three transports, but in order to comply with the amount of funding available we have had to cut out the 2019 transport in this revision. The long-term success of the reintroduction will certainly require additional transports of animals beyond the first two that are currently budgeted in this revision of the application. We will use the next two years, together with the experience gained in the first two transports, to seek additional funding from multiple sources to fund further transport(s) in 2019 and beyond as well as further genetic, health, and socio-economic monitoring.

We regard the first three years of this project, with two fully funded first two transports, as a pilot phase. The first two transports will certainly give the nascent population a solid start, as well as providing a proof of concept. The experience gained will guide subsequent release and monitoring strategies, and make the search for additional funding easier.

5.4.2 Wider institutional, infrastructure, and logistic resources

The kulan reintroduction will be coordinated by the Norwegian Institute for Nature Research (NINA), and implemented by the Association for the Conservation of Biodiversity of Kazakhstan (ACBK) in partnership with the Committee of Forestry and Wildlife (CFW) of the Ministry of Agriculture of Kazakhstan, the Royal Society for the Protection of Birds (RSPB), Frankfurt Zoological Society (FZS), and Nuremberg Zoo (Fig. 5.13).

ACBK (a Kazakhstan based NGO; http://www.acbk.kz/en/) is a strong local partner with a clear conservation vision. The ACBK staff consists of a mix of young, highly motivated individuals at the beginning of their careers and senior scientists with many years of experience. For almost 10 years, ACBK has concentrated on the Torgai steppe, which is located in the west of the ADCI project area in central Kazakhstan. The Kazakh team also have a great deal of experience of working with the Government of Kazakhstan within the ADCI area, where saiga antelope have been a focal species for many years. This experience includes anti-poaching patrols, research, protected area establishment, and public outreach. The field station at Alibi, allows year-round presence of reserve (rangers) and scientific / technical staff. Two separate enclosures were built with the support of Nuremberg Zoo to function as acclimatization enclosures for reintroduction of wild equids.

Corral capture in Altyn Emel NP will be organized by Sergey V. Sokolov, LLP Okhotprojekt, Almaty, Kazakhstan. International veterinary support will be provided by Chris Walzer, Research Institute of Wildlife Ecology (FIWI) at the Veterinary University of Vienna, Austria & Wildlife Conservation Society (WCS), New York, USA. Genetic screening and monitoring will happen in cooperation with Ralph Kuehn, Chair of Zoology, Molecular Zoology Unit, Technische Universität München, Germany. Socio-economic research will happen in cooperation with Nicolas Lescureux, Centre for Functional and Evolutive Ecology (CEFE) in Montpellier, France.

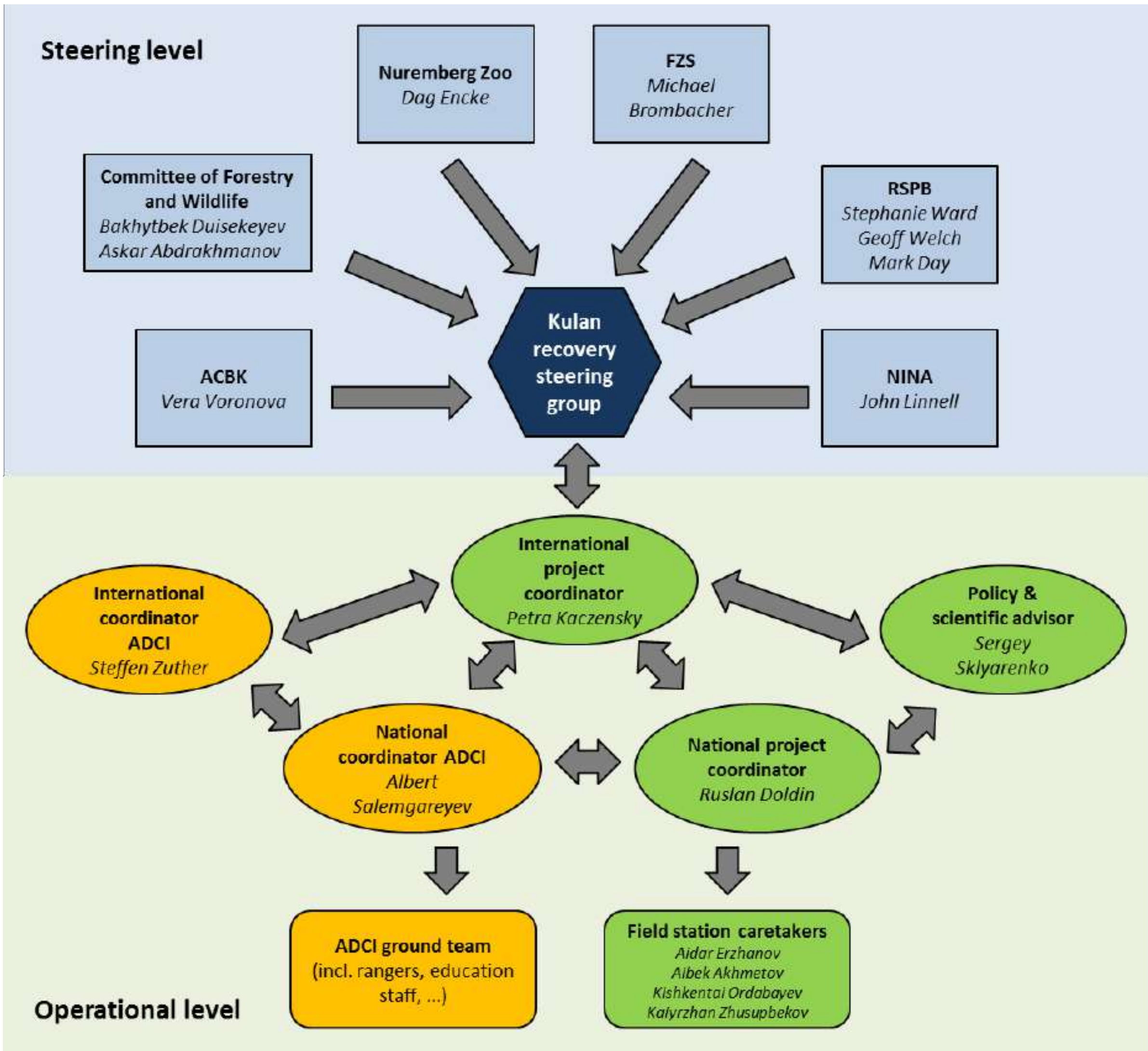

Fig. 5.13. Project organigram.

6 Risk assessment

Kulan were extirpated from Kazakhstan around the end of the 1930s, reportedly because of overhunting, competition with livestock over pasture and especially access to water, and a succession of extreme winters (Heptner et al. 1988).

6.1 Overhunting

Today the kulan is fully protected in all range countries, including Kazakhstan. Illegal killing of wildlife remains a problem in Kazakhstan and elsewhere in the region. However, outreach programs in combination with ranger patrols have allowed the Betpak-Dala saiga population to recover from a mere 20,000 in 2003 to 242,500 in April 2015 suggesting that law enforcement is working (unfortunately this recovery success was severely compromised by a disease outbreak later in 2015, which killed almost two thirds of the saiga population; ACBK 2015b).

In the past, kulan were hunted for their meat, which was considered a delicacy, their fat, believed to have healing powers, and their hides used to make valuable “Morocco” leather (Heptner et al. 1988). There is currently little evidence of an international market in kulan meat or body parts and thus it seems unlikely that kulan will become a key target of organized poaching operations in the way that saiga are exposed. Nevertheless, opportunistic killing could become a problem, especially in the initial phase of the reintroduction, thus necessitating intensive monitoring and ranger patrols.
The reintroduction site is located within a ~40,000 km² network of protected areas. A total of 137 rangers from the two state protected areas and the ACBK hunting area are responsible for protection and monitoring of the area. Additional rangers of the state wildlife service PA Okhotzooprom also patrol the area frequently. Consequently, reintroduced kulan will benefit from the infrastructure available to combat saiga poaching.

Post release monitoring of kulan via GPS-Iridium collars and regular ranger patrols will be able to determine if and at what intensity kulan may fall victim to illegal hunting.

6.2 Competition with livestock over water and pasture

The decline and eventual extirpation of kulan and Przewalski’s horse in Kazakhstan probably took place between the middle of the 18th and the middle of the 19th century (Heptner et al. 1988). Under the Russian Empire due to the increasing colonization of the steppe, and finally the disruption of nomadism during the 19th century, livestock and human densities in the steppe rose. The colonisation and cultivation of the steppe interfered with the movements of kulan and Przewalski’s horses and reduced their access to winter fodder and water (Heptner et al 1988).

Recent socio-political changes have resulted in the de-population of large parts of the central steppe and current human and livestock populations are very low and largely confined to areas around the remaining villages and towns. This leaves large parts of the central steppe ungrazed by livestock. Furthermore, water availability in the Torgai steppe seems much less of a constraining factor than in other parts of the kulan’s range, which largely consists of semi-desert or desert habitats.

6.3 Extreme weather events

According to Bekenov et al. (1998) *dzhuts* occur every 3-4 years and extreme *dzhuts* every 10-12 years in Kazakhstan. *Dzhut* winters are believed to have been one of the main causes of the saiga’s reduction in range in the early twentieth century. In the more recent past severe winters reduced the Betpak-Dala saiga population by 20% in 1976/77 and by 37% in 1985/86 (Bekenov et al. 1998). Several of the remnant Asiatic wild ass population in the former Soviet Union are believed to have succumbed to *dzhut* events. However, little is known about the mechanisms of the extinction; e.g. did kulan actually die because of the winters or were they subsequently hunted to extinction by the starving human population?

Kulan are highly mobile and able to outdistance unfavorable weather conditions, including localized *dzhuts* as observed in the Dzungarian Gobi in Mongolia in the winter 2009-2010 (Kaczensky et al. 2011b). Historic records also suggest that kulan in the central steppe of Kazakhstan once migrated between steppe areas in the north and desert areas in the south, especially during severe winters (Bannikov 1981).

Given the uncertainties about winter conditions and the risk of severe *dzhuts*, emergency winter hay storage needs to be prepared, at least in the initial phase when the reintroduced kulan population is still small and spatially confined.

6.4 Minimum number of founders

The first Kulan reintroduction was initiated in Kazakhstan in 1953, when animals from Badkhyz SNR in Turkmenistan where reintroduced to Barsa Kelmes, a former island in the Aral Sea. Since than multiple other initiatives have followed resulting in the following lessons learned (for details see Kaczensky et al. 2016b):

- Success of Asiatic wild ass reintroductions have been mixed. Out of 18 reintroduction initiatives, five successfully reestablished substantial (≥100 animals) free-ranging populations (two in Turkmenistan, two in Kazakhstan, and one in Israel), two reestablished the species in large fenced areas within the historical distribution range in Uzbekistan and Ukraine, four are very small and their future is unsure, and five have failed (Fig. 6.1).
- The four successful reintroduction initiatives that released Asiatic wild asses into non-enclosed areas (not counting Barsa-Kelmes, as it was initially an island) all used >30 founders.
- In Kazakhstan, Turkmenistan, and Iran, reintroduced (as well as autochthonous) Asiatic wild ass populations are still subject to illegal hunting — one of the key factors that led to their extinction in the first place. The reintroductions that failed likely succumbed to the combined effect of small population size and illegal hunting.

Consequently, this project aims to transport a minimum of 32-48 kulan from Altyn Emel NP to the Torgai steppe. Per transport, we aim to transport at least 16 animals of which two should be adult stallions, at least eight adult mares, and the remaining animals a mix of juveniles (foals and yearlings) of either sex. It is also likely that most adult mares will be pregnant.

Post-release monitoring will determine mortalities and recruitment in the initial phase, and mortalities will be compensated for by additional transports (but also see section 4.3. Exit Strategy). Genetic monitoring (using faeces) will also make sure that the initial population has a sufficiently high variability and potentially high inbreeding values will be counteracted by bringing in additional animals. We will also assess the genetic variability of the kulan population around Barsa Kelmes and explore the possibility of bringing additional animals from this second source to potentially increase genetic variability.

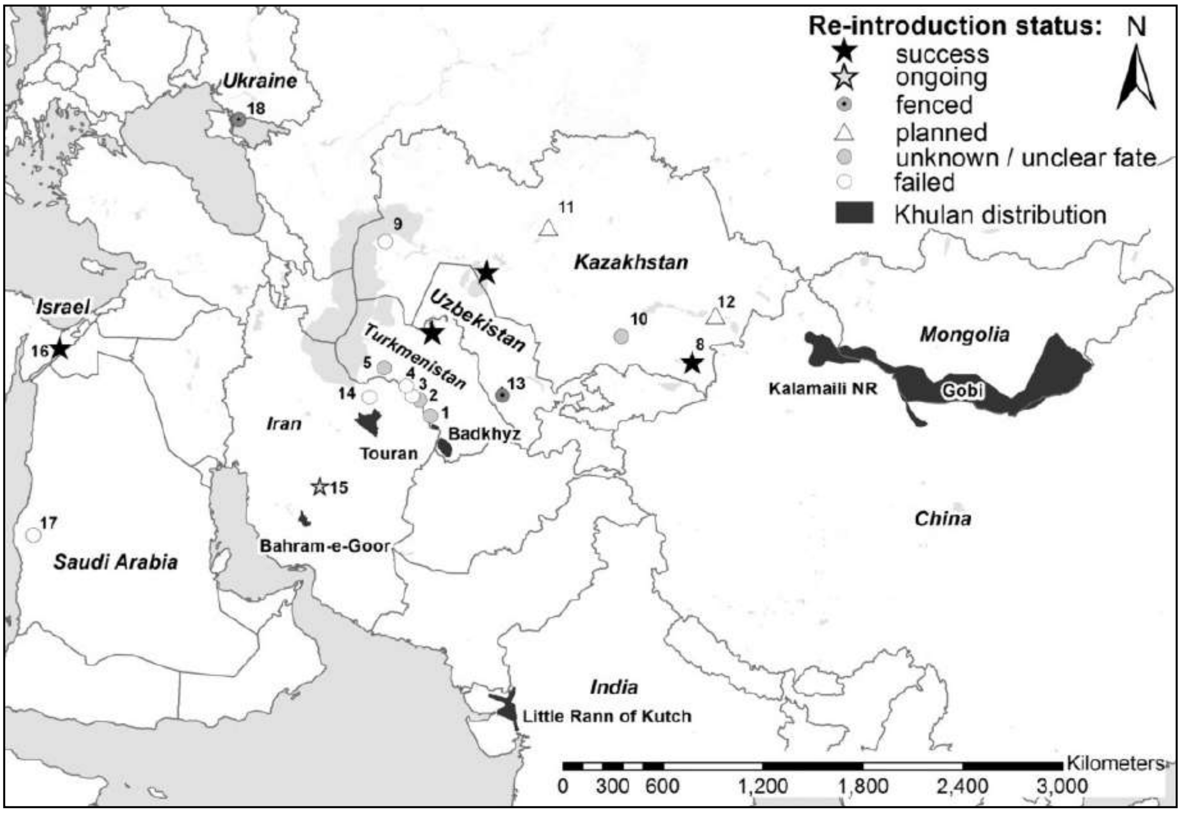

Fig. 6.1. Overview of Asiatic wild ass distribution and reintroduction projects (Source: Kaczensky et al. 2016b).

6.5 Health and disease risk

6.5.1 Diseases

For the translocation process we propose to use the Disease Risk Analysis (DRA) framework developed by the World Organisation for Animal Health (OIE), which is used to identify, assess and manage the risks posed by animal diseases with a focus on economic and human health impacts. This framework has been adapted for Wildlife Disease Analysis by the IUCN/ SSC (World Organisation for Animal Health (OIE), International Union for Conservation of Nature (IUCN) 2014). In this particular situation, Disease Risk Analysis (DRA) is used to analyse the risks of disease introduction from translocated kulan or the emergence of disease in the translocated population. Furthermore, the DRA will help in assessing the risk of disease spill-over (when a disease moves from one species to another) most notably to saiga. The end-goal of the DRA is to provide efficient and cost- effective disease prevention and mitigation strategies (Jakob-Hoff et al. 2014).

Generally, most diseases of domestic equids can be transmitted to wild equids and vice versa. A clear understanding of potential infectious agents, their vectors and the underlying epidemiological processes is essential when developing and implementing conservation measures. When moving wild equids from one population (e.g. a captive population in Europe) to another (e.g. in-situ in Central Asia) it is important to note that the animals moved are at the same time a vessel for numerous infectious agents that could adversely affect the receiving population. On the other hand, naïve animals when faced with a novel infectious agent in a new and often demanding environment are similarly at risk due to the lack of an adequate pathogen-adapted immune response.

Very few cases of infectious disease have been reported from Asiatic wild asses (Radcliffe and Osofsky 2002) and kulan are only being moved from one part of the country to another. Domestic horses are distributed throughout the country in Kazakhstan (horses are also present in Altyn Emel NP) and must be regarded as the most important potential contiguous reservoir of equid diseases. A search on the OIE-WAHIS website revealed that none of the reportable equid diseases (see Table 6.1) had been reported in Kazakhstan in the past seven (or more) years.

The only reported OIE-listed disease that has been reported from Kazakhstan and can afflict kulan is anthrax, a disease caused by the spore-forming bacteria *Bacillus anthracis*. While predominantly a disease of ruminants, various zebra species in Africa have been reported to have died of the disease (Hugh-Jones and de Vos 2002). A decline in a local population of Grevy's zebra (*Equus grevyi*) has been attributed to anthrax (Muoria et al. 2007). However, previous outbreaks in Kazakhstan primarily occurred in the north and south of the country, rather than in the central steppe (Joyner et al. 2010).

Table 6.1: OIE reportable Equine diseases and infections and reporting status from Kazakhstan over the past seven (or more years).

OIE reportable Equine diseases	Reporting status
• Contagious equine metritis	Not reported
• Dourine	Not reported
• Equine encephalomyelitis (Western)	Not reported
• Equine infectious anaemia	Not reported
• Equine influenza	Not reported
• Equine piroplasmosis	Not reported
• Glanders	Not reported
• Infection with African horse sickness virus	Not reported
• Infection with equid herpesvirus-1 (EHV-1)	Not reported
• Infection with equine arteritis virus	Not reported
• Venezuelan equine encephalomyelitis	Not reported
• Antrax	Reported

The increasing pressure from grazing livestock on wild equids in remnant ecological islands is of serious concern in many parts of the world. Recent and repeated outbreaks of equine influenza A in Mongolia and the Xinjiang Autonomous Region of China have directly threatened reintroduced Przewalski's horses in the south-west of Mongolia (Great Gobi B SPA) and the Kalamaili Nature Reserve in Xinjiang, China (e.g. Wei et al. 2010). Equine herpes viruses (EHV) has in recent years received increased attention, as the susceptible host range for these viruses is far larger than previously thought. It is important to note that in a captive environment, Thompson's gazelles (*Eudorcas thomsonii*) have been affected by EHV, causing encephalomyelitis (Abdelgawad et al. 2016). Zebras, Asiatic wild ass, Przewalski's horses, and domestic horses have all been shown to be asymptomatic carriers of numerous EHVs and therefore all theoretically pose a certain threat to gazelles. However, the translocation of kulan is unlikely to add significant risk of transmission beyond that already posed by the domestic horses in the region.

In recent years, equine brucellosis (*Brucella abortus or Brucella suis*) has been raised by some parties as an issue of concern. Suppurative bursitis, most commonly recognized as fistulous withers, is the most common condition associated with brucellosis in horses. Occasionally, abortion has been reported. While Kazakhstan has not reported brucellosis in any form to the OIE (http://www.oie.int/wahis_2/public/wahid.php/Countryinformation/animalsituation) in the past 10 years (or more) it appears, based on various outbreak reports in cattle and human cases, that *Brucella sp.* occurs on a level similar to that reported in other Central Asian countries (see *5.1.3.*

Human population and livestock presence). It is, however, highly unlikely that infected kulan can be a source of the disease for horses, other animal species, or people. Kulan in turn will be potentially exposed to disease transfer from local livestock, but there are no indications that this exposure risk is greater in Torgai than in Altyn Emel.

The state veterinary service conducts several routine preventive measures to fight the spread of animal diseases, including brucellosis, rabies, pasteurellosis, anthrax, glanders, blackleg, and *Dermatitis pustulosa*, which is achieved through vaccinations of livestock in spring or autumn. Immunization of animals against anthrax is conducted with a reported 100% coverage of susceptible livestock in all parts of the districts. Horses, which are used for breeding, are vaccinated against strangles (*Adenitis equorum*). Each year, horses are tested for malleus, infectious anemia (EIAV) (*Anemia infectiosa equorum*), *Lymphangoitis epizootika*, Leptospirosis and Listeriosis.

6.5.2 Capture and anaesthesia

Non-infectious hazards: Main risks would include trauma during capture and an extremely unlikely anaesthesia-related death event. Due to the extensive 20 years of experience in working with this species and other similar wild equids the team can safely and reliably manage the capture events and necessary anaesthesia. The balanced anaesthesia protocol is fully reversible and has proven its safety in some 250+ wild equid procedures (no mortalities during anaesthesia or within 6 months post- anaesthesia).

6.5.3 Transport

Non-infectious hazards: Main risks would encompass trauma. Similarly, the team has extensive knowledge and hands-on experience in the transport of wild equids which facilitates correct transport conditions. The previously developed use of long-acting neuroleptics also significantly reduces the risks during transport.

6.5.4 Release

Infectious hazards: As equids are distributed throughout the country and occur both at the source site in Altyn Emel NP and the translocation site on the Torgai steppe no specific risks of introducing or exposing animals to new infectious agents have been noted. Though a very minor risk, it appears prudent to vaccinate the translocated individuals for rabies, tetanus, and anthrax during the anaesthesia process.

6.6 Summary assessment of the kulan reintroduction to the Torgai steppe

Reintroduction criteria (Pérez et al. 2012):		**YES / No**	**Details**
1	Is the species or population under threat?	YES	The IUCN criteria for Turkmen kulan *E. hemionus kulan* is "Endangered". The autochthonous population in Badkhyz SNR in Turkmenistan may have vanished and most of the reintroduced populations are small or of unknown status. In Kazakhstan, the species presently occupies only about 0.25% of its original range.
2	Have the threatening factors been removed or controlled, or were they absent in the release area?	YES / MOSTLY	Socio-political changes have resulted in low human population and livestock densities suggesting a low potential for competition, disturbance and conflicts.
			Sufficient pasture and water sources available.
			Almost no agriculture is present in the region.
			There currently seems to be no international market for kulan body parts, but kulan meat was once regarded as a delicacy in Kazakhstan and thus there certainly remains a risk for illegal killings. Strong ranger presence is expected to minimize losses to illegal hunting.
3	Are translocations the best tool to mitigate conservation conflicts?	YES	The species became extinct in the central steppe of Kazakhstan by the late 19th to early 20th century. Recolonization from two previously reintroduced populations cannot be expected due to long distances and past developments of the kulan populations. There is a suitable source population available for reintroduction within Kazakhstan.
4	Are risks for the target species acceptable?	YES	The source population in Altyn Emel NP is large and genetically diverse.
			Capture and transport is not expected to pose a notable mortality or morbidity risk due to past experience of the team.
			Access to water and pasture is not a confining factor any more.
			An increase in the frequency of extreme winters (*dzhuts*) could become a limiting factor, especially in the initial phase when the reintroduced population is still small. Emergency winter hay will be prepared to allow winter feeding in extreme situations; however, the free-ranging kulan may be impossibly to reach if they range too far from infrastructure.
			Introduction to a more mesic steppe habitat can be expected to increase the species overall resilience to the expected climate change effects of increasing aridity.
			Exposure to new diseases or parasites is not expected.
			Wolf predation may have a negative impact in the initial phase of the reintroduction, but is not expected to jeopardize population growth. Ultimately wolf predation can be viewed as a success criteria as it reflects the restoration of ecological processes.
		YES	Introduction of new diseases or parasites is not expected.

5	Are risks for other species or the ecosystem acceptable?		Grazing competition with sympatric saiga is expected to be low due to different food preferences and the vast size of the reintroduction area. Moderate grazing by kulan may even improve pasture quality through facilitation.
6	Are the possible effects of the translocation acceptable to local people?	YES	Conflicts with local pastoralists or agriculture can be expected to be small and localized.
		???	No interviews or attitude surveys have been conducted yet, but are scheduled for early summer 2017.
7	Does the project maximize the likelihood of establishing a viable population?	YES	The project will adopt an adaptive release strategy based on past experience and post-release monitoring of mortality and recruitment.
8	Does the project include clear goals and monitoring?	YES	See chapter 4 and other parts of this document. Post-release movement, demographic, health, and genetic monitoring of kulan is part of the project. Additional funds will be necessary to broaden socio-economic monitoring and community involvement.
9	Do enough economic and human resources exist?	PARTLY	There is full funding for the first 3 years of the project (pilot phase), including 2 kulan transports; further fund-raising for additional transports and subsequent Przewalski's horse reintroduction is planned.
			The project is firmly embedded within the framework of the Altyn Dala Conservation Initiative, a long-term commitment by the government of Kazakhstan in cooperation with various national and international groups. Monitoring, patrolling, and outreach for the new kulan reintroduction component will be integrated into ongoing activities.
10	Do scientific, governmental, and stakeholder groups support the translocation?	YES	Reintroduction of kulan is one of the components of the ADCI to re-establish the full faunal assemblage of the central steppe of Kazakhstan. This consortium involves all the relevant governmental and non-governmental actors.
Additional criteria added			
11	Are there expected benefits for the local ecosystem?	YES	Grazing facilitation and creation of a mosaic of short and long-grass steppe habitats without the associated human disturbance of livestock grazing.
			Nutrient re-distribution and seed dispersal.
			Diversification of prey and scavenger basis.
12	Are there expected benefits for the local economy?	YES	Awareness for and interest in the area, resulting in better protection and financial input (for research, management and sustainable development).
			Community involvement and additional job opportunities (e.g. rangers, maintenance workers, field assistants)
			Increasing value of the area for nature tourism.

7 Release and implementation

7.1 Selecting release sites and areas

The Torgai steppe has been chosen as a release site for re-establishing the once native wild equids of the central steppe of Kazakhstan because (also see Kaczensky 2011):

- It is within the historic range of both the kulan and the Przewalski's horse.
- It is in the heart of the Betpak-Dala saiga population and has the potential for restoring the complete large herbivore assemblage of historic times.
- The ADCI provides the necessary institutional frame work to embed the kulan reintroduction into a large scale and long-term steppe conservation initiative.
- Reintroduced kulan will profit from past and ongoing conservation work focused on saiga.
- The steppe ecosystem provides sufficient pasture and water resources.
- The area has a large network of protected areas, covering 40.000 km² of intact steppe habitat.
- The area has a very low human population density with little agricultural production.

The Torgai steppe currently represents one of the largest steppe regions with the potential to re-establish two extirpated wild equids in what was once their prime habitat. Although reintroduction programs managed to re-establish the kulan in Kazakhstan, the species currently occupies less than 1% of its historic range in the country. The kulan population in Altyn Emel NP is expected to be close to reaching carrying capacity and has little prospect for further range increase.

7.2 Release strategy

We are aiming for three transports with 16-18 kulan in 2017, 2018, and 2019. Current funding is guaranteed for the first two years. Depending on initial population development (also considering population composition, spatial distribution, and genetic diversity), more transports will be organized to reach the target population of 100 kulan by 2027. For details see chapter 6.

8 Dissemination of information

Regionally and nationally information on kulan reintroduction will be integrated as a new element in the ongoing activities on steppe restoration and species conservation routinely conducted by ACBK (see 5.2. Social Feasibility).

Internationally the project will be presented at workshops and conferences and advertised on the project partner's websites (e.g. http://www.nina.no/english/Research/KULANSTEP).

Although this project is primarily motivated by a desire to improve the conservation status of kulan and the restoration of the wildlife assemblage of the central Kazkhstan steppes there is a a high value in the scientific data that will be produced. The intensity of post release monitoring using GPS collars will ensure that valuable knowledge on species translocations will be obtained to improve both this and other similar projects. This data on animal movement in the source and reintroduced populations will also provide more fundamental insights into how kulan respond to habitat, seasonality, water availability, and human disturbance. The data on disease / pathogen presence and health will also be of interest for setting baselines from these poorly studied species / regions. Accordingly, peer-reviewed scientific and popular science articles will be written. Experience has shown that scientific publication serves as a powerful way to attract media attention.

9 References

ACBK. 2015a. ACBK studies the keeper of the steppe. ACBK NEWS, 2: 9-10.

ACBK. 2015b. Saiga Aerial Survey & Saiga Die-Off Study. ACBK Annual Report, 6-7.

ACBK. 2016. Aerial survey. ACBK NEWS, 4: 5.

Abaturov, B.D., Larionov, K.O., Kolesnikov, M.K., Nikonova, O.A. 2005. State and food provision of saigas on pastures with vegetation of various types, Zoologichesky Zhurnal, 84(3): 377-390.

Abdelgawad, A., Damiani, A., Ho, S.Y.W., Strauss, G., Szentiks, C.A., East, M.L., Osterrieder, N., Greenwood, A.D. 2016. Zebra Alphaherpesviruses (EHV-1 and EHV-9): Genetic Diversity, Latency and Co-Infections. Viruses, 8(10): 262–13.

Asa, C.S. 2002. Equid Reproductive Biology. Pages 113-117 in: Moehlman P.D. (Ed). IUCN Publication Services Unit, Cambridge, United Kingdom.

Assylbekov, A.D. 2013. V Kazakhstane sosdan gosudarstvenniy pririodniy reservat “Altyn Dala”. Stepnoi buleten, 37: 25-27.

Atkinson, M., Blumer. E.S. 1997. The use of a long-acting neuroleptic in the Mongolian wild horse (*Equus prezwalskii prezwalskii*) to facilitate the establishment of a bachelor herd. Proc. AAZV, pp. 199–200.

Baucus, K.L., Ralston, S.L., Nockels, C.F., McKinnon, A., Squires, E.L., 1990. Effects of transportation on early embryonic death in mares. Journal of Animal Science, 68: 345-351.

Bannikov, A.G. 1981. The Asian wild ass. Lesnaya Promyshlennost, Moscow, Russia. [In Russian, English translation by M. Proutkina, Zoological Society of San Diego]

Beauvais, W., Coker, R., Nurtazina, G., Guitian, J. 2015. Policies and Livestock Systems Driving Brucellosis Re-emergence in Kazakhstan. Ecohealth. DOI:10.1007/s10393-015-1030-7

Bekenov, A.B., Grachevand, I.A., Milner-Gulland, E.J. 1998. The ecology and management of the Saiga antelope in Kazakhstan. Mammal Review*,* 28(1): 1–52.

Bennett, E.A., Champlot, S., Peters, J., Arbuckle, B.S., Guimaraes, S., Pruvost, M., Bar-David, S., Davis, S.J.M., Gautier, M., Kaczensky, P., Kuehn, R., Mashkour, M., Morales-Muniz, A., Pucher, E., Tournepiche, J.F., Uerpmann, H.P., Balasescu, A., Germonpre, M., Gundem, C.Y., Hemami, M.R., Moulle, P.E., Otzan, A., Uerpmann, M., Walzer, C., Grange, T., Geigl, E.M. 2017. Taming the late Quaternary phylogeography of the Eurasiatic wild ass through ancient and modern DNA. PLoS ONE, 12: e0174216.

Burnik Šturm, M., Ganbaatar, O., Voigt, C.C., Kaczensky, P. 2016 *EarlyOnline*. Sequential stable isotope analysis reveals differences in dietary history of three sympatric equid species in the Mongolian Gobi. Journal of Applied Ecology. DOI://10.1111/1365-2664.12825

Buuveibaatar, B., Mueller, T., Strindberg, S., Leimgruber, P., Kaczensky, P., Fuller, T.K. 2016a. Human activities negatively impact distribution of ungulates in the Mongolian Gobi. Biological Conservation, 203: 168-175.

Buuveibaatar, B., Strindberg, S., Kaczensky, P., Payne, J., Chimeddorj, B., Naranbaatar, G., Amarsaikhan, S., Dashnyam, B., Munkhzul, T., Purevsuren, T., Hosack, D.A., Fuller, T.K. 2016b *EarlyOnline*. Mongolian Gobi supports the world’s largest populations of khulan and goitered gazelles. Oryx. DOI:10.1017/S0030605316000417

Buzzard, P.J., Bleisch, W.V., Xü, D., Zhang, H. 2008. Evidence for lekking in chiru. Journal of Zoology, 276: 330-335.

Cao, Y., T. Zhang, X. Lian, Q. Cui, D. Deng, J. Su. 2009. Diet Overlap among Selected Ungulates in Kekexili Region, Qinghai Province. Sichuan Journal of Zoology, 1: 49-54.

Chu, H.J., Jiang, Z.G., Lan, W.X., Wang, C., Tao, Y.S., Jiang, F., 2008. Dietary overlap among khulan *Equus hemionus*, goitered gazelle *Gazella subgutturosa* and livestock. Acta Zoologica Sinica, 54(6): 941-954. [In Chinese with English abstract]

Deem, S.L. 2015. Conservation Medicine to One Health: The Role of Zoologic Veterinarians. Pages 698-703 in: Miller R.E., Fowler M. (Eds). Fowler’s Zoo and Wild Animal Medicine. Elsevier-Saunders, St Louis, USA.

Dixon, A.P., Faber-Langendoen, D., Josse, C., Morrison, J., Loucks, C.J., Ebach, M. 2014. Distribution mapping of world grassland types. Journal of Biogeography, 41: 2003-2019.

Donaldson, L. 2006. Anesthesia and pregnancy. Pages 26-267 in: Doherty, T., Valverde, A. (Eds). Manual of equine anesthesia and analgesia. Blackwell Publishing, Oxford, UK.

Duke, T. 2006. The risk of equine anesthesia. Pages 17-18 in: Doherty, T., Valverde, A. (Eds). Manual of equine anaesthesia and analgesia. Blackwell Publishing, Oxford, UK.

Esteruelas, N.F., Huber, N., Evans, A.L., Zedrosser, A., Cattet, M., Palomares, F., Angel, M., Swenson, J.E., Arnemo, J.M. 2016. Leukocyte Coping Capacity as a Tool to Assess Capture- and Handling-Induced Stress in Scandinavian Brown Bears (*Ursus Arctos*). Journal of Wildlife Disease, 52: 40-53.

Feh, C., Munkhtuya, B., Enkhbold, S., Sukhbaatar, T.,2001. Ecology and social structure of the Gobi khulan *Equus hemionus* subsp. in the Gobi B National Park, Mongolia. Biological Conservation, 101: 51–61.

Flint V.E., Kovshar A.F., Pereladova O.B., Blank, D.A. 1988. Methodological recommendations for reintroduction of kulan (capture, transport, acclimatisation, release). All-union research institute for nature protection and protected areas under the Goskomprirody USSR. [In Russian]

Gerritsmann, H., Stalder, G.L., Kaczensky, P., Buuveibaatar, B., Payne, J., Boldbaatar, S., Walzer, C., 2016. Arterial pH and Blood Lactate Levels of Anesthetized Mongolian Khulan (*Equus hemionus hemionus*) in the Mongolian Gobi Correlate with Induction Time. Journal of Wildlife Disease, 52(3): 642-646.

Ghasemi, A., Hemami, M.R., Iravani, M., Senn, J., 2012. Seed Dispersal by Persian Wild Ass (Equus hemionus onager) in Qatruiyeh National Park, South Central Iran. Page 71 in: P. Kaczensky and J. Ransom (Eds). International Wild Equid Conference - Book of abstracts. Conference in Vienna, Austria from 12-22 September 2012. Research Institute of Wildlife Ecology, University of Veterinary Medicine, Austria.

Harrington, L.A., Moehrenschlager, A., Gelling, M., Atkinson, R.P., Hughes, J., Macdonald, D.W., 2013. Conflicting and complementary ethics of animal welfare considerations in reintroductions. Conserv Biol 27, 486-500.

Hemami, M., Kaczensky, P., Lkhagvasuren, B., Pereladova, O., Bouskila, A. 2015. *Equus hemionus* ssp. onager. The IUCN Red List of Threatened Species 2015: eT7966A3144941.

Heptner, V.G., Nasimovich, A.A., Bannikov A.G. 1988. Mammals of the Soviet Union Volume 1 – Artiodactyla and Perissodactyla. Pages 1011-1036 Kulan: *Equus (Equus) hemionus*. [English translation of the original book published in 1961 by Vysshaya Shkola Publishers Moscow]. Smithsonian Institution Libraries and The National Science Foundation Washington, D.C., USA.

Hohhot Declaration 2008. XXI International Grasslands Congress/VIII International Rangeland Congress, June 2008, Hohhot, Inner Mongolia, China https://cmsdata.iucn.org/downloads/hohhot_declaration_july_9_08.pdf

Hugh-Jones, M.E., de Vos, V. 2002. Anthrax and wildlife. Revue scientifique et technique International Office of Epizootics, 21: 359-383.

IUCN/SSC, 2013. Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0. Gland, Switzerland: IUCN Species Survival Commission.

Jakob-Hoff, R.M., MacDiarmid S.C., Lees C., Miller P.S., Travis D., Kock R. 2014. Manual of Procedures for Wildlife Disease Risk Analysis. World Organisation for Animal Health, Paris, 160 pp. Published in association with the International Union for Conservation of Nature and the Species Survival Commission.

Janssen, D.L., Allen, J.L. 2015. Equidae. Pages 559-567 in: Miller, R.E., Fowler, M. E. (Eds.). Fowler’s Zoo and Wild Animal Medicine. Elsevier-Saunders, St Louis, USA.

Jombart, T., Devillard, S., Balloux, F. 2010. Discriminant analysis of principal components: a new method for the analysis of genetically structured populations. Genetics, 11:94.

Joyner, T.A., Lukhnova, L., Pazilov, Y., Temiralyeva, G., Hugh-Jones, M.E., Aikimbayev, A., Blackburn, J.K. 2010. Modeling the potential distribution of Bacillus anthracis under multiple climate change scenarios for Kazakhstan. PLoS ONE, 5: e9596.

Kaczensky, P., Ganbaatar, O., von Wehrden, H., Walzer, C. 2008. Resource selection by sympatric wild equids in the Mongolian Gobi. Journal of Applied Ecology, 45: 1662-1769.

Kaczensky, P., Dresley, V. Vetter, D. Otgonbayar, H., Walzer C. 2010a. Water use of Asiatic wild asses in the Mongolian Gobi. Exploration into the Biological Resources of Mongolia (Halle/Saale, Germany), 11: 291-298.

Kaczensky, P., Ito, T.Y., Walzer, C. 2010b. Satellite Telemetry of Large Mammals in Mongolia: What Expectations Should We Have for Collar Function? Wildlife Biology in Practice, 6: 108-126.

Kaczensky, P., 2011. First assessment of the suitability of the Altyn Dala and Altyn Emel region of Kazakhstan for Przewalski's horse re-introduction. Unpublished report.

Kaczensky, P., Kuehn, R. Lhagvasuren, B. Pietsch, S. Yang, W., Walzer, C. 2011a. Connectivity of the Asiatic wild ass population in the Mongolian Gobi. Biological Conservation, 144: 920–929.

Kaczensky, P., Ganbataar, O., Altansukh, N., Enkhsaikhan, N. Stauffer, C., Walzer, C. 2011b. The Danger of Having All your Eggs in One Basket – Winter Crash of the Re-introduced Przewalski's Horses in the Mongolian Gobi. PloS ONE, 6(12): e28057

Kaczensky, P., Lkhagvasuren, B., Pereladova, O., Hemami, M.-R., Bouskila, A. 2015. *Equus hemionus*. The IUCN Red List of Threatened Species 2015: e.T7951A45171204.

Kaczensky, P., Lkhagvasuren, B., Pereladova, O., Hemami, M., Bouskila, A. 2016a. *Equus hemionus* ssp. kulan. The IUCN Red List of Threatened Species, e.T7964A3144714.

Kaczensky, P., Hrabar, H., Lukarevski, V., Zimmermann, W., Usukhjargal, D., Ganbaatar, O., Bouskila, A. 2016b. Reintroduction of Wild Equids. Pages 196-214 in: Ransom, J.I., and Kaczensky, P. (Eds). Wild Equids - Ecology, Management, and Conservation. Johns Hopkins University Press, Baltimore, USA.

Kamp, J., Sheldon, R.D. Koshkin, M.A. Donald, P.F., Biedermann, R. 2009. Post-Soviet steppe management causes pronounced synanthropy in the globally threatened Sociable Lapwing *Vanellus gregarious*. Ibis, 151: 452–463.

Karlstetter, M., Mallon, D. 2014. Assessment of gaps and needs in migratory mammal conservation in Central Asia. Report prepared for the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Financed by the Ecosystem Restoration in Central Asia (ERCA) component of the European Union Forest and Biodiversity Governance Including Environmental Monitoring Project (FLERMONECA).

Kerven, C. 2004. The influence of cold temperatures and snowstorms on rangelands and livestock in northern Asia. Pages 41-55 in S. Vetter (Ed): Rangelands at equilibrium and non-equilibrium. Programme for Land and Agrarian Studies (PLAAS), Cape Town, South Africa.

Kühl, A., Balinova, N., Bykova, E., Arylov, Y.N., Esipov, A., Lushchekina, A.A., Milner-Gulland, E.J. 2009. The role of saiga poaching in rural communities: Linkages between attitudes, socio-economic circumstances and behaviour. Biological Conservation, 142: 1442-1449.

Lenk, M., 2008. Demografische und Sozioökonomischen Situation im Projektgebiet der "Altyn Dala Conservation Initiative" (ADCI) (Kasachstan) [Demographic and socio-economic situation in the project area oft he „Altyn Dala Conservation Initiative" (ADCI (Kazakhstan)]. Unpublished report. University Greifswald, Germany. [In German]

Levanov, V.F., Sokolov, S.V., Kaczensky, P. 2013. Corral mass capture device for Asiatic wild asses. Wildlife Biology, 19(3): 325-334.

Linnell, J.D.C., Kaczensky, P., Lescureux, N., 2016. Human dimensions of wild equid management: exploring the meaning of “wild”. Pages 121-132 in J. Ransom and P. Kaczensky (Eds), Wild Equids: Ecology, Conservation, and Management. John Hopkins University Press.

Lkhagvasuren, D. 2015. Some Population Characteristics of the Asiatic Wild Ass (*Equus hemionus* Pallas, 1775) in Mongolia. PhD thesis at the School of Arts and Sciences, National University of Mongolia.

Lushchekina, A., Struchkov, V. 2001.The saiga antelope in Europe: once again on the brink. The Open Country, 3: 11-24.

Mallon, D.P. Zhigang, J. 2009. Grazers on the plains: challenges and prospects for large herbivores in Central Asia. Journal of Applied Ecology, 46: 516–519.

Meldebekov, A.M., Bajzhanov, M.K., Bekenov, A.B., Kovshar, A.F. 2010. Turkmen kulan. Pages 262-263 in: The Red Data Book of the Republic of Kazakhstan, Volume 1: Animals, part 1: Vertebrates. 4th edition. DPS, Almaty, Kazakstan.

Milchunas, D.G., Lauenroth, W.K., Burke. I.C. 1998. Livestock grazing: animal and plant biodiversity of shortgrass steppe and the relationship to ecosystem function. Oikos, 83: 65-74.

Moehrenschlager, A., 2017. Tiptoeing Cautiously Yet Confidently: Health Considerations for Conservation Translocations. Ecohealth 14, 167-170.

Muoria, P.K., Muruthi, P., Kariuki, W.K., Hassan, B.A., Mijele, D., Oguge, N.O. 2007. Anthrax outbreak among Grevy's zebra (*Equus grevyi*) in Samburu, Kenya. African Journal of Ecology, 45: 483–489.

Nandintsetseg, D., Kaczensky, P., Ganbaatar, O., Leimgruber, P., Mueller, T. 2016. Spatiotemporal habitat dynamics of ungulates in unpredictable environments: The khulan (*Equus hemionus*) in the Mongolian Gobi desert as a case study. Biological Conservation, 204: 313–321.

Neumann-Denzau, G., Denzau, H., 2007. Remarks on the social system of the Mongolian wild ass (*Equus hemionus hemionus*). Exploration into the Biological Resources of Mongolia (Halle/Saale), 10: 177-187.

Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D., Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P., Kassem, K.R., 2001. Terrestrial Ecoregions of the World: A New Map of Life on Earth. BioScience, 51: 933-938.

Olson, K.A. 2014. Saiga Crossing Options Guidelines and Recommendations to Mitigate Barrier Effects of Border Fencing and Railroad Corridors on Saiga Antelope in Kazakhstan. Report for Frankfurt Zoological Society, Association for the Conservation of Biodiversity of Kazakhstan, Fauna & Flora International, Convention on Migratory Species.

Olson, K.A., van der Ree, R. 2015. Railways, roads and fences across Kazakhstan and Mongolia threaten the survival of wide-ranging wildlife. Pages 472-478 in R. van der Ree, D.J. Smith, C. Grilo (Eds) Handbook of Road Ecology, John Wiley & Sons, Ltd., Chichester, UK.

Painer, J., Kaczensky, P., Ganbataar, O., Huber K., Walzer, C. 2011. Comparative parasitological examination on sympatric equids in the Greater Gobi “B” Strictly Protected Area, Mongolia. European Journal of Wildlife Research, 57: 225–232.

Pavlov, M.P. 1996. Translocations of kulans in the former Soviet Union. Re-Introduction News, 12: 15-16.

Peled, T. 2010. Reintroductions as an ecosystem restoration tool: A case study of reintroduced ungulates as vectors for seed-dispersal. PhD thesis, Ben-Gurion University of the Negev, Israel.

Pérez, I., Anadón, J.D., Díaz, M., Nicola, G.G., Tella, J.L., Giménez, A. 2012. What is wrong with current translocations? A review and a decision-making proposal. Frontiers in Ecology and the Environment, 10: 494-501.

Prince, S.D., Goward, S.N. 1995. Global primary production: a remote sensing approach. Journal of Biogeography, 22: 815–833.

Rachkovskaya E.I., Evstifeev Yu.G., Sidorova T.V., 2012. Ecosystem map of the Irgiz-Turgai-Zhylanshyk pilot area. Unpublished ACBK Report.

Radcliffe, R.M., Osofsky, S.A. 2002. Disease concerns for wild Equids. Pages 124-153 in Moehlman, P.D. (Ed), Equids: Zebras, Asses and Horses. IUCN Publication Services Unit, Cambridge, UK.

Ransom, J.I., Kaczensky, P., Lubow, B.C., Ganbaatar, O., Altansukh, N. 2012. A collaborative approach for estimating terrestrial wildlife abundance. Biological Conservation, 153: 219-226.

Ransom, J.I., Kaczensky, P., (Eds) 2016. Wild Equids - Ecology, Management, and Conservation. Johns Hopkins University Press, Baltimore, USA.

Rubenstein, D.I., Sundaresan, S., Fischhoff, I., Tantipathananandh, C., Berger-Wolf, T.Y. 2015. Similar but Different: Dynamic Social Network Analysis Highlights Fundamental Differences between the Fission-Fusion Societies of Two Equid Species, the Onager and Grevy's Zebra. PLoS ONE, 10: e0138645.

Saltz, D.,Rubenstein D.I., White, G.C. 2006. The impact of increased environmental stochasticity due to climate change on the dynamics of Asiatic wild ass. Conservation Biology, 20(5): 1402-1409.

Schoenecker, K.A., King, S.R.B., Nordquist, M.K., Nandintsetseg, D., Cao, Q. 2016. Habitat and Diet of Equids. Pages 41-55 in: Ransom, J.I., and Kaczensky, P. (Eds). Wild Equids - Ecology, Management, and Conservation. Johns Hopkins University Press, Baltimore, USA.

Schook, M.W., Wildt, D.E., Weiss, R.B., Wolfe, B.A., Archibald, K.E., Pukazhenthi, B.S, 2013. Fundamental studies of the reproductive biology of the endangered persian onager (*Equus hemionus onager*) result in first wild equid offspring from artificial insemination. Biology of Reproduction, 89: 41.

Shah, J., Rinnerberger, N., Murisic, M., Srivastava, J., Levine, T.A., 2013. Kazakhstan - Overview of climate change activities. Washington DC ; World Bank Group http://documents.worldbank.org/curated/en/859941468040174046/Kazakhstan-Overview-of-climate-change-activities

Shmalenko, A. Salemgareyev, A. 2016. On the experience of satellite tagging wolves in Kazakhstan. Pages 273-275 in: International scientific and practical conference "Problems of biodiversity conservation in Kazakhstan and neighboring territories in wildlife and collections", dedicated to the 80th anniversary of the Biological Museum of Al-Farabi Kazakh National University - Almaty.

Sklyarenko, S.L., Zuther S., Shaimukhanbetov O.K., Salemgareyev A.R., Gromov A.B., Sidorova T.V. 2009. Provedeniye kompleksnovo obsledovaniya territorii k yugu ot planiruemovo Gosudarstvennovo prirodnovo reservata "Altyn Dala" [Conduction of a complex investigation of the territory south of the State nature reservat "Altyn Dala"]. Unpublished report, Association for the Conservation of Biodiversity of Kazakhstan.

Stephen, C. 2014. Toward a modernized definition of Wildlife health. Journal of Wildlife Disease, 50(3)**:** 427-430.

Sundaresan, S.R., Fischhoff, I.R., Dushoff, J., Rubenstein, D.I. 2007. Network metrics reveal differences in social organization between two fission-fusion species, Grevy's zebra and onager. Oecologia, 151; 140-149.

Swan, G.E. 1993. Drugs used for the immobilization, capture, and translocation of wild animals. Pages 2-64 in: The Capture and Care Manual (AA McKenzie, ed.). Pretoria: Wildlife Decision Support and the South African Veterinary Foundation.

Tabor, G.M. 2002. Defining Conservation Medicine. Pages 8-16 in: Aguirre, A.A. Ostfeld, R.S. Tabor, G. House C., Pearl M.C. (Eds). Conservation Medicine Ecological Health in Practice. Oxford University Press, New York, USA.

Tengelsen, L.A., Yamini, B., Mullaney, T.P., Bell, T.G., Render, J.A., Patterson, J.S., Steficek, B.A., Scott D. Fitzgerald, Kennedy, F.A., Slanker, M.R., Ramos-Vara, J.A., 1997. A 12-year retrospective study of equine abortion in Michigan. Journal of Veterinary Diagnostic Investigation, 9: 303-306.

Volf, J. 2010. Sixty years of kulan, *Equus hemionus kulan* (Groves et Mazák, 1967) breeding at Prague Zoo. Equus, 30-55.

Wagner, A.E., 2008. Complications in Equine Anesthesia. Veterinary Clinics: Equine Practice, 24: 735-752.

Walzer, C., 2014. Nondomestic Equids. Pages 719-728 in West, G. (Ed.) Zoo Animal and Wildlife Immobilization and Anesthesia. 2. Ed. Ames, Iowa, Wiley Blackwell.

Walzer, C., Baumgartner, R., Robert, N., Suchebaatar, Z., Bajalagmaa, N. 2000. Medical aspects in Przewalski horse (*Equus przewalskii*) reintroduction to the Dzungarian Gobi, Mongolia. Pages 7–21 in: Proc. American Association of Zoo Veterinarians. New Orleans, LA

Walzer, C., Kaczensky, P., Ganbataar, O., Lengger, J., Enkhsaikhan, N., Lkhagvasuren, D. 2006. Capture and anaesthesia of wild Mongolian equids - the Przewalski's horse (*E. ferrus przewalskii*) and the Khulan (*E. hemionus*). Mongolian Journal of Biological Sciences, 4: 19–28.

Wei, G., Xue-Feng, L., Yan, Y., Ying-Yuan, W., Ling-Li, D., Li-Ping, Z., Wen-Hua, X., Jian-Hua, Z. 2010. Equine influenza viruses isolated during outbreaks in China in 2007 and 2008. Veterinary Record, 167: 382-383.

World Organisation for Animal Health (OIE), International Union for Conservation of Nature (IUCN). 2014. Guidelines for Wildlife Disease Risk Analysis. OIE, Paris. Published in association with the IUCN and the Species Survival Commission. http://www.oie.int/wahis_2/public/wahid.php/Countryinformation/animalsituation

Xu, W., Xia, C., Yang, W., Blank, D., Qiao, J., Liu, W. 2012. Seasonal diet of Khulan (Equidae) in Northern Xinjiang, China. Italian Journal of Zoology, 79(1): 92–99.

Zhang, Y., Cao, Q.S., Rubenstein, D.I., Zang, S., Songer, M., Leimgruber, P., Chu, H., Cao, J., Li, K., Hu, D. 2015. Water Use Patterns of Sympatric Przewalski's Horse a and Khulan: Interspecific Comparison Reveals Niche Differences. PLoS ONE, 10: e0132094.

10 Appendices

10.1 Appendix 1: Plant community descriptions.

1. Dry steppes ecosystems (*Ecosystems of dry steppes on chestnut soils)*

Ecosystems of plateaux with xerophytic-forbs –- feather grass steppes on heavy sandy loam carbonate soils

1 A plateau with fallow lands and agricultural plantings on the place of xerophytic forbs – fescue — feather grass (*Stipa lessingiana*) steppes on heavy sandy loam carbonate soils

Slopes of plateau and low level plateaux with feather grass steppes and communities of calciphiles on heavy sandy loam carbonate soils with elements of solonetz

2 Slopes of plateau with grey sagebrush – feather grass (*Stipa lessingiana, Artemisia semiarida*), tansy – feather grass (*Stipa lessingiana, S. sareptana, Agropyron pectinatum, Leymus ramosus, Tanacetum achilleifolium*) and *Psathyrostachys juncea* communities on clay carbonate soils with elements of solonetz and heavy sandy loam soils

Ecosystems of steep dissected slopes to river valleys with complexes of communities on solonetz and fescue – feather grass steppes on soils with elements of solonetz

3 Steep dissected slopes to river valleys with dominance of black sagebrush (*Artemisia pauciflora*), *Anabasis salsa* and *Atriplex can*a) communities on solonetz and fescue communities on soils with elements of solonetz, locally in combination with outcrops of clays

2. Desert steppe ecosystems (*Ecosystems of sagebrush – bunch grass desert steppes on light chestnut soils)*

Ecosystems of slopes of plateaux and inclined plains with sagebrush – bunch grass steppes on sandy loam carbonate soils with underlying clays

4 Gentle slope of plateaux with grey sagebrush – feather grass (*Stipa lessingiana, Artemisia semiarida*) steppes on thin heavy sandy loam soils with nearby underlying clays

5 Dissected and washed out slopes of plateaux with groupings of plants (*Anabasis eriopoda, A. salsa, Artemisia semiarida, Artemisia pauciflora*) on weakly developed clay soils formed on eluvia of clays in combination with outcrops of clays

Ecosystem of plains with low ridges with sagebrush – feather grass steppes on light sandy loam soils

6 Gently inclined plains with relief of residual low ridges with sagebrush – feather grass (*Stipa sareptana, Artemisia semiarida, A. gracilescens*) steppes on loamy sand – light sandy loam soils with elements of solonetz in complex with grass – sagebrush (*Stipa sareptana, Artemisia gracilescens*), sometimes black sagebrush (*Artemisia pauciflora*) communities on solonetz

7 Weakly undulating plains with relief of residual low ridges with dominance of sagebrush – fescue (*Festuca valesiaca, Artemisia gracilescens*) steppes on sandy loam soils with strong influence of solonetz in complex with sagebrush (*Artemisia gracilescens*) communities on medium thickness solonetz and black sagebrush (*Artemisia pauciflora*) communities on small thickness solonetz of desert – steppe type in combination with spirea – feather grass (*Stipa capillata, Spiraea hypericifolia*) steppes on chesnut soils with elements of meadow soils in depressions.

8 Weakly undulating plains with dominance of sagebrush – fescue (*Festuca valesiaca, Artemisia gracilescen*s) steppes on sandy loam soils with strong influence of solonetz in complex with sagebrush (*Artemisia gracilescens*) communities on solonetz in combination with spirea (*Spiraea hypericifolia*) brushwood on meadow-chestnut soils in ravines

9 Elevated plains with relief of residual low ridges with complex of grass – grey sagebrush (*Artemisia semiarida, Stipa sareptana*) and sagebrush – grass (Artemisia semiarida, Stipa sareptana, Anabasis aphylla) communities on typical light sandy loam soils and light sandy loam soils with elements of solonetz

10 Weakly undulating plains with dominance of grass – grey sagebrush (*Artemisia semiarida, Stipa sareptana*) and sagebrush – feather grass (*Stipa sareptana, Artemisia semiarida*) communities on typical light sandy loam soils and light sandy loam soils with elements of solonetz in combination with spirea (*Spiraea hypericifolia*) brushwood on meadow-chestnut soils in depressions
11 Plains with relief consisting of ridges and low ridges with complexes of grass – sagebrush (*Artemisia semiarida, Stipa sareptana*) and sagebrush – grass (*Artemisia semiarida, Stipa sareptana, Anabasis aphylla*) communities on typical light sandy loam soils and light sandy loam soils with elements of solonetz in combination with lacustrine meadow vegetation on meadow soils in depressions among the hills
12 Plains with undulating relief of residual low ridges with grass – sagebrush (*Artemisia semiarida, Stipa sareptana*), sagebrush – grass (*Stipa sareptana, Artemisia semiarida*) communities on typical light sandy loam soils in complex with *Nanophyton erinaceum – Anabasis salsa* – black sagebrush (*Artemisia pauciflora*) communities on solonetz
13 Plains with undulating relief of residual low ridges with grass – sagebrush (*Artemisia semiarida, Stipa sareptana*) and sagebrush – grass (*Stipa sareptana, Artemisia semiarida*) communities on typical light sandy loam soils in complex with Nanophyton erinaceum – Anabasis salsa – black sagebrush (Artemisia pauciflora) on solonetz in combination with communities of *Atriplex cana* on meadow – steppe solonetz in depressions

Ecosystems of plains with low ridges and small ravines with sagebrush – grass steppes on loamy sand soils

14 Plains with relief of elongated residual low ridges with sagebrush – grass (*Koeleria cristata, Festuca valesiaca, Stipa sareptana, Artemisia semiarida, A. lerchiana*) steppes on typical loamy sand soils in combination with couch grass (*Elytrigia repens*) meadows on estuary-meadow saline soils in depressions and meadows on meadow soils around the lakes
15 Undulating plains with relief of flattened low ridges with sagebrush – grass (Koeleria cristata, Festuca valesiaca, Stipa sareptana, Agropyron fragile, Artemisia semiarida, A. lerchiana) steppes on loamy sand soils with small influence of solonetz in complex with grass – sagebrush (*Artemisia gracilescens, A. pauciflora*) communities on solonetz in combination with feather grass – spirea (*Spiraea hypericifolia, Stipa capillata*) on meadow-chestnut soils and, locally, with couch grass (*Elytrigia repens*) communities in depressions on estuary-meadow soils and meadows on meadow saline soils of lake hollows
16 Weakly undulating plains with relief of residual low ridges with sagebrush – grass (*Koeleria cristata, Festuca valesiaca, Stipa sareptana, Artemisia semiarida, A. lerchiana*) steppes on loamy sand soils, locally in complex with grass – sagebrush (*Artemisia gracilescens, A. pauc*iflora) communities on light chestnut soils with small influence of solonetz.

Ecosystems of undulating plains with sagebrush – feather grass steppes on loamy sand soils

17 Undulating plains with sagebrush – feather grass (*Stipa capillata, Stipa lessingiana, Festuca valesiaca, Artemisia marschalliana, Artemisia austriaca*) steppes on loamy sand soils
18 Undulating plains with sagebrush – feather grass (*Stipa capillata, Stipa lessingiana, Festuca valesiaca, Artemisia marschalliana, Artemisia austriaca*) steppes on loamy sand soils in combination with couch grass meadows on estuary-meadow soils and brushwood in depressions on meadow-chestnut soils.

Ecosystems of undulating plains with Siberian wheat grass – sandy feather grass and psammophytic-sagebrush – grass steppes on sandy soils

19 Undulating plains with psammophytic-forbs – sagebrush – grass (*Agropyron sibiricum, Stipa pennata, Koeleria gracilis, Artemisia marschalliana, Potentilla glaucescens, Helichryzum arenarium*) steppes on typical dusty – sandy soils
20 Undulating plains with psammophytic-forbs – sagebrush – grass (*Stipa pennata, Agropyron fragile, Artemisia marschalliana, Herbae psammophytica*) communities on dusty – sandy soils in combination with spirea (Spiraea hypericifolia) brushwood on meadow-chestnut soils in depressions

Ecosystems of sands with hills and ridges, with sandy feather grass steppes and psammophytic-sagebrush and psammophytic-grass communities on sandy soils

21 Sands with low hills and low ridges, with Siberian wheat grass – sandy feather grass (*Stipa pennata, Agropyron fragile*), sagebrush – grass (*Festuca beckeri, Agropyron fragile, Artemisia lerchiana, Artemisia arenaria*) steppes on sandy soils, locally with great anthropogenic transformation

22 Hilly and honeycomb sands with dominance of Siberian wheat grass – sagebrush (*Artemisia marschalliana, A. arenaria, Agropyron sibiricum, Jurinea cyanoides, Achillea micrantha*), Siberian wheat grass (*Agropyron sibiricum*) and wild rye (*Elymus giganteus*) communities at the tops and slopes of hills, and also wheat grass – sandy feather grass (*Stipa pennata, Agropyron fragile*) communities in depressions, locally in combination with reed grass (*Phragmites communis*) and groups of willow (*Salix caspica*) and oleaster (*Elaeagnus angustifolia*) on meadow-chestnut and meadow soils in depressions among the hills

3. Desert ecosystems (*Ecosystems of northern grass – dwarf semi shrub deserts on brown soils)*

Ecosystems of plateaux and elevated plains with grass – sagebrush deserts on sandy loam soils with elements of solonetz

23 Weakly undulating plains with feather grass – grey sagebrush (*Artemisia semiarida, Stipa sareptana, Poa bulbosa*) and blue grass – grey sagebrush (*Artemisia semiarida, Poa bulbosa, Stipa sareptana*) deserts, locally with *Anabasis aphylla* on sandy loam soils with elements of solonetz

24 Same vegetation in combination with couch grass (*Elytrigia repens*) meadows on estuary-meadow soils in depressions

25 Plains with dominance of complex of blue grass – feather grass – grey sagebrush (*Artemisia semiarida, Poa bulbosa, Stipa sareptana*) deserts on sandy loam soils with elements of solonetz with black sagebrush, black sagebrush (*Artemisia pauciflora*) – *Anabasis salsa* communities on solonetz

Ecosystems of plateaux and elevated plains with feather grass – sagebrush deserts on light sandy loam soils

26 Weakly undulating plains with dominance of grass – sagebrush (*Artemisia semiarida, Stipa sareptana*) deserts on typical loamy sand – light sandy loam soils, locally with in combination with spirea (*Spiraea hypericifolia*) brushwood on meadow – brown soils in depressions

Ecosystems of plateaux and plains with *Anabasis salsa* deserts

27 Plateaux and plains with complex of Anabasis salsa and black sagebrush (*Artemisia pauciflora*) communities on solonetz with grass – grey sagebrush (*A. semiarida, Stipa sareptana, Poa bulbosa*) deserts on sandy loam soils with elements of solonetz

28 Plateaux with dominance of Anabasis salsa, black sagebrush (*Artemisia pauciflora*), *Atriplex cana*, annual saltwort – *Anabasis aphylla* (species of genera Climacoptera and Petrosimonia) communities on solonetz, locally in complex with grass – sagebrush (*Artemisia semiarida, Stipa sareptana*) communities on heavy sandy loam soils with elements of solonetz

Ecosystems of thin and small hilly sands with sandy wheat grass – sagebrush black saxaul deserts

29 Flat plains with thin aeolian drift and small hilly sands with sandy wheat grass – sagebrush – black saxaul (*Haloxylon aphyllum, Artemisia terrae-albae, Agropyron fragile, Stipa sareptana, Poa bulbosa*) deserts

Ecosystems of hilly sands with sandy wheat grass – psammophytic sagebrush deserts

30 Hilly-hollow sands with psammophytic forbs – sagebrush – sandy feather grass – sandy wheat grass (*Agropyron fragile, Stipa pennata, Artemisia arenaria, Artemisia tomentella, Herbae psammophytica*) communities and psammophytic-forbs – sagebrush – sandy feather grass (*Stipa pennata, Herbae psammophytica*) steppes

31 Hilly-hollow sands with *Calligonum aphyllum* – sandy wheat grass – sagebrush (*Artemisia arenaria, Agropyron fragile*), sagebrush – sandy wheat grass (*Agropyron fragile, Artemisia arenaria*) communities with *Calligonum aphyllum*, locally in combination with thickets of reed grass and poplar groves on meadow soils in hollows

32 Hilly-holllow sands with *Calligonum aphyllum* – sandy wheat grass – sagebrush (*Artemisia arenaria, Agropyron fragile*), sagebrush – sandy wheat grass (*Agropyron fragile, Artemisia*

arenaria) communities with *Calligonum aphyll*um on the slopes and groups of psammophytes (*Asperula danilevskiana, Elymus giganteus*) on the tops in combination with willow (*Salix caspica*), oleaster (*Elaeagnus oxycarpa*) and thickets of reed grass (*Phragmites communis*) on meadow soils, also with spirea (*Spiraea hypericifolia*) brushwood on meadow – brown soils in hollows

33 Hilly-hollow sands with psammophytic-forbs – sagebrush – sandy feather grass – sandy wheat grass (*Agropyron fragile, Stipa pennata, Artemisia arenaria, Artemisia tomentella, Herbae psammophytica*) communities with reed grass (*Phragmites australis*), grass – sagebrush (*Artemisia arenaria, Agropyron fragile*) communities with *Calligonum aphyllum* in combination with reed grass (*Phragmites australis*), wood-reed grass (Calamagrostis epigeios), reed grass – *Achnatherum splendens* meadows on meadow soils , and also groves of willow (*Salix caspica*) and oleaster (*Elaeagnus oxycarpa*) in hollows

Ecosystems of hilly sands and sands with hills and ridges with psammophytic-brushwood deserts

34 Hilly sands with *Calligonum pterococcus* (*Kochia prostrata, Ceratoides papposa, Artemisia terrae-albae, Agropyron fragile*) and psammophytic-brushwood (*Calligonim pterococcus, Haloxylon persicum, Astragalus paucijugus, A. ammodendron, Ceratoides papposa, Artemisia terrae-albae*) deserts

4. Halophytic ecosystems ***(Ecosystems of low plains, depressions, hollows and its slopes with dominance of halophytic sagebrush, halophytic perennial saltwort and succulent saltwort vegetation)***

Ecosystems of flat, weakly undulating and gently inclined plains with dominance of complexes of black sagebrush communities on solonetz

35 Weakly undulating, almost flat plains, with dominance of complexes of black sagebrush (*Artemisia pauciflora*) communities on solonetz, fescue (*Festuca vale*siaca) and feather grass (*Stipa sareptana*) steppes on sandy loam soils with strong influence of solonetz

36 Flat plains with dominance of complexes of black sagebrush (*Artemisia pauciflora*) and black sagebrush – *Atriplex cana* communities on solonetz

37 Flat plains with black sagebrush (*Artemisia pauciflora*), sagebrush (*Artemisia schrenkiana*) and black sagebrush – *Atriplex cana* communities on solonetz, locally in combination with meadows on meadow and meadow saline soils in lacustrine depressions

38 Flat plains with dominance of complex of Anabasis salsa – black sagebrush (*Artemisia pauciflora*) communities on solonetz, with black sagebrush – *Atriplex cana* on solonetz with elements of solonchak

Ecosystems of flat and gently inclined plains with dominance of *Atriplex cana* communities on solonetz with elements of solonchak

39 Flat plains with dominance of complexes of black sagebrush (*Artemisia pauciflora*) – *Atriplex cana* communities on solonetz with elements of solonchak and sagebrush (*Artemisia pauciflora, A. schrenkiana*) communities on solonetz, locally in combination with bunch grass and shrub communities with spirea on meadow-chestnut soils in depressions

40 Flat plains with *Anabasis sa*lsa – black sagebrush (*Artemisia pauciflora*) – *Atriplex cana* communities on solonetz with elements of solonchak in complex with Anabasis salsa communities on solonetz

41 Low plains and hollows with dominance of *Suaeda physophora* – *Atriplex ca*na (with participation of *Limonium suffruticosum*) communities on solonetz – solonchak and juicy saltwort (*Halocnemum strobilaceum, Kalidium foliatum*) communities on solonchak

Flat plains with dominance of *Anabasis sal*sa communities on heavy sandy loam solonetz – solonchak

42 Flat plains of hollows' bottoms with dominance of sparse *Anabasis salsa* communities on solonetz – solonchak

43 Same vegetation in combination with juicy saltwort (*Halocnemum strobilaceum, Kalidium foliatum*) communities on solonchak

Ecosystems of eroded slopes of plateaux and hollows with outcrops of clays, and also outcrops of clays on plains with halophytic perennial saltwort communities

44 Erosional-dissected slope of plateau to lacustrine depressions with fragments of *Anabasis salsa* communities, *Atriplex cana, Anabasis truncata* and sagebrush (*Artemisia pauciflora, A. schrenkiana*) communities on solonetz in combination with outcrops of saline clays
45 Slopes to river valleys with dominance of *Anabasis salsa* – black sagebrush (*Artemisia pauciflora*), *Anabasis salsa, Atriplex cana* communities on solonetz in combination with meadows on meadow soils and outcrops of clays
46 High steep erosional-dissected slopes of depressions with outcrops of clays with isolated plants of *Anabasis truncata* and sparse groups of *Anabasis salsa, Nanophyton erinaceum, Atriplex cana* and black sagebrush (*Artemisia pauciflora*), and also with shrubs in ravines (*Spiraea hypericifolia, Athraphaxis frutescens*)

Ecosystems of depressions, hollows and ancient valleys of spillway with halophytic juicy saltwort communities on solonchak

47 Low plains, depressions and hollows with annual saltwort (*Salicornia europaea, Suaeda acuminata, Petrosimonia triandra*), annual saltwort – *Halocnemum strobilaceum* (*Suaeda physophora, Climacoptera crassa, C. brachiata, Suaeda acuminata*), *Halimione verrucifera, Kalidium* sp. (*Kalidium caspicum, K. foliatum*) communities on typical solonchak, also sagebrush (*Artemisia scopiformis*) and Atriplex cana deserts on solonetz with elements of solonchak
48 Depressions with “sor” (solonchak without vegetation)

5. Rivers & Lakes *(Ecosystems of river valleys and lacustrine (lake) depressions with meadow, swampy, brushwood and woody vegetation)*

Ecosystems of river valleys with meadow, swampy, brushwood and woody vegetation

49 River valleys with willow (*Salix viminalis, Salix triandra, S. acutifolia, S. dasyclados, Lonicera tatarica*) communities on alluvial-meadow soils , rush – spike rush (*Eleocharis acicularis, E. palustris, Juncus gerardii, Triglochin palustris, Halerpestes salsuginosa*), reed grass (*Phragmites communis*), reed mace (*Typha latifolia*), bulbous bulrush (*Bolboschoenus maritimus*) thickets on meadow-swampy soils, liquorice – couch grass (*Elytrigia repens, Glycyrrhiza aspera*) meadows on meadow soils and halophytic grass (*Puccinellia tenuissima, P. distans, Hordeum brevisubulatum*) communities on meadow saline soils (Turgai, Sary-Turgai, Kara-Turgai rivers)
50 River valleys with fragments of willow (*Salix triandra, S. acutifolia, S. dasyclados*) communities on alluvial-meadow soils, reed grass (*Phragmites communis*), reed mace (*Typha latifolia*), bulbous bulrush (*Bolboschoenus maritimus*) riparian thickets on meadow-swampy soils , couch grass (*Elytrigia repens*), brome grass (*Zerna inermis*), wild rye (*Leymus angustus*) meadows on meadow soils and *Aeluropus littoralis* meadows on meadow saline soils (Uly-Zhilanchik, Ulkayak rivers)
51 River valleys with plots of reed grass (*Phragmites australis*) communities on meadow-swampy soils, couch grass (*Elytrigia repens*), brome grass (*Zerna inermis*), wild rye (*Leymus angustus*) meadows on meadow soils, locally in combination with spirea brushwood on meadow-chestnut soils (upper riches of Sary-Turgai and Uly-Zhilanchik rivers)
52 River valleys with reed grass (*Phragmites australis*), rush – bulbous bulrush (*Bolboschoenus maritimus, B. popovii, Juncus soranthus, J. jaxarticus*) swampy meadows on meadow-swampy and swampy-meadow soils, *Aeluropus littoralis* meadows and brushwood (*Tamarix ramosissima, Salix triandra*) on meadow saline soils (Irgiz and Turgai rivers)

Ecosystems of flooded lands of river valleys with long-flooded vegetation (“plavni”) and lakes with swamps and meadows

53 Lands near rivers with swamps and meadows with dominance of reed grass (*Phragmites australis*), bulrush – reed grass (*Phragmites australis, Scirpus lacustris*), spike rush – couch grass (*Elytrigia repens, Eleocharis*) communities on swampy soils, spike rush (*Eleocharis sp.*) – *Aeluropus litoralis*, rush (*Juncus gerardii*) – *Aeluropus litoralis* communities on meadow –swampy soils and couch grass (*Elytrigia repens*) on meadow soils

Ecosystems of lake hollows and depressions with meadows, swamps and brushwood

54 Plains near lakes with couch grass (*Elytrigia repens*) meadows on estuary-meadow soils and sagebrush – couch grass (*Elytrigia repens, Artemisia nitrosa*) on meadow solonetz

55 Depressions with sagebrush – wild rye (*Leymus ramosus, Artemisia nitrosa*) meadows on meadow saline soils, wild rye – sagebrush (Artemisia nitrosa, Leymus ramosus), communities on meadow solonetz and in combination with fragments of couch grass (Elytrigia repens) meadows on meadow soils

10.2 Appendix 2: CMS letter of support.

UN environment
United Nations Environment Programme

Convention on the Conservation of Migratory Species of Wild Animals

CMS

CMS COP12 MANILA-PHILIPPINES 23-28 OCTOBER 2017

To Whom it May Concern

03 April 2017

Subject : CMS Support to the Project "Kulan (*Equus hemionus kulan*) Reintroduction into the Central Steppe of Kazakhstan"

Dear Sir or Madam,

I am writing to you on behalf of the Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (UNEP/CMS) to express my strong support for the project proposal "Kulan (*Equus hemionus kulan*) reintroduction into the central steppe of Kazakhstan" led by the Norwegian Institute for Nature Research (NINA) and the Association for the Conservation of Biodiversity of Kazakhstan (ACBK).

The UNEP/CMS Secretariat welcomes this project as an important contribution to the implementation of the CMS Central Asian Mammals Initiative (CAMI) and its associated Programme of Work. It specifically calls for implementing various conservation actions related to Kulan, which is listed on Appendix II of the Convention. This project fits well into the Altyn-Dala Conservation Initiative which has already led to an expansion of the protected areas network in Kazakhstan since 2006, benefitting also the Torgai steppe, the target area of this reintroduction project.

NINA and ACBK both have an impressive track record in achieving conservation impact on the ground. They are experienced, professional and very competent partners. Their comprehensive feasibility study explains the different steps and analyses possible risks and challenges. CMS strongly encourages concrete conservation action on the ground, especially when there is such profound scientific analysis and competence supporting it.

The Kulan faces various challenges. Once a key species in the assemblage of large herbivores that ranged the Eurasian steppes, it got overhunted and disappeared from the Kazakh steppes already in the 1930ies. This project will be a crucial step to rehabilitate Kulan in Kazakhstan in its original habitat and act as a catalyst for improving the overall status of the species.

I would therefore highly appreciate your positive evaluation of the proposal, which will make a vital contribution to the conservation of the endangered Kulan in Central Asia as well as to the conservation and restoration of the vulnerable steppe ecosystems in general.

Yours sincerely,

Bert Lenten
Deputy Executive Secretary

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10.3 Appendix 2: Equid Specialist Group letter of support.

IUCN/SSC
EQUID
SPECIALIST
GROUP

18 May 2017

Re: Support of the project "Kulan (*Equus hemionus kulan*) reintroduction to the central steppe of Kazakhstan"

To Whom It May Concern:

We are writing in support of the project proposed by the Norwegian Institute for Nature Research (NINA), the Association for the Conservation of Biodiversity of Kazakhstan (ACBK) and their partners to reintroduce kulan (*Equus hemionus kulan*) to the central steppes of Kazakhstan.

Asiatic wild ass (*E. hemionus*) once roamed throughout the Eurasian steppes, but over the millennia their range has been reduced and their populations fragmented as agriculture and livestock have taken over the steppes. One subspecies of Asiatic wild ass has already become extinct, and another (the onager in Iran) is Critically Endangered. The kulan subspecies is considered Endangered by the IUCN as fewer than 2,500 mature individuals remain and the population continues to decline. Currently around 75% of this subspecies is found in only one area, Altyn Emyl, making it vulnerable to stochastic events.

The reintroduction of the kulan to another area in Kazakhstan therefore represents an important conservation action for the species. Creating another population not only expands their range, but also provides another population in case of a sudden catastrophe affecting the kulan at Altyn Emyl.

The team leading this reintroduction effort has a great deal of experience in conserving and managing endangered wild equids in central Asia. Their experience with another subspecies of Asiatic wild ass, the khulan, in Mongolia puts them in a strong position to carry out this reintroduction. We therefore trust that this proposal will be positively evaluated, as it represents an important step in the recovery of Asiatic wild ass and their habitat, and has the potential to inform future reintroduction efforts.

Yours sincerely,

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NINA Report

The Norwegian Institute for Nature Research (NINA) is Norway's leading institution for applied ecological research.

NINA is responsible for long-term strategic research and commissioned applied research to facilitate the implementation of international conventions, decision-support systems and management tools, as well as to enhance public awareness and promote conflict resolution.

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