

Przewalski's horses on the track to reintroduction - various projects compared -

The Przewalski's horse is the best example in demonstrating the rescue of a species which would not have survived without the intervention of zoological gardens. Numerous TV documentations exist: wild horses are loaded in crates or lorries and are transported – accompanied by an operatic aria – to a reserve in Europe or fly at sunset to their new home in Asia. At their destination, the crates or lorry are opened and the horses jump out and gallop “happily” to freedom. The commentary is often poetic and doesn't interpret the behaviour of the horses correctly. This is not meant to criticize zoos or the organisations responsible for such a project, but rather the filmmakers who try to touch the TV spectators emotionally instead of fascinating them with the more accurate and often exciting facts. The TV station considers the topic covered, a sequel is not produced and consequently the spectators often get to know only the beginning of a story. Whether it ends in success or in tragedy, they never learn to know. There are only a handful of films that document not only the history and the transport, but also the difficult adaptation period of the horses to their new habitat, a habitat often occupied by people for a long time.

The intention of this article is give a more detailed account of the development of the various conservation projects of Przewalski's horses in Europe, the release projects in Asia and the true re-introduction projects in their historic range in Mongolia and China.

There exist numerous semi-reserves where Przewalski's horses still reside. Sometimes these are former military bases or also those which are still in use. If the last is true they are not open to the public. Other enclosures are situated in recreation zones, e.g. the Schorfheide in Brandenburg, the Tennenlohe Forest in Bavaria the nature park Lelystad in Holland or the Nationalpark Neusiedler See in Austria. Characteristic for these semi-reserves is that they have only a few horses, mostly just one group. As the survival of the Przewalski horse started with such an enclosure, a closer look into the past is required.

Semi-Reserves

In West-Europe (fig. 2), the first reserves were created by the Dutch couple Jan and Inge Bouman, who wanted to realize a dream with the help of a foundation. They wanted to buy Przewalski's horses from zoos, to breed them and then release the semi-wild offspring into Mongolia. This article will show that they were the first who succeeded in this and it will also show which small role the Cologne Zoo played in it.

Fig. 3 shows the stallion Apoll when he arrived in the semi reserve Lelystad (32 ha) in the Northwest of Holland. He was a donation from the Cologne Zoo to the Foundation Reserve Przewalski Horse (FRPH). He successfully fulfilled his task in producing offspring for Mongolai: 17 of his 37 sons and daughters were released in the Hustai National Park (see below), four of them are still alive. Apoll is the ancestor of 45 offspring of 3 generations.

The semi-reserves of Noorderheide (250 ha near Arnhem/NL), Sprakel (68 ha near Emmen/D), Goudplaat (40 ha near Rotterdam/NL) and De Ooij (22 ha near Nijmegen/NL);

fig. 4) were also created by the Dutch foundation with the goal of resettlement in Mongolia in sight. Some of them even became home for colts and stallions only. This was a new and courageous step, as at that time it was unknown how Przewalski's horse stallions would interact with each other. Once again, Cologne Zoo then played a part in history: Askan, a brother of Apoll, grew up in a colt group before he became the harem stallion in the European bison park of Springe (D). A comprehensive article about the keeping of colts and stallions was issued in the 'Zeitschrift des Kölner Zoo (Kolter & Zimmermann 2001)'.

After the Dutch-Mongolian project in Hustai NP was successfully re-established so that it is independent of imports from Europe, the foundation decided to either give up the semi-reserves or to transfer them to other partners. Today Lelystad belongs to the city of the same name and Sprakel – situated in Germany – was kindly offered and symbolically sold to the EEPP (European breeding programme of Przewalski's horses) for 1 €. With the take-over, the management also changed.

The EEPP initially had a slightly different situation compared to the FRPH. Although it had many advantages with regards to choosing semi-wild born horses for a reintroduction project, it had one important disadvantage, which is obvious from the above mentioned numbers: many closely blood-related animals from the same families instead of less related animals from different locations build the founder population. However, at the reintroduction site it was hoped that the Przewalski's horses would be able to adapt to new and difficult circumstances and therefore their gene pool would have an increasing and greater variability.

“A semi-reserve is an enclosure with natural vegetation, where, dependent on the biomass, a certain amount of herbivores can be kept over the year without getting additional food.” This simple definition does not reflect how important semi-reserves are for the EEPP. They are not only additional keeping and breeding places, but areas where observations under 'almost natural' conditions can be made. Numerous papers for bachelor, master or PhD degrees have already been made here. Additionally, more and more nature reserves use horses and cattle for grazing and stopping the growth of bushes and trees to keep the landscape open. Such an extensive management also allows the preservation of the biological diversity of flora and fauna and sometimes even new little biotopes are found where new plant and animal species find a home. The next overview reflects on other European semi-reserves.

Eelmoor Marsh – U.K.

This area of only 66 ha is classified as “Site of Special Scientific Interest” (SSSI). It is situated in the South of England and is part of the military airport of Farnborough. Heath, moor-land and marsh alternate with each other and are biotopes with an interesting plant and animal kingdom. e.g. the Red Data book Nail fungus *Poronia punctata* appeared at Eelmoor Marsh following introduction of the horses. It is a fungus associated with rotting horse dung on acidic grasslands. Eelmoor Marsh is one of only two places in Britain where it is known to occur outside of the New Forest. Various orchids such as the Early marsh orchid (*Dactylorhiza incarnata* ssp. *pulcella*, fig. 5) and the Marsh helleborine (*Epipactis palustris*, fig. 6) have profited from the horses grazing as has the Long-leaved sundew (*Drosera intermedia*, fig. 7). For obvious reasons a great variety of insects are found living in this landscape: The Cuckoo wasp (*Chrysis fulgida*, fig. 8) is a Red Data Book species that is only known to be found at five locations in Britain. It lays its eggs in the chamber of a rare potter wasp, which in turn feeds on a beetle which in turn feeds on low growing willow. The growth form of the willow appears to be influenced by the browsing impacts of horses and cattle. The **Silver-studded blue (*Plebejus argus*) and the common name? (*Ceragriion telellum*)** are seen flying here too. From the bird watchers point of view, the breeding pairs of Wood lark

(*Lullula arborea*, fig. 15), European nightjar (*Caprimulgus europaeus*) and Dartford warbler (*Sylvia undata*) are of special interest.

For the EPPP and the English zoos, Eelmoor Marsh serves as interim station for young Przewalski's colts, who have to leave their maternal group at an age of 1 to 2 years. In a bachelor group they learn how to fight and how to behave in a social system. Only when they are 5 to 7 years old are they sent to other zoos, where they are coupled with mares for mating. In such reserves, students study not only the behaviour of the stallions, but also their influence on the ecosystem.

Cloacaenog Forest – U.K.

Cloacaenog Forest is classified as "Site of Ancient Interest" too and is situated in the North of Wales. As the title suggests it became famous for its prehistoric settlement in the Neolithic/Iron Age. An intriguing possibility is that in those times Neolithic people tried to domesticate horses in these enclosures or at least kept them for meat.

In the beginning, only 6 ha were fenced by the Forestry Commission Wales and 3 Przewalski mares from the zoo of Colwyn Bay were transported to the site (fig. 10). The successful resettlement and the interest shown by tourists led to the decision to send more animals to this place. Although the horses are no longer used for breeding, they still play an important role in the preservation of natural and cultural heritage in Cloacaenog Forest. **As the remains of the structures are apparent when the sward is short, grazing by large herbivores is the preferred approach. (what structures?)**

Cloacaenog Forest is also known as an interesting site for native animals, especially for rare bird species, namely the Butcher bird (*Lanius excubitor*), Black grouse (*Lyrurus tetrix*) and Red crossbill (*Loxia curvirostra*). With the extensive grazing by large herbivores, the forestry also expects an increase of indigenous plant and animal species in the future.

Sprakel – Germany

The semi-reserve Sprakel is situated in the region of the river Ems and is 68 ha large. Like Eelmoor Marsh it too is suitable for keeping stallions. Przewalski's horse stallions can become very aggressive when they are 5 years and older. Thus they can only be successfully kept in bushy or tree-dense areas providing lots of coverage. Another complication is the fact that the group composition can change from time to time i.e. when stallions are taken away for breeding, and others join the group, so that only new fights can clarify the rank positions. Catching the stallions with the use of a blow pipe gun for veterinarian reasons also proves difficult as they often become wild again and not used to human contact. Thus a domestic pony mare is used for teasing. When the stallions are distracted by her, they ignore the vet who uses the possibility to shoot the file with the immobilisation drug. There is however no guarantee on where the stallion will finally fall down. As this can happen on the marshy ground, a tractor must be readily available to carry the horse to the trailer (fig. 11). This year we brought the stallion Erich from Sprakel to Cologne Zoo, to continue breeding after a 4 years pause. Erich was born in Stuttgart Zoo, but grew up for a period of 4 years in the reserve. Although he had hardly any human contact in the past, he easily adapted again to zoo conditions. Two other stallions from this area were shipped to China this year (see below).

Interestingly, stallions of the highly threatened Onager (*Equus hemionus* Onager) also lived here for some years. Although Onager are much smaller, they are a match for the Przewalski's horses as they are faster and more aggressive (fig. 12).

Tennenlohe Forest - Germany

The Tennenlohe Forest was the military camp of the Americans. It is a sandy biotope of high ecological importance near the city of Erlangen (fig. 14). About 300 animal and plant species, which occur here, are listed in the Red Data Book. Alternating areas of heath (*Calluna spec.*) and broom (*Cytisus scoparius*), wet depressions with sun dew (*Drosera rotundifolia*, fig. 7) and sandy places with silver grass (*Corynephorus canescens*) occur here. With the removal of the heavy tanks and other military machines, these biotopes were threatened by overgrowth of other plants. Thus, 53 ha were fenced and since 2003, Przewalski's horse stallions originating from Munich and Nuernberg, keep the land open (fig. 13). In these fenced area European nightjars (*Caprimulgus europaeus*) and Wood larks (*Lullula arborea*) are found breeding (fig. 15), as they are safe against disturbances from humans or dogs.

Schorfheide – Germany

In 1991, shortly after the fall of the Berlin wall, a grazing area of 36 ha was fenced in the biosphere reserve Schorfheide-Chorin near Liebenthal. Here however, in contrast to the three previous semi-reserves, only Przewalski's horse mares were introduced. As there are no stallions, no unwanted inbreeding can occur and the dangerous possibility of attacks by stallions on their young, are avoided. For the EEPP such single sex groups have the advantage that the development of the total population can be slowed down. In other words, the mares are prevented from breeding for several years, to retard the coming up of the next generation. If all zoos would breed every year we would not find enough places for the offspring. Therefore the species commission determines every year where breeding is allowed and where not. This explains the groups with or without a stallion and accordingly with or without foals in the zoos.

From the beginning, research was carried out by the Institute of Zoo and Wildlife Biology (IZW) and by the Free University of Berlin. Several papers were published and more knowledge was gained. Some animals wear radio collars which protocol their activity and diurnal rhythm throughout the year (fig. 16). For instance, with the help of a microchip, a horse can be identified at the drinking bowl and the daily water consumption measured (fig. 17). Similarly the factors determining the growth of the hoof-horn can be identified (fig. 18). Each single new fact is important in learning more about Przewalski's horses. This would not obviously have been previously possible in their original environment as extinction would have happened. In 1991, the ownership of the pastures came into question and consequently the land was handed over to its legitimate private owner. In agreement, the genetically important mares were exchanged with surplus mares and research is still carried out here by the scientists of the IZW.

Neusiedler See – Austria

In 1999, within the National park Neusiedler See, 300 ha on the shores of the lake were fenced with the lake forming the fourth natural border. The Przewalski' horse mares all originated from the Zoo Schönbrunn (Vienna) and the stallion Dino came from the wild animal park Langenberg in Switzerland. Here the Przewalski's horses were also introduced to preserve the landscape, especially the salt meadows near the shore, which faced overgrowth by the reed (fig. 19). But this was not their only task. These horses were chosen to disclose secrets to the scientists of the Institute of Wildlife and Ecology of the University of Vienna. In this reserve quite interesting results were obtained. All animals of the Palaearctic in Eurasia

and North America are known to adapt to extreme temperatures within a year. e.g. in the Jungarian Gobi, the Przewalski's horses are known to cope well with temperatures between -40°C and 40°C! The question however was, how are Przewalski's horses able to survive the long and very cold winters, when food too is sparse or difficult to find underneath a snow cover. Some horses in the reserve at the lake Neusiedel received an implant, which could measure heart rate and the subcutaneous temperature. The telemetric system, which consisted of radio collars (registration of the activity) and a receiver station, monitored data of 7 Przewalski's horses over 546 days (May 2002 to November 2003). The summary of the results is as follows: between November and March the horses not only reduce their heart rate, but also decrease their subcutaneous temperature down to 15°C. Thus their energy budget is well controlled as the lower the body temperature is underneath the skin, the less the heat is transmitted to the air during winter. Altogether the results give information about the activity of the horses during all seasons in adaptation to the various environmental influences.

Hortobágy – Hungary

This project is known to the subscribers of the 'Zoozeitung' since 1999. Next year (2006) the annual report will be left out, so as not to fatigue the zoo friends. Instead we will write a summary of two years in volume 1 of 2007.

This area named Pentezug, where Przewalski's horses graze, is 2.400 ha large and thus the biggest semi-reserve in Europe. It belongs to the core zone of the Hortobágy National park, which the UNESCO classified as a world heritage site in 1999. With the help of the large herbivores, the native and partly endemic plant and animal species are protected in an area which is of special ecological value. e.g. the highly threatened Great bustard (fig. 39) was about to stop breeding here, as this bird was too disturbed by herders and their guarding dogs. For bird watchers, this national park is an ideal location: 337 bird species were sighted here in the last 25 years. Ruffs (*Philomachus pugnax*) and Dotterels (*Eudrominas morinellus*), brood birds of the tundra, make stopovers here as do between here 40 000 to 60 000 European cranes (*Grus grus*). Numerous birds of prey, e.g. the Red-footed falcon (*Falco vespertinus*); Long-legged (*Buteo rufinus*) and Ruff-legged buzzard (*B. lagopus*); all three Harriers (*Circus cyaneus*, *C. aeruginosus*, *C. macrourus*) and even the Imperial eagle (*Aquila heliaca*), hunt here for insects, mice and ground squirrels. Fish ponds - in total 5000 ha large - attract many ducks, geese, herons and egrets and in the swamps and marshes, the grass snake is seen catching frogs (fig. 20).

From 1997 to 2001 **5,1** Przewalski's horses were released in this reserve (fig. 21.). Today 67 horses live here in 7 harems and 1 bachelor group and in this year alone, 17 foals were born. The mare Ashnai from Cologne zoo is the most "successful" horse until now: in 7 years she has given birth to 7 foals, all of which survived. One of her sons has also already become a successful harem stallion. Besides the Przewalaski's horses 47 Aurochs also graze here. The reconstruction of the extinct Aurochs was started about 1920 by the brothers Lutz and Heinz Heck, zoo directors in Berlin and Munich and the project was named after them. In Pentezug these reconstruction attempts are continued. The phenotype of the Heck cattle of today very closely resembles that of the ur (*Bos Taurus*). However the shape and the thickness of the horns as well as the body size has only been achieved in a few individuals. Therefore the breeding policy of the ABU in Soest was adopted and Heck cattle were cross-bred with other big cattle like the Sayaguesa and Chianina breeds, which stand 1.90 m high at the withers. Some hybrids of watussi and grey cattle were also used, because of their thick horns. Unfortunately all of these breeds also inherit unwanted traits, like an aberrant colour or horn

form. Therefore more time and intensive selection will be needed before the goal is reached. (fig. 22).

Numerous studies accompany this project. Pentezug has a big advantage in size as it offers the herbivores abundant food, which in turn allows a high population density. Important knowledge about the social behaviour of the Przewalski's horses and their population dynamics can be gained here. It was a surprise for us, that the stallions, known to be very aggressive, learnt to estimate the strength of each other. This allows them to graze with their harems in close vicinity to each other, abstaining from a fight. A lot can be learned from this reserve for future reintroduction projects, where the harem and stallion groups develop in a natural way together.

Le Villaret – France

This reserve in the South of France, has a size of about 500 ha and is managed by the TAKH foundation and the WWF France. In 1993 and 1994, 11 Przewalski's horses from EEP zoos, including one mare from Cologne, were donated to this project. Several groups graze in this area (fig. 23), but the carrying capacity is lower due to its smaller size and less productive soil (limestone). As in other reserves, the goal here is to preserve the biodiversity of the formerly overgrazed area (by sheep) and the rare plant and animals species. The ultimate goal, the reintroduction of the horses into the Khar us nuur national park in Mongolia, was realized in 2004 (see below). The TV film "Gallop to Freedom" was made by BBC.

Askania Nova – Ukraine

In 1856 the German settler Friedrich Fein bought 60.000 ha of land, 100 km west of Kherson, for 525.000 Taler. Through marriage into the also emigrated family Falz, the family branch Falz-Fein came into existence. This family was raised to the peerage by Tsar Nicholas II for their efforts in cultivating the Ukrainian steppe. About 2.000 ha land remained untouched and officially became a nature reserve, called Askania Nova. Forty-three different mammal and bird species were imported and tested for their ability of adaptation and domestication. They included Kulans (*Equus hemionus* Kulan, fig. 24), wildebeests (*Connochaetes taurinus*), Eland antelopes (*Taurotragus oryx*), Saiga antelopes (*Saiga tatarica*, fig. 25), deer, various bovid species (e.g. *Bison bison*) and ostrich (*Struthio camelus*). Hybrids were also included in these tests. Still today the domestication process of Eland antelopes continues. The cows are milked in the 7 months period of lactation. On average a cow gives 3 to 4 litres of milk per day (max. 7 litre). It is not only very rich in fat (11 %) and proteins (8%), but is also regarded as especially healthy because of its high values of immunoglobulins.

Askania Nova is also recognized historically because of its Przewalski's horses (fig. 26). Friedrich Falz-Fein was the first to get 3 specimens in 1899 and to breed them. During the revolution however, him and his family were expropriated and fled to Liechtenstein. All the horses died during the war. It was only after the II World War, that Askania Nova became famous again for its breeding of more than 300 Przewalski's horses. Among the founder stock was also the last wild caught mare, Orlitza III. Unfortunately genetic studies proved that hybridisation was not avoided in this species, and that the wild horses were crossed with domestic horses resulting in a tarpan look. In the meantime, this bloodline is almost extirpated and some of the horses released in Chernobyl.

Chernobyl – Ukraine

After the accident with the atomic reactor in Chernobyl (26.4.1986), an exclusion zone of 207.000 ha was created with forbidden entry. Only staff with special protective clothing were allowed in. In time, with no human intervention, the nature regained its strength. Today the forest steppe is inhabited by roe and red deer, moose (*Alces alces*), and even wolves (*Canis lupus*, fig. 42).

From 1989 to 1999, 31 Przewalski's horses in total, originating from Askania Nova, were released in this place. They reproduced successfully and numbers rose to 70, all descendants from the excluded line (fig. 27). Until now, no signs of radioactive harm are reported and the successful breeding is evidence of this, with a survival rate of foals as high as 90%. Unfortunately in the surroundings, domestic horses are also kept, so further hybridisation can be expected (fig. 28). Routinely staff from Askania Nova visit here to look after the horses and to register births and death cases. Until now this data is also sent to the International studbook keeper. The future development can not be forecasted as of yet.

Bukhara – Uzbekistan

The most western Asiatic reserve (fig. 29) is the breeding centre in Bukhara. In 1977 in the 5.126 ha enclosure, an experiment was started to show which animal species – including zoo-bred Przewalski's horses – could adapt to desert-like conditions. Eleven horses from Moscow and St. Petersburg were selected for this project. A single stallion and 4 mares are the founder animals of today's population of about 30 heads. As there are no wolves in the reserve, the horses' reactions to predators are tested with the help of specially trained dogs from time to time. Besides Przewalski's horses; Kulans (fig. 24), Saiga antelopes (fig. 25) and Goitered gazelles (*Gazella subgutturosa*, fig. 46) have also been released in this reserve. The Saiga population grew very slowly and could not adapt in the long run. In 1990 the last ones became extinct. In contrast, Kulans and Goitered gazelles reproduced rapidly. The carrying capacity was already reached in 1986. The maximum population size was 1224 heads of Goitered gazelles, before the population stagnated at a size of about 700 animals. Besides about 30 Przewalski's horses, the same amount of Kulans are living in the reserve today. Their population needs to be regulated at times. Since the animals can not be set free here, the future planning is unknown.

Altyn Emel – Kazakhstan

The National Park Altyn Emel is situated 160 km north of Almaty. It was founded in 1996 and has a size of 520.000 ha. In the mountain plains of Argali (*Ovis ammon*) and Siberian Ibex (*Capra sibirica*), Goitered gazelles and Kulans are found living. The latter had been successfully introduced here in 1982. From originally 32 specimen, the population increased to 500 heads. The area is very arid, having extended stone deserts and is thus no suitable home for Przewalski's horses which are dependant on grass as their main food. The landscape is breath-taking, as the colours in the various mountains or sand dunes differ considerably (fig. 31). As good roads lead through the park and sufficient water places and guest houses are present, tourism already plays a role here.

Presumably, Kazakhstan belongs to the historic range of the Przewalski's horse. Fertile plains extend along the Ili river but these areas do not belong to the NP. The border of the park can easily be recognized by the vegetation: where grass is dominating, domestic animals are grazing and these place lies outside the park.

In July 2003 the Munich zoo transported 4,4 Przewalski's horses for readaptation to Altyn Emel, to a 3 ha enclosure rich in vegetation and with a water place. By autumn 2004, only 5 of them were still alive (fig. 32): 2 died from meningitis, one mare went missed. The animals were full of ticks and very thin (fig. 33). The park wardens now supply them with extra food and the veterinarian of the Almaty zoo is also looking after them. The goal of a successful reintroduction with a self-sustaining population proves difficult here. Not only the poor quality of the sparse and fibre rich vegetation is problematic, but also the narrow genetic base of the founder animals, as all descend from one line only. With additional food, a small population could develop, which would be an enrichment for the tourism.

Reintroduction projects

The word reintroduction is associated with success. If zoological gardens are successful in keeping and breeding an animal species which got extinct in the wild, many years of intensive care with high financial expenses, are part in par. It is not surprising that this word is more often used than permissible. The official definition of the IUCN (International Union for conservation of Nature) is as follows: "Re-introduction: an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or become extinct." A reintroduction also implies that the species concerned must develop a self-sustaining population, independent of humans. The historical range of the Przewalski's horse includes the Dzungarian Gobi in Mongolia and China, westwards up to Kazakhstan. Exactly where is unknown, but some place names contain the word "takhi" (in Mongolian language: wild horse) and rock paintings found indicate possible habitation.

In 1990, during the 5th International Symposium of the Preservation of the Przewalski's horse at Leipzig, colleagues from China and Mongolia were also present. The interest in an reintroduction attempt was big on the European as well as on the Asiatic side. Whereas in a breeding centre near Jimsar in China, Przewalski's horses were breeding already, the Mongols aimed at importing the first wild horses for the Naddam festival on the occasion of the 70 years anniversary of independence. The political pressure was high but the preparations for a safe transport could not be finished in time. However a year later, two transports with wild horses arrived the same day in the capital of Ulan bator: one was organized by the Dutch foundation for the forest steppe in Hustain Nuruu, the other by the Christian Oswald foundation for Takhin tal in the Gobi B.

Hustain Nuruu – Mongolia

The Hustai NP is a 50.000 ha sized forest steppe, about 150 km south-west of the capital Ulan baator. The holly mountain "Hustai" rises 1842 m above sea level and is characterized by an alpine flora (fig. 34) and fauna. The vegetation grows well and the grass is dense because of the snow fall during winter supplying the Przewalski's horses with abundant food (fig. 35). Here the first observations were made on free ranging Przewalski's horses. Other large herbivores include the marals (*Cervus elaphus maral*, fig. 36) and on the edge of the park the Mongolian gazelle (*Procapra gutturosa*). The shy bobaks (*Marmota bobak*, fig. 42) are plentiful and the wolf (*Canis lupus*) which is hunted everywhere in Mongolia, has also reproduced well in the protected area. Faeces sampled over a period of 4 years, showed that the wolves feed mostly on marals, but seldom in June, when the cows live as singles, giving birth to their calves and hiding themselves. With the exception of the summer months July to September, 50 % of the wolves' prey consisted of domestic animals. Wolves only feed on bobaks when they are very fat and slow at the end of the summer. Whether the wolves are also

responsible for the deaths of all foals is doubtful. However the possibility exists that big wounds infested by maggots (fig. 38) weaken some of the foals making them easy prey for wolves (van de Vlasakker, pers. comm.).

As for the avifauna, the imposing black vulture (*Gyps monachus*) should be mentioned, as well as the Golden eagle (*Aquila chrysaetus*), the Great bustard (fig. 39), the black stork (*Ciconia nigra*) and the Demoiselle crane (*Anthropoides virgo*).

Whether the Przewalski's horse ever lived in this forest steppe is doubtful, but it has now adapted successfully to these conditions. The winters are very long: they can begin already in September and can last until May. Without the rich vegetation the winter would be a serious problem for the survival of the Przewalski's horses. From 1992 until the end of 2005, the population has grown to 180 animals. It is the first project which is independent from imports and it is meanwhile excellently managed by the Mongolians alone. The vicinity to the capital allows a modest but profitable tourism. During the summer months many ecotourists help to collect data like the position and activity of the horses. The 16 year old stallion Ares was shipped to Hustain Nuruu in 1996. Long ago he had to leave his harem to another younger stallion, but Ares has learned to stay comfortably in the tourist camp. Here he is not attacked by rivals (fig. 40). He will certainly not live for much longer, as at the age of 16 years, he belongs to the oldest free-ranging Przewalski's horse stallions known. For the tourists, a wild horse encounter is certainly as exciting as a visit to buffalos or hippos in an African camp.

Gobi B – Mongolia

Before wild animals can be reintroduced to the wild, one should visit their former range and determine whether it is still a suitable habitat for the species concerned. In 1993 such a feasibility study was carried out by the UNDP in the Gobi B. The area itself seemed to be suitable, but the best biotopes were nonetheless occupied by too many domestic animals during the months of summer and winter migrations of the nomads. Therefore the EEPP decided not to participate in a reintroduction at this stage. The factors leading to extinction were still present and the Mongolian government did not want to accept the changes necessary.

Meanwhile the 950.000 ha reserve is professionally managed and numerous research projects are carried out concerning the Przewalski's horses especially, as well as the Mongolian khulans (*Equus hemionus hemionus*, fig. 41) and the wolf (fig. 42). The main priority is the monitoring of the species' migration and home-ranges with the help of telemetry. Additionally, students accompany the various Przewalski's horse groups after their release and monitor biological and medical data. Some publications can be downloaded from the website.

The mares Nikola and Liane as well as Nikola's foal Andrea, have been in Mongolia since 2004 and were released in July at a place named Takhin us (fig. 43), after an acclimatisation period of 1 year. At the time, 8 harems and 2 bachelor groups roamed free in the park. The Hustai and Gobi project deserve more special attention and more information is available on the relevant websites.

Khomiin tal – Mongolia

Khomiin tal belongs to the buffer zone of the Khar us nuur National park so a reintroduction is thus not possible at the moment. The park is situated in West-Mongolia in the plains of the

big lakes. Khar us nuur translates as “black water lakes”. Where water is so abundant, a rich bird fauna can normally also be expected. Twenty-five ha of overgrazed grassland were fenced and left untouched for one year, whereafter in 2004 and 2005, 22 Przewalski’s horses were transported there. As can be seen from the photographs, the vegetation has recovered very well (fig. 45). In the long run the grazing by domestic animals is very much reduced. As in all reintroduction projects, the breeding of domestic horses has to be excluded first here, before the ultimate goal of releasing the horses can become reality. This will not be the case within the next 10 to 15 years. However this gives time in the meanwhile to solve the socio-economic problems. Another success will become reality very soon as with the fencing the plant and animal kingdom will recover totally from previous damage by overgrazing.

Anxi Gobi – China

The Anxi breeding centre is situated in the Gansu province and is managed by the governmental Department of Environment. The project partner being the English Zoo Howletts/Port Lympne, sent 4,5 Przewalski’s horses already in 1992 to China for a reintroduction project. It is known that the horses first went to the imperial hunting park “Nanhaizi” in Beijing and were later transported to the acclimatisation pen. Personal communication with Jie Cao, the director of the breeding centre in Sinkiang reveals that no more than 20 Przewalski’s horses are living there now. Studbook data were not updated and reliable statements about the future planning are absent as well. It is not very likely that a successful reintroduction can happen in the Anxi nature reserve.

Gansu – China

The breeding and research centre for rare and threatened wild animal species also lies in the Gansu province, 25 km far from the **Millionenstadt** Wuwei and is managed by the Forestry Department of the government. Wuwei is threatened by the shifting sand dunes of the Tengeli desert. The Chinese people plant seedlings of tamarisks (*Tamarix spec.*), Saxaul (*Haloxylon ammodendron*) and grass, to stop desertification. The semi-reserve inside the wall (6.700 ha) had to be developed for the horses in the same way.

Between 1989 and 1994 the breeding centre got 7 stallions and 12 mares from the German zoos of Munich, Nurnberg and of the Berlin Tierpark; 1 additional stallion originated from Denver zoo and two mares came from one zoo in Beijing. Besides Przewalski’s horses, other species were also bred here, like the Saiga antelope, the White-lipped deer (*Cervus albirostris*), the Wild camel (*Camelus ferus*) and also the rare Golden Snub-nosed monkey (*Rhinopithecus roxellana*).

As no updates were sent to the International studbook, it is unknown how many offspring have been bred. It seems to be unlikely that the wall has been torn down after 10 years and the horses released. The probability is greater that a new place has been searched for them: an article published in 2004 in China Daily stated that 18 Przewalski’s horses would be sent to Anxi. As this has not happened yet (Jie Cao, per. comm.), the future of this project, which deserves being made into a film, lies in the dark.

Kalameili - China

This project in the autonomous province of Sinkiang is old and new at the same time. It started with 18 Przewalski’s horses imported from European and American zoos to the newly built Wild Horse Breeding Centre (WHBC) near Jimsar. Eleven of them belong to the founder

stock of successful breeding. In the last 20 years, 234 foals were born here and all data precisely written down and many events documented by photos.

The Kalameili reserve itself has a size of 1.700.000 ha and its habitat resembles that of the Gobi B. Being almost double in size, it also has larger desert areas, especially in the West. Situated 200 km east of the Gobi B, is an area belonging to the historic range of the Przewalski's horse and the Saiga antelope. Both species became extinct in the 50's of the last century. Today, viable populations of Mongolian khulans and Goitered gazelles (fig. 46) are still living there. In the Kalameili mountains, Argali sheep and Sibirian ibex also occur. The pressure through poaching is considerably lower than in Mongolia, as the Chinese have strict laws and the people are not allowed to possess weapons.

A first reintroduction attempt in the Kalameili reserve, undertaken by the Chinese in 2001/2002 failed. The acclimatisation enclosure lies too far in the North where although the vegetation is good, this is only because of long, snowy winters. The enclosure also lies on the migration route of the nomads with their domestic animal herds, which leads to conflicts between wild and domestic horses. After 4 horses of the first released group, consisting of 27 horses, became victims of the harsh winter, the rest were brought back to the 200 ha big enclosure. Here they spent the winter, until the nomads had left and then they were released back into their home-range in the reserve (fig. 47). Foals are regularly born (fig. 48) and the herd of 36 horses has split into 3 harems and 2 bachelor groups.

To speak of a true reintroduction, more has to be achieved and the director of the breeding centre Jie Cao decided to co-operate with countries from abroad. A first official visit (Behlert/Zimmermann) took place in October 2004 in Urumqi, which decided about the future cooperation between Cologne Zoo and the WHBC. In November the SSP (Species Survival Plan) for Przewalski's horses also joined the project under the leadership of the coordinator Steven Monfort and his colleague Peter Leimgruber (Smithsonian foundation, Washington). In June 2005 the representatives met in Urumqi to start the project. Three subjects were placed into the foreground:

1. Identification of new habitats in the Kalameili Reserve which are suitable for a reintroduction (fig. 49).
2. Development of a socio-economic programme (to be carried out by the SSP) for the nomads as compensation for the detours of their seasonal migration routes and abandonment of accompanying domestic horses (exception: geldings as riding horses).
3. New blood through the import of Przewalski's horse stallions from the EEP and the SSP.

The Cologne Zoo lived up to their promise in June quickly. By September, 6 stallions were flown to Urumqi (fig. 50). As in the capital of the province Sinkiang, no bi carriers land routinely, LUFTHANSA agreed to make a rerouting in their flight from Frankfurt to Shanghai and landed also in Urumqi airport. The stallions from the zoos of Karlsruhe, Cologne, Leipzig and Stuttgart all survived the strain quite well and could leave the quarantine almost immediately. The stallion from Springe unfortunately died 2 weeks later from a pleurisy, probably due to a trauma from a fight.

In the current winter, two harem groups will be built in the WHBC, to be transported to the acclimatisation enclosure in the Kalameili Nature Reserve in spring 2006. This time nothing will be left to chance. Chinese, German and American colleagues will accompany the project, to make it as successful as the nearby Gobi B or the distant Hustain Nuruu project in

Mongolia.. As the Kalameili Reserve is situated between two tourist centres, the Altai mountains in the North and the Tien Shan mountains with the silk road in the South, ecotourism is also planned by the Chinese. The reserve has the potential to become a National Park soon so the Cologne Zoo is participating in another new international project.

Subscribers will receive regular information about the ongoings of the project. We thank all sponsors, who participated in the project until now and made the realization possible: zoos from Karlsruhe, Kerkrade (Holland), Köln, Leipzig, Springe, Stuttgart; friends of the Safaripark Beekse Bergen (Holland); Zooshelp (Holland); Bayer Thai Co (Thailand).

Summary

Since the nineties of the last century it has become common in Europe to use Przewalski's horses in landscape management. They were also reintroduced in their former habitats in Asia where large areas became strictly protected and thus also plants and other animals species also profited. Not all reintroduction attempts were successful so far or ever will be. Whether a project develops positively can easily be checked via the relevant websites. If no news is available any more, this is more likely an indication of failure. In the table below, the various projects are clearly laid out.

	Size in ha	Status	Number of horses (Carrying capacity)	Project partner
Lelystad	32	Nature Reserve	15-20 horses	formerly FRPH, now city of Lelystad
Eelmoor-Marsh www.QinetQ.com	66	Site of Special Interest	5 stallions	Marwell Zoo
Clocaenog Forest www.forstry.gov.uk	6	Scheduled Ancient Monument	3 mares	Welsh Mountain Zoo
Sprakel	68	Nature Reserve	6-15 stallions	Cologne Zoo (EEP)
Tennenlohe Forest www.wildpferde-tennenlohe.de	53	Nature Reserve	6 stallions	Zoos of Munich and Nürnberg
Schorfheide www.izw-berlin.de	20	Biosphere Reserve	5 mares, 1 sterilized stallion	IZW Berlin
Neusiedler See	300	National Park	6-10, harem group	Tierpark Schönbrunn, Wien
Hortobágy www.hnp.hu www.zoo-koeln.de	2.400	National Park World Heritage Site	67 (200 – 300) harems + bachelors	Cologne Zoo
Le Villaret www.tourduvalat.org	500	Nature Reserve	34 (50) harems + bachelors	Takh foundation WWF-France
Askania Nova	2 000	Nature Reserve	86 (100) harems + bachelors	Ministry of Environment

				Ukraine
Chernobyl www.chernobyl.in.ua	207 000	Exclusion Zone	70 (??) harems + bachelors	State Ukraine
Buchara	5.126	Breeding Centre Semi-reserve	about 30 harems + bachelors	Zoo Moscow
Altyn Emel www.zoo-munich.de	520 000	National Park	5 (?) reintroduction questionable	Zoos of Munich and Nürnberg
Hustain Nuruu www.freemail.n/takh www.hustai.mn	50 000	National Park	170 (300-500) re-establishment	FRPH Holland
Gobi B www.takhi.org	881 000	National Park	92 (300 – 500) harems + bachelors reintroduction in process	International Takhi Group
Khomin tal www.takh.org www.wwf.mn	25 000	Buffer zone of National Park	22 (150-200) harems + bachelors reintroduction planned	Station Biologique du Tour du Valat WWF
Anxi Gobi	unbekannt	Naturreservat Nature Reserve	20 (??)	Howletts Zoo
Gansu www.zoo-munich.de	6 700	Breeding Centre Semi-reserve	unknown	Zoo Munich
Kalameili www.zoo-koeln.de	1 700 000	Nature Reserve	36 (500) harems + bachelors reintroduction in the initial stage	Cologne Zoo (EEP), Smithsonian Institution (SSP)

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