



## Spatial Analysis of Conservation Potential in Cold Winter Deserts of Central Asia

FINC-report 201701



Report to the  
Michael Succow Foundation for Protection of Nature

Greifswald, May 2017

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Photo Front cover: Chinks at the Southern Ustyurt Plateau, Uzbekistan. Sebastian Schmidt

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## Acronyms

CMS	Convention on Migratory Species
GEF	Global Environment Facility
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
KAZ	Kazakhstan
LC	Least Concern
OUV	Outstanding Universal Value
PA	protected area
TKM	Turkmenistan
UNDP	United Nations Development Programme
UZ	Uzbekistan
WDPA	World Databas of Protected Areas
WH	World Heritage
WHS	World Heritage Site
WWF	World Wide Fund for Nature

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# 1. Executive Summary

Planning at a scale of conservation reserves aims to maintain or improve the ecological condition of the targeted biological or environmental feature of these areas or mitigate the threats to them (Groves et al. 2002). The deserts of Central Asia are – for long – a space of human and culture as well as highly diverse plant and animal species. Central Asia cold winter deserts extent from the Caspian Sea to southern Mongolia, from the foot of the Tibetan Highland to the steppes of Kazakhstan.

Koeppens climate classification (Kottek et al 2006) and allocation of the Bwk climate type for Middle Asia spatially well reflects the deserts in the regions. The “southern deserts” with Rachkovskaya et al (2005) classification are the most distinct by plant species/ communities, mainly as a results of pedological factors. Sand massifs with high biomass production based on *Haloxylon* spec. and other wooden species form the clear distinction to other desert communities and areas in the wider region. Yet, cold winter desert of Middle and Central Asia are more than sand massifs but are also characterised by cliffs/ chinks as geological peculiarity, salt pans, stone and gypsum deserts.

Any regional network or Protected Areas (PA) should reflect this regional diversity of desert biomes including geological highlights. For working with national PAs, many emphasise can be laid, depending on the political support or the strategic consideration of the project. New PA establishment in desert ecosystems is most urgent in Uzbekistan, where PAs are clearly underrepresented. Southern Ustyurt and Central Kyzylkum are of highest priority within. In Kazakhstan, several PAs exist, protecting various expressions of the Middle Asian deserts, ongoing UNDP project support this. In Turkmenistan the newly established Central Karakum National Park requires much attention as does Reptek Biosphere Reserve to develop it into a modern PA.

World Heritage Site nomination for Middle Asian deserts faces the challenge of Outstanding Universal Value (OUV), as well as representation of sites on the tentative list and within national PA networks. Prior a site specific comparative analysis, a strategic decision should be taken on the story to be told with a WH nomination. A nomination process related to biodiversity as the key feature may face severe challenges as species of interest diversity and abundance is rather low and almost all have a wide range beyond Middle Asian deserts. Except Important Bird Areas (IBAs) no relevant site specific global valuation of the regions is available<sup>1</sup>. Data scarcity creates another big obstacle for a species focused nomination, in any case site specific update of species lists and landscape should be made prior the nomination process. The high biomass production of the sand massifs (via *Haloxylon*) certainly is distinct feature of cold winter deserts in Middle Asia, yet no real OUV, at least not if focussed on one site only.

Consequently, any nomination must go beyond biodiversity/ communities and focus on other values too. There are two more options – beside the sand massif – first: focusing on the diversity of desert types (including various habitats and species) in the Turanian biogeographical province and second: linking natural heritage of deserts with cultural heritage of the Silk Road or Bronze Age Oasis centres.

Whereas the second option could be clustered around Reptek Biosphere Reserve and the cultural WH of Merv, the first option could be located at the edge of the Ustyurt plateau, where earth history of amazingly visible, all representative Middle Asian desert types, IBA sites and PA exists and species of global importance occur. A serial nomination of different cluster could be considered once site specific up to date information on species diversity and abundances as well as political support can be gained.

## 2. Introduction

### 2.1. Definition and principles

As Stadelbauer (2003) and Cowan (2007) show, English, German, French and Soviet literature used no standard definition and understanding of the the terms Central and Middle Asia. As a consequence, setting a short (incomprehensive) baseline for this report might be advisable.

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<sup>1</sup> WWF Global 200 Ecoregion, Middle Asian Deserts are part of, can be regarded as the very bottom-line, the value of this in the nomination process remains limited.

For this study, the term “Central Asia” (Tsentral'naya Aziya) refers to the definition of v.Richthofen 1877 (in Stadelbauer, 2003), which is based on physical-geographical distinctions and refers to the endocrinic regions between the Tibetan plateau and the Altai as well as the watershed in Pamir, Tien Shan and Xinjiang Mountains (Fig 1).

By doing so, I distinct the regions from spatial areas addressed by the term “Middle Asia” (Srednyaya Aziya), which I consider to be the five Post-Soviet republics in the region.

In political terminology, these five countries since independence refer themselves to be “Central Asia”, yet for this report this terminology also includes parts of North-Eastern Iran, Xinjiang and Southern Mongolia.

This report uses the term “cold winter desert” which I relate to Schröder’s (1998) definition of nemoral deserts which are a spatial expression of the climate classification of Köppen-Geiger (here BWk type) as depicted in Fig 2. By doing so, I more precisely address a particular geographical area, which Udvardy (1975) describes as “Cold Winter Deserts” but which cover a much larger area and expands from the Anatolian highlands to the Tibetan plateau (Fig 3). Udvardy’s further defines his biome “cold winter desert” with several biogeographic provinces, being: the Anatolien-Iranian Desert-, Turanian, Takla-Makan Gobi Desert-, and Tibetan biogeographic province. In this study I focus on the “Turanian” biogeographical province which basically covers Kazakhstan, Uzbekistan and Turkmenistan lowlands desert regions and coincidences with western part of Köppen’s Bwk climate regions. What is a pragmatic approach for the project this report is contributing to, in regard to UNESCO World Heritage site designation, this geographical limitation will become an important factor to discuss.

Fig 1  
Delimitation of  
„Central  
Asia“. Source:  
Stadelbauer  
2003



A “true” Central Asian perspective might then need to be applied and the Udvardy province TaklaMakan Gobi Desert (Western China (Xinjiang province) as well as Southern Mongolia (Gobi) regions) be included into the assessment. Both of these regions are part of the Irano-Turanian floristic region, bear the majority of the same plant and animal genus also found in Central Asian deserts as well as Red List species of potential relevance for WHS nomination. Representative Central Asian desert species like the Bactican camel or the Prtezevalski horse, only occur in Chinese and Mongolian cold winter deserts.

Yet, the Irano-Turian floristic province can be further divided to a western and an eastern floristic province (Pfadenhauer and Klötzi 2014), with the Western border of China roughly forming the border. On this basis, Rachkovskaya et al (2005) distinct Turanian and Dzungarian floristic elements.

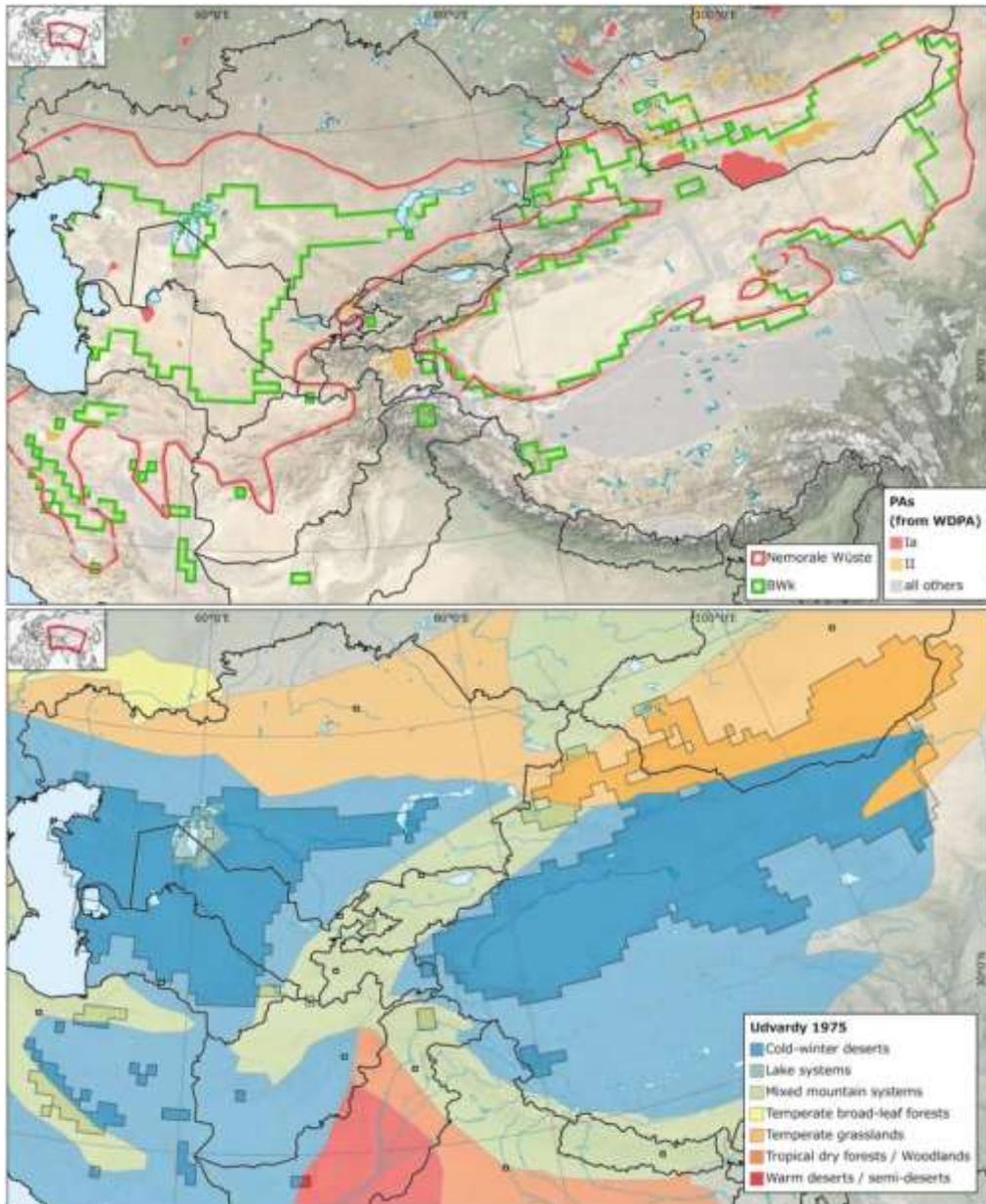


Fig 2 Central Asia, location of PAs (IUCN and UNEP-WCMC 2017) in the region and the spatial expression of „cold desert climate BWk“ as defined by Köppen-Geiger (Kottek et al. 2006). Schroeder (1998) in his definition of “nemorale Wüsten” encapsulates a similar area.

Fig 3 Udvardy's biogeographical provinces, including the cold winter desert – in blue – in comparison to Köppen-Geiger BWk climate region – in light grey.

## 2.2. Planning process

Any conservation planning process requires the definition of the planning process target(s). Conservation targets may be e.g.:

- Floristic or faunistic species of local or national concern,
- Genetic diversity,
- Preservation of “étalon” sites,
- Migratory species of global concern,
- Representative landscapes and habitats,
- Integrative, traditional and sustainable land use schemes.

The study tries to focus on some primary aspects of a hierarchical approach on identifying high value conservation areas as done by Kreyer et al (2009) (Fig 4). As data constraints limit the application of this approach, subjective

expert judgement will become part of the assessment, a common approach also for other regions in the world (AlHirsh et al. 2016). On vast territories of Middle Asian desert ecosystem up to date science based data on species composition and abundance, as well as ecosystem conditions is hardly available. As for Turkmenistan, even the updated version of the Red Book (as of 2011) is largely based on “historic” data.

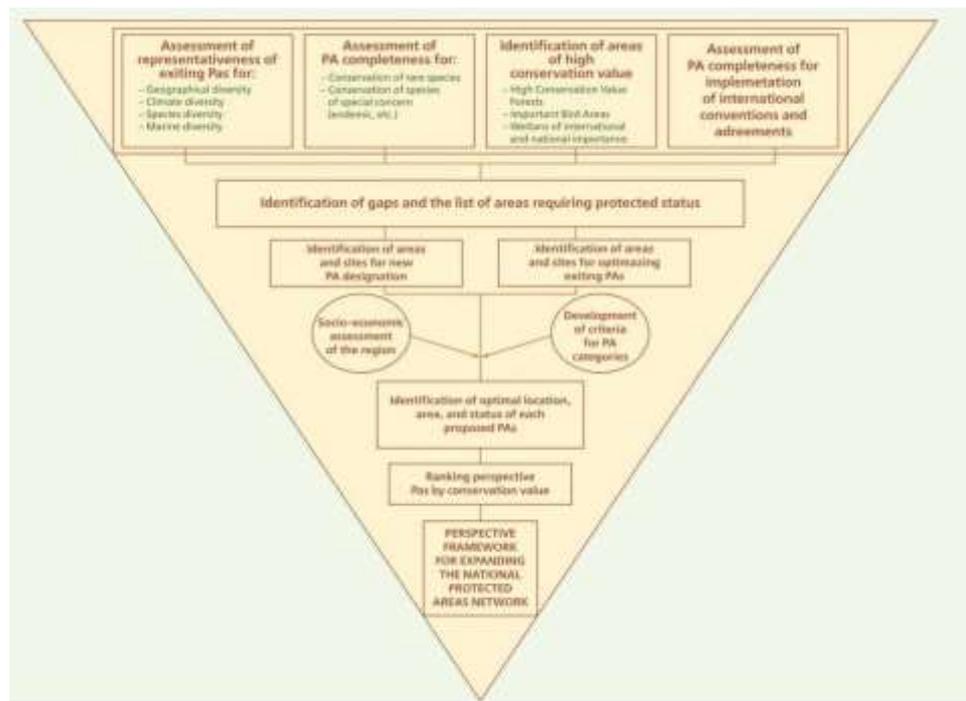
For setting spatial conservation priorities the identification of the conservation goal is the required first step. Quantitative and qualitative targets then support this goal and make the value of the goals and the planning progress explicit.

Representative landscapes and habitats become the prime goal for conservation in the frame of this study, based on the assumption that protected land with conservation potential will in any case become valuable, either for sustaining livelihoods, provide space for natural phylogenetic diversity and evolutionary processes, protect species and contribute to global programmes.

Thus, the *regional quantitative target* of the assessment should be:

The diversity of Middle or Central Asian desert biome (Sand, Gravel/Stone, Loess, Solontchak, Gypsum) with its particular species composition is representatively reflected in the regional PA network. The minimum size and number of the PA reflects the representative biotic and abiotic factors (like climate, landscape, vegetation, threatened species).

Fig 4 Identifying high value conservation areas.  
Source: Krever et al 2009



Three criteria reflecting the significance of a potential PA are:

1. ensuring geographical (landscape and habitat) representativeness of the entire PA network;
2. ensuring conservation of all natural communities and ecosystems of high conservation value;
3. ensuring adequate representativeness of species diversity and conservation of rare and endangered species.

The *national quantitative targets* would support this approach on a national scale but should consider:

- improving the connectivity of existing protected areas and - offer transboundary potential for CMS species

To fulfil the target and as a consequence of data scarcity on species distribution (see below), this study relies on:

- theoretical assessment of landscape diversity
- former – spatial explicit – conservation recommendations made by NGOs

- Important Bird Area (IBA) (recommendations)
- governmental programmes on the extension of the PA network
- site specific knowledge

The *national qualitative targets* are much harder to assess and compare but would need to include information on the abundance, distribution and population status of e.g.:

- Red List species,
- endemic species
- CMS species

### 3. Middle Asian desert flora and fauna

The Middle Asian deserts are largely composed of distinctive deserts landscapes (Fig 5), namely the: -

- Karakum desert (Turkmenistan),
- Kyzylkum Deserts (Uzbekistan),
- Sundukli Desert (Uzbekistan),
- Betpak-Dala Desert (Kazakhstan),
- Muyunkum Desert (Kazakhstan),
- Balkash regions (Kazakhstan),
- Ustyurt Plateau (Kazakhstan, Uzbekistan)

The Central Asian cold winter deserts are unique in terms of biomass production, at least for the sandy part, due to winter and spring precipitation (Fig 6).

Fig 5 Main physiographic features of Central Asia (De Pauw, 2007 in Lal R. et al, 2007)

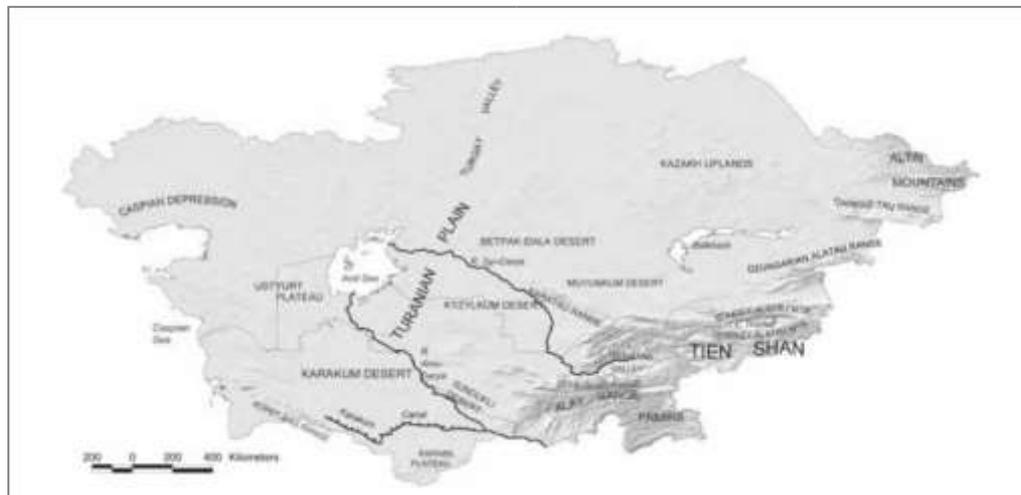
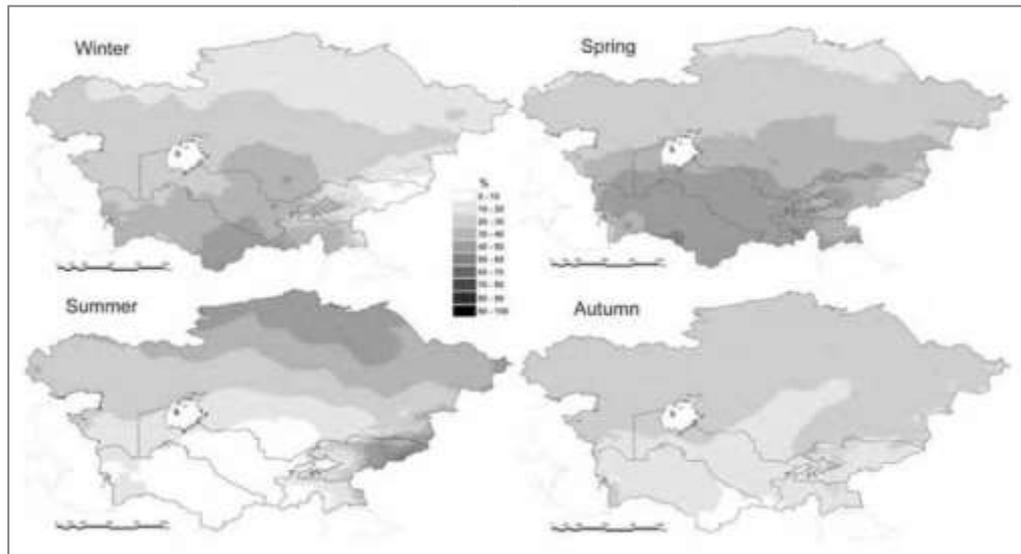


Fig 6 Seasonal distribution of precipitation as a percentage of the annual total. (De Pauw, 2007 in Lal et al., 2007)



Among rare and endangered mammal species in the Central Asian desert ecoregion, the Honey badger (*Mellivora capensis*), Sand lynx (*Felis caracal*), Desert cat (*Felis margarita*), Asiatic Wild Ass/Kulan (*Equus hemionus kulan*), Goitred gazelle (*Gazella subgutturosa*), and Marble polecat (*Vormela peregusna*) are of special interest (Krever et al. 1998).

Migratory mammal species of global concern (CMS species) occurring in Central Asian desert ecosystem are:

- Bukharian deer (*Cervus elaphus yarkandensis*)
- Bactrian camel (*Camelus bactrianus*)
- Saiga (*Saiga tatarica*)
- Asiatic wild ass/Kulan (*Equus hemionus kulan*)
- Goitred gazelle (*Gazelle subgutturosa*)

For Middle Asian desert surrounding, Saiga and Asiatic wild ass (Kulan) are the most vulnerable to be considered as here. Among these two, Kulan should be paid highest attention as Saiga only part time migrates into the desert landscape of Ustjurt, for main parts of the population protected areas exist in Kazakhstan already. The endangered Kulan instead has its main distribution in the study region in the trilateral border area of Turkmenistan, Uzbekistan and Kazakhstan as well as in the Aral Sea region (former Barsakelmes island). Out of these facts, a certain responsibility for its conservation arises. The desert inhabitants Asiatic cheetah (*Acinonyx subatus venaticus*) and Przewalski's horse (*Equus caballus przewalskii*) are no subject for consideration as there have been no reports on both species for Middle Asian countries, the focus of this study. The Goitred gazelle, with its wide range is not only also a species of steppes, also records for Turkmenistan and Uzbekistan are missing (CMS 2014).

Whereas data on CMS species appears to be sufficient for an assessment, the present spatial allocation of e.g. the cats regional data seem outdated. It becomes obvious that, for the spatial justification of new PA's (of any kind) this data gap provides challenges.

Middle Asian deserts form an important bird migratory route between Eurasia and Africa/India, yet they have no outstanding value in this, in comparison to the semi-deserts and steppes of the wider regions. On the example of bird diversity, the desert biomes even perform low, when compared with other regional ecosystems (Fig 7), yet they perform high in regard to phylogenetic distinctiveness, meaning evolutionary relationships between species, which "...can be used as a measure for evolutionary processes and as a proxy for ecosystem functioning and stability as more phylogenetically diverse assemblages potentially maintain higher function..." (Schweizer et al. 2014). A range of characteristic bird species like Sandgrouse (*Pterocles alcata*, *P. orientalis*), Desert sparrow (*Passer simplex*), Short-toed eagle (*Circaetus gallicus*), Golden eagle (*Aquila chrysaetos*) or Egyptian vulture (*Gyps fulvus*) occur in the deserts of middle Asia. Yet, they are considered "least concern" (LC) of IUCN and are also typical for other habitats like semi deserts and have a wide range in Central Asia.

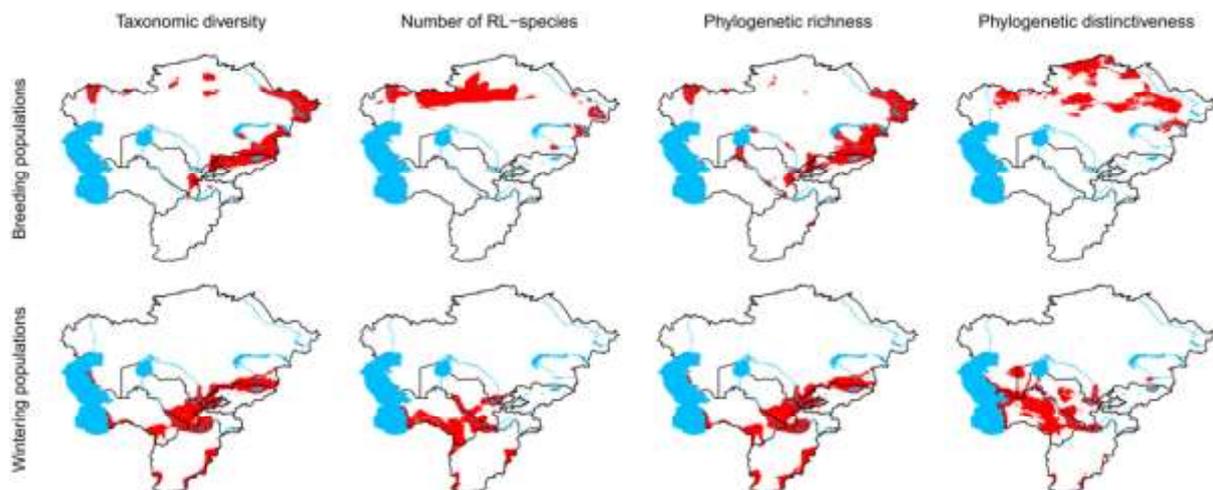


Fig 7 Distribution of bird diversity hotspots in Central Asia. (Schweizer et al. 2014)

A similar range have the vulnerable Imperial eagle (*Aquila heliaca*), the endangered Saker falcon (*Falco cherrug*) or the vulnerable bustard (*Chlamydotis macqueenii*), occurring in almost all deserts in Central Asia, although partly in low numbers. Even the endemic Saxaul sparrow (*Passer ammodendri*) (IUCN LC) – found mainly in Haloxylon bushes occurs in the deserts of entire Central Asia and is not limited to particular sites and spatial territories. Only the endemic, (not threatened) Turkestan ground jay (*Podoces panderi*) (IUCN

LC) is a distinction “biological feature” in Middle Asian deserts, which leads to some responsibility for its protections.

A particular rate of endemic species can be found in Central Asian desert's, among them: „...the *selevinia* (*Selevinia betpakdalensis*), which belongs to an endemic rodent family; the comb-toed jerboa (*Paradipus ctenodactylus*), belonging to an endemic sub family; and three-toed and five-toed dwarf jerboas (*Salpingotus heptneri*, *Salpingotus pallidus*, *Cardiocranius*). Also endemic are several mammalian genera, such as *Diplomesodon*, *Spermophilopsis*, *Pyderethmus*, *Allactodipus*, *Eremodipus* and many others.”( Krever et al., 1998). The same author (ibid) states that the “...the invertebrate fauna of the sandy deserts is especially rich, representing species such as grasshoppers, darkling beetles, scarabaeid beetles, butterflies, termites, and ants. These deserts are also rich in reptile life, harboring a tremendous variety of agama, gekko, lizard and snake species. One of the largest reptiles in Eurasia, the gray monitor, can be found in these deserts...”. Unfortunately, also on this aspect there is little spatial data supporting this general information.

Yet, any desert ecosystem, in comparison to other (global) ecosystems, is poor in species diversity and abundance. Additional, few species of global concern only occur in the survey region (at least with up to date data) and thus can be used for distinction and prioritising of high value conservation areas.

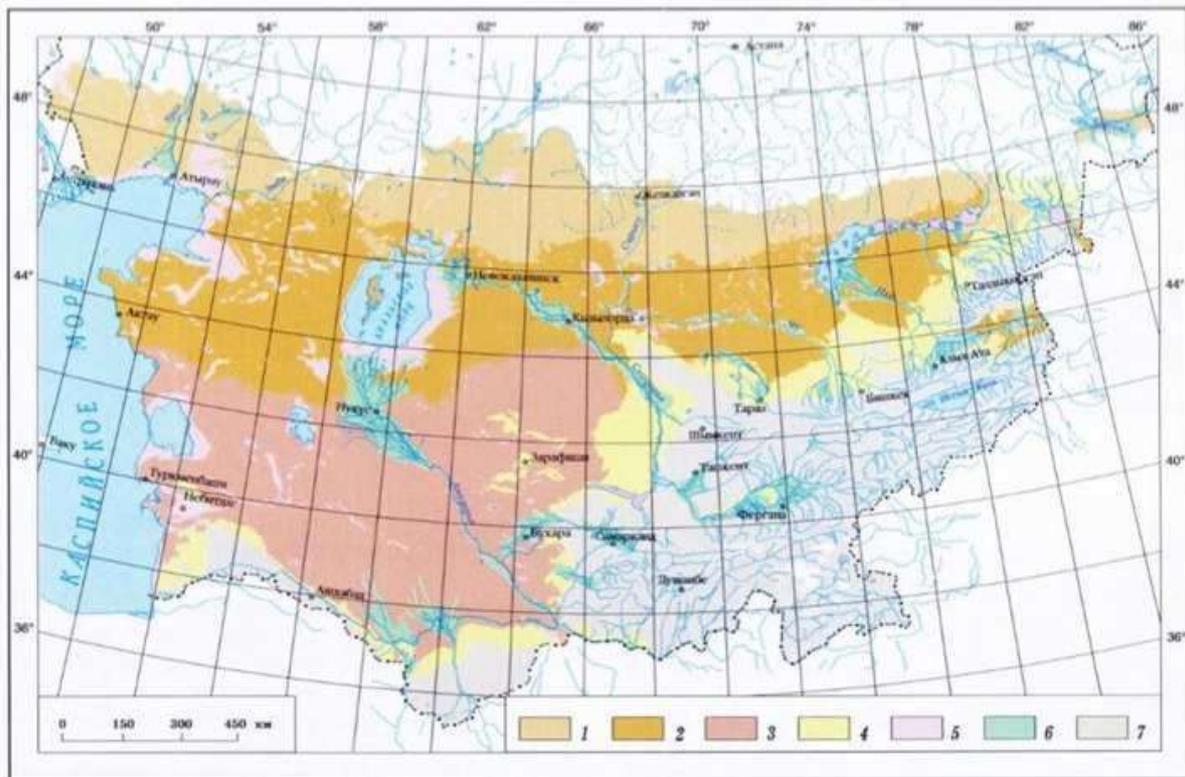
Rachkovskaya et al. (2003) classify the Middle Asian desert ecosystems largely into four botanicalgeographical categories on the basis of temperature and precipitation and the resulting change of vegetation cover, species and dominances (Fig 8).

First, the northern desert, which related to “North Turanian floristic province”, second the middle desert and third the southern desert, which relates to Rachkovskaya et al. (2003) “South Turanian floristic province. The fourth, being the Djungarian floristic province and desert type at the eastern border of Middle Asia (Fig 8), is of no spatial relevance for this study.

Each unit has its own characteristic plant species composition, which reflects the large zonal gradient of decreasing precipitation from north to south. As a consequence, the “northern desert” still bears elements of steppe and semi-desert plant formations, *Artemisia* spec. and perennial saltwort communities prevail. The subdominant appearance of *Stipa* species underlines the transition character of this zone which has been described for the southern part of the Turgai Plateau, the northern part of Betpak-Dala and Balkash region. Although cold winter climate prevails, the steppe elements found in this zone, clearly differentiates the area from the following two (see also Fig 1). The “middle deserts”, which cover the territory of the Mangyshlak Peninsula, central parts of Ustyurt, most parts of Betpak Dala and the southern parts of Balkash regions instead are dominated by perennial saltworts and psammophytic species like *Haloxylon* spec. are widely distributed on sand. Along this latitude of the “middle deserts” grass dominated communities are restricted to sandy sites, making a clear distinction to the “northern deserts”. Further to the south, the “southern deserts” occupy parts of Ustyurt, Krasnovodskoe Plateau and the sand massif of Kara-Kum and Kyzalkum. These regions are significantly distinct from the “northern” and “middle deserts” by their species composition. The pedological condition forms a high grade for differentiation and diversity of plant species (groups) than the location along latitude and longitude.

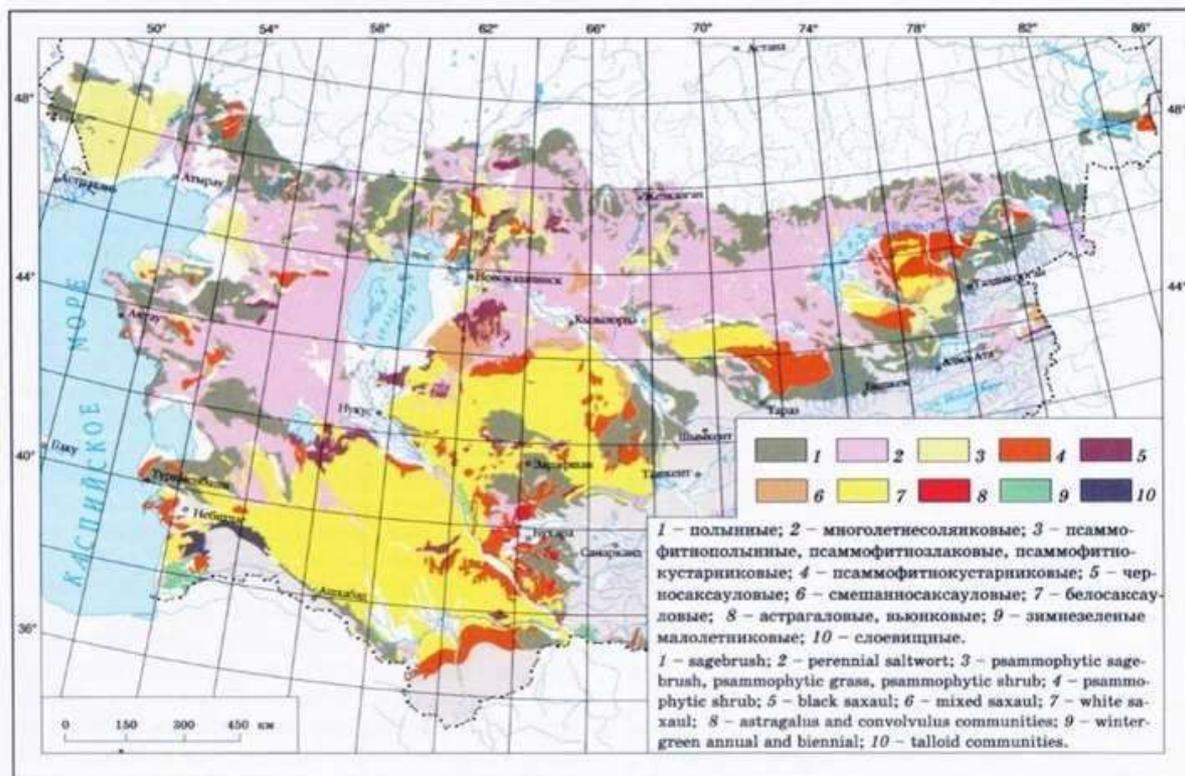
This clear distinction is mainly based on the dominance of White (*Haloxylon persicum*) and Black (*Haloxylon ammodendron*) saxaul as well as other woody plant species like the endemic Eichwald's and Karelin's sand acacias (Krever et al. 1998). Herein, Saxaul is the most important plant genus in this ecosystem, not only for stabilizing sands, preventing erosion, and providing a shady microenvironment for other plant and animal species but also for storing underground carbon and providing livelihoods for communities living in the desert. The distribution of Saxaul is depicted in Fig 8 for Middle Asia and Fig 9 for entire Central Asia.

Azonal ecosystems like river valley with the riparian floodplains or lake systems play another important and vital role in the desert ecosystems of Central Asia and are integral part of the landscapes complexes of Central Asia. As a consequence, regarding representativeness of areas to be chosen to work with in the Bwk climate region, the botanical-geographical distinction as well as the pedo-geological distinction (Fig 9) are important attributes reflecting desert diversity but also for weighting priorities.



1. Основные подразделения растительного покрова.  
 Пустыни: 1 — северные, 2 — средние, 3 — южные, 4 — предгорные, 5 — растительность солончakov.  
 6 — Растительность долин рек и оазисов. 7 — Растительность гор.

1. Main subdivisions of vegetation cover.  
 Deserts: 1 — northern, 2 — middle, 3 — southern, 4 — piedmont, 5 — vegetation of solonchaks.  
 6 — Vegetation of river valleys and oases. 7 — Vegetation of mountains.



1. Эколого-физиономические типы растительных сообществ и фитоценозоxy с их преобладанием.  
 1. Ecological-physiognomic types of plant communities and phytocoenoses with its predominance.

Fig 8 Botanical-geographical categories of Middle Asian desert ecosystems. (Rachkovskaya et al 2003)

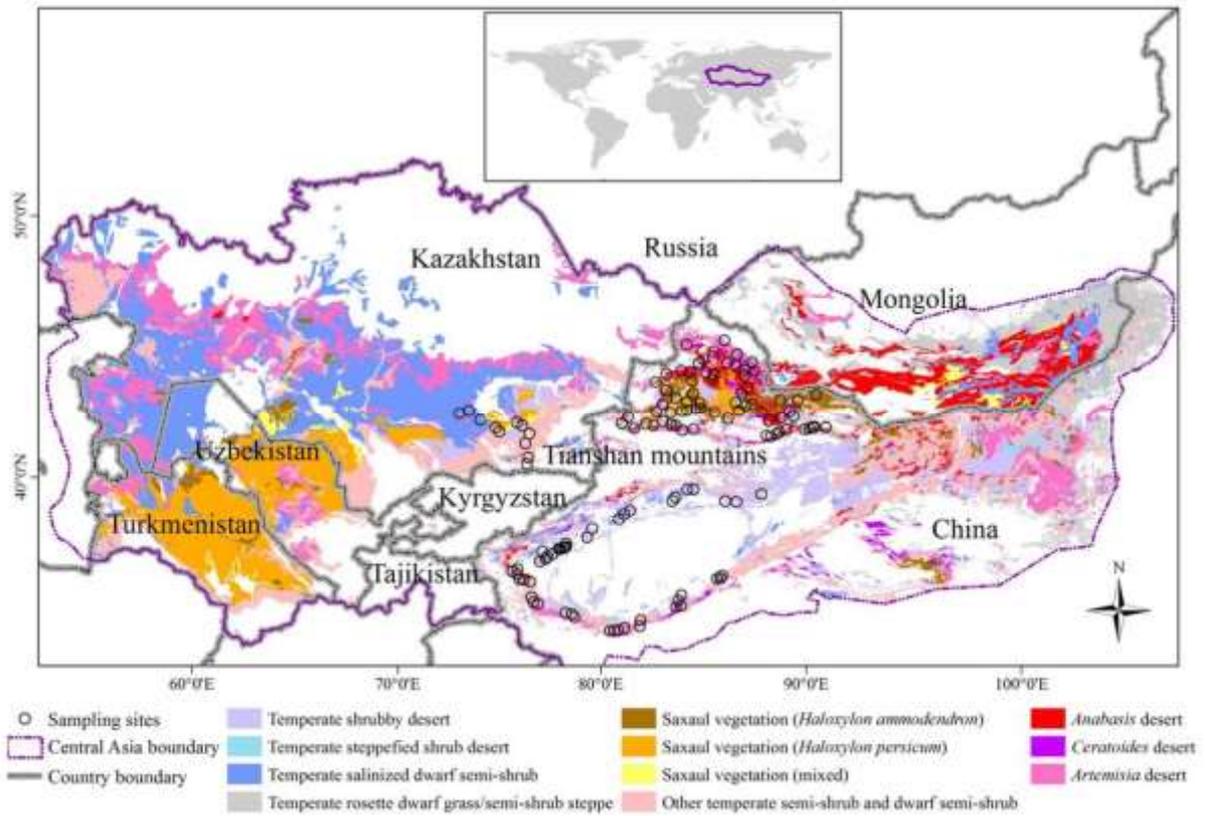


Fig 9 Central Asian desert vegetation units. (Zhang et al 2016)

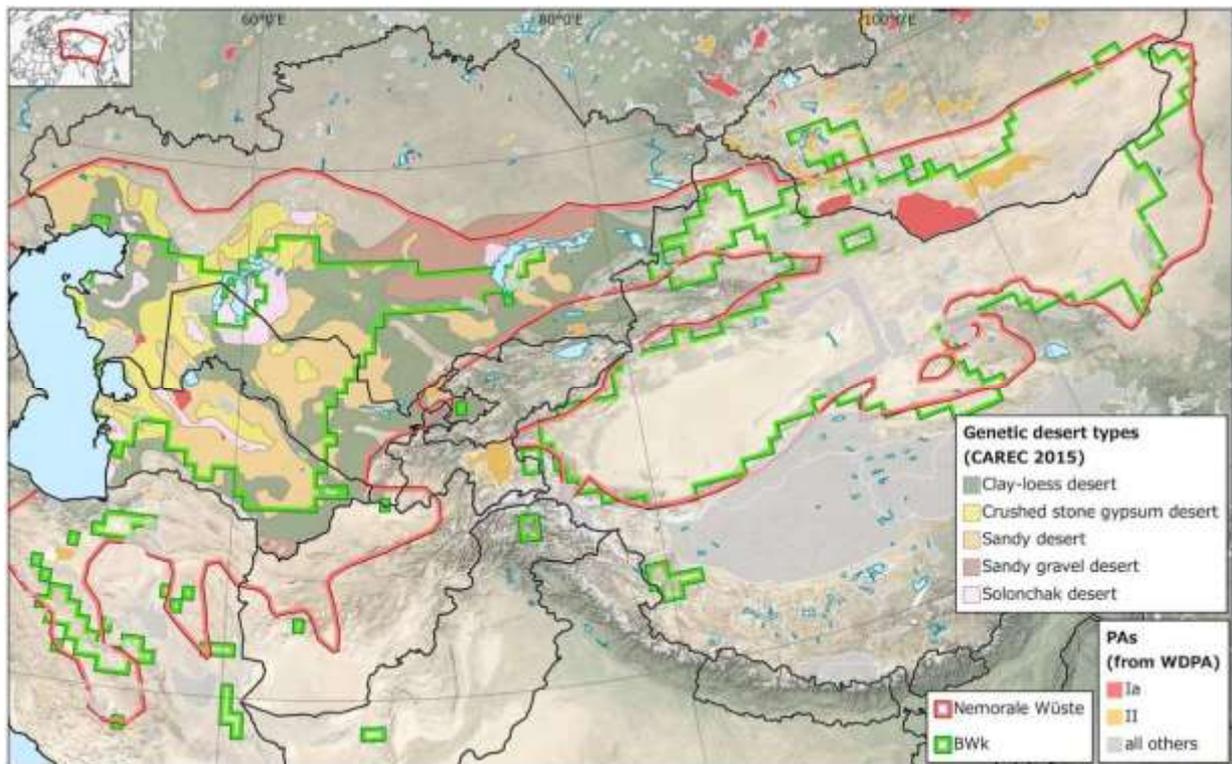


Fig 10 Genetic desert types (CAREC 2015)

Fig 10 Location of Genetic desert types (CAREC 2015), PAs (IUCN and UNEP-WCMC 2017) in the spatial expression of „cold desert climate BWk“ as defined by Köppen-Geiger (Kottek et al. 2006) and “nemoral Wüsten” as defined by Schroeder (1998)

## 4. Gap analysis and spatial conservation priorities in the cold winter deserts biome of Middle Asia

Central Asian desert ecosystems are part of WWF Global 200 priority ecoregions (Fig 11) and are critically endangered (Olson & Dinerstein 1998). They have unique ecological qualities, support numerous endemic species and particularly the sand deserts support great biodiversity (Magin 2005). Yet they are not part of the 25 biodiversity hotspot (Myers et al. 2000) or represent high biodiversity wilderness areas (Cantú-salazar & Gaston 2010). With 8,8% of the national territory protected, Kazakhstan has the highest share of the three Middle Asian countries (UZ 5%, TKM 4,4%) (CAREC et al. 2015).

Desert ecosystems of Middle Asia are imperilled on a global scale and its desert PAs are underrepresented in regional and global PA network (Dinerstein et al. 2017). Often, for example in Uzbekistan, the area of desert habitats nature reserves is “insufficient for a normal support of species breeding and communities inhabiting these habitats” (UNDP 2015), despite large efforts in all three countries to designate Important Bird Areas (IBAs). Runge et al. (2015) outline the low protected area coverage of migratory bird distribution in Central Asia, including the three target countries of the study.

In relation to the space and extension of the middle Asian deserts, it become obvious that desert protected areas of adequate size to provide ecosystem integrity are missing, in particular in Uzbekistan and Turkmenistan (Fig 12 & Fig 13).

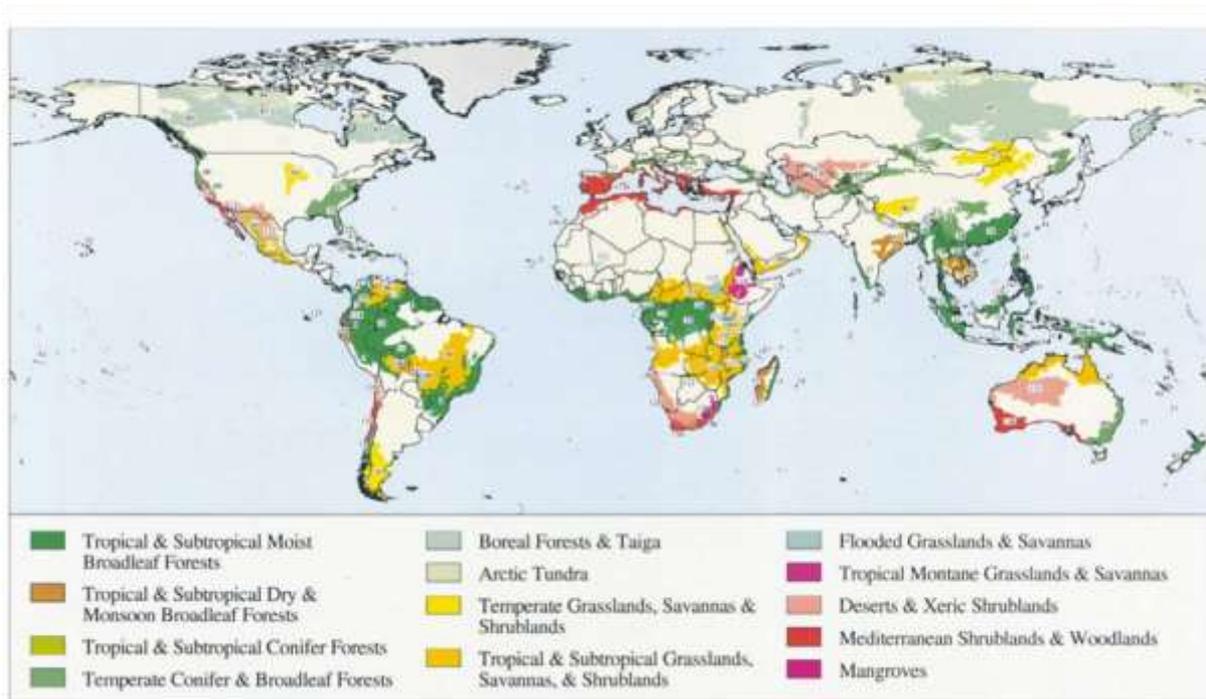
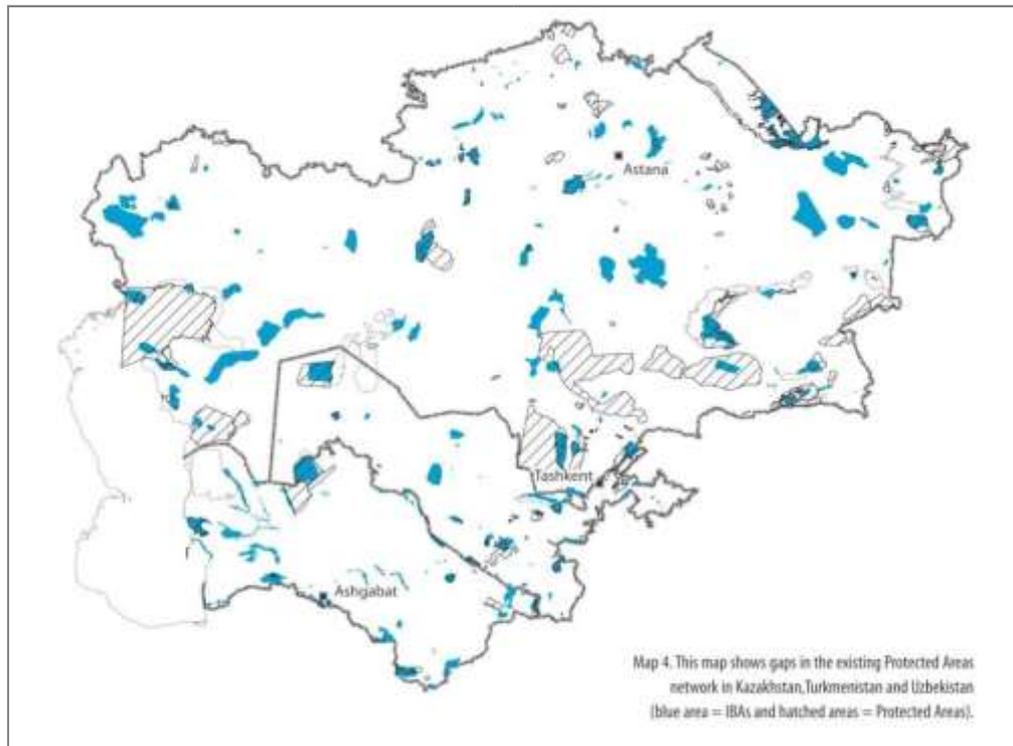


Fig 11 Terrestrial Global 200 ecoregions and their major habitat types. The estimated original extent of ecoregions is shown, not the remaining habitat. Olson & Dinerstein 1998

Fig 12  
Protected areas in former post Soviet countries. (CAREC et al. 2015)



Fig 13 PAs network in Kazakhstan, Turkmenistan and Uzbekistan. (Kashkarov et al. 2008)



Consequently, the extension of the PA network is advisable, preferable to include yet underrepresented desert biomes. Extending or linking existing PA's should be paid particular attention. For site selection of potential areas as well as weighting the given, the following criteria are proposed:

#### 4.1. Criteria matrix for site selection

1. Regional distinction criteria
  - 1.1. Climate region
  - 1.2. Floristic region

### 1.3. Desert type/ representativeness of habitat

#### 2. Species and habitat distinction criteria

##### 2.1. Habitat diversity and integrity

##### 2.2. Species diversity and abundance

##### 2.3. occurrence of IUCN Red List species and/or species of particular interest <sup>2</sup>

##### 2.4. occurrence of CAMI species importance

#### 3. Connectivity (national/international) criteria (including dissection of landscape by roads- roadless areas<sup>3</sup>)

#### 4. Political distinction criteria

##### 4.1. IBA (as category of global importance)

##### 4.2. Availability of former and present recommendations / planning documents

In a second step, selected and assessed regions should be weighted against the attributes of: -  
irreplaceability,

- vulnerability and
- representativeness to support the selections but also to prioritise actions.

Modified assessment criteria, based on the general approach of Margules & Pressey (2000), can be applied, contributing to the selection of regions and/or sites.

Tab 1 Criteria supporting the weighting of priority conservation regions

Criterion	Scale	sub-aspects of criterion
Hemeroby	1- highly altered; 4- natural	level of anthropogenic alteration, proximity of settlements and technical installations
Representativeness	Scale 1-4 (low - high)	abundance of the habitat (National/ Regional) size and spatial extension of the habitat occurrence of threatened species species diversity and abundance
Vulnerability (urgency for conservation)	Scale 1-4 (not urgent - very urgent)	threats like economic development but also remaining naturalness or restoration potential

Among these, irreplaceability (or uniqueness or rarity) is arguably the most relevant concept for the WH Convention, as it relates most strongly to the notion of Outstanding Universal Value (Schmitt 2011).

On species distinction criteria, their diversity and abundance, only limited information is available. Base in the pre-selection of sites, detailed field survey should be conducted to assess the biodiversity value of the priority regions and to refine the selection. Only then, the application of the entire list of above mentioned criteria is possible.

<sup>2</sup> Potential occurrence of mammals of conservation interest: within the desert mountains in Mangyshlak and Ustyurt, a Desert cat (*Felis margarita*) and Caracal (*F. caracal*) and Ustyurt urial occur, Striped hyena (*Hyaena hyaena*) is still assumed to occur in the border region between Turkmenistan and Uzbekistan, increasing the conservation value of these sites.

<sup>3</sup> The density of roads can act as a supportive argument when selecting priority conservation regions in regard to ecosystem integrity and naturalness. As shown in Fig 16, the density of roads is not very high in most of the preselected regions, with Central Karakum, Kyzylkum desert and Ustyurt being lowest. Using this indicator can only be of minor relevance due to the vast extension of landscapes and the pending detailed location, delineation and zonation of potential PAs.

Nevertheless, already in terms of habitat diversity there are eight larger “priority regions” within the Bwk climate zone of Middle Asia, which represent at least three different desert types within a reasonable sized territory (Fig 14). Additional to that, there is an overlap between these eight regions and:

- Existing PAs
- IBAs
- Spatial recommendations for PAs from the Econet project as well as the migratory range of CMS species (Fig 15).

The characteristics of these “priority regions” is given in table 1.

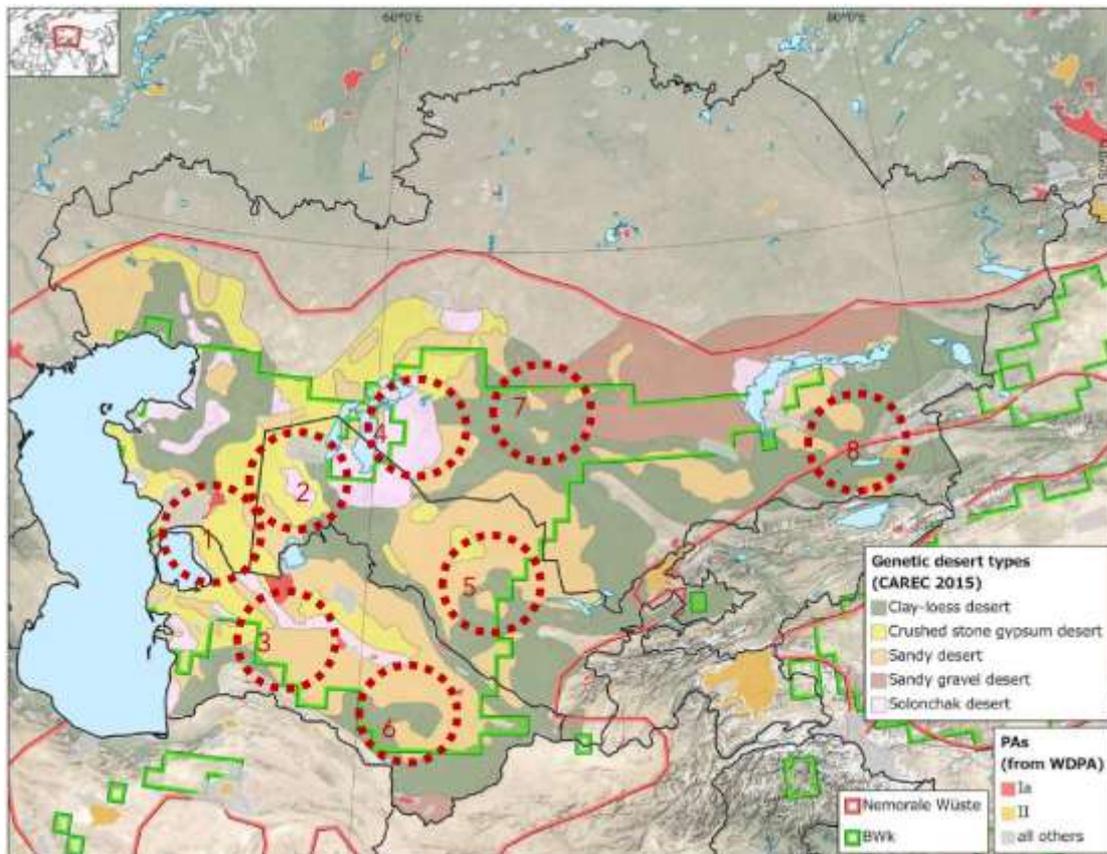


Fig 14 Eight “priority regions” in terms of habitat diversity representing at least three different desert types within a reasonable sized territory.

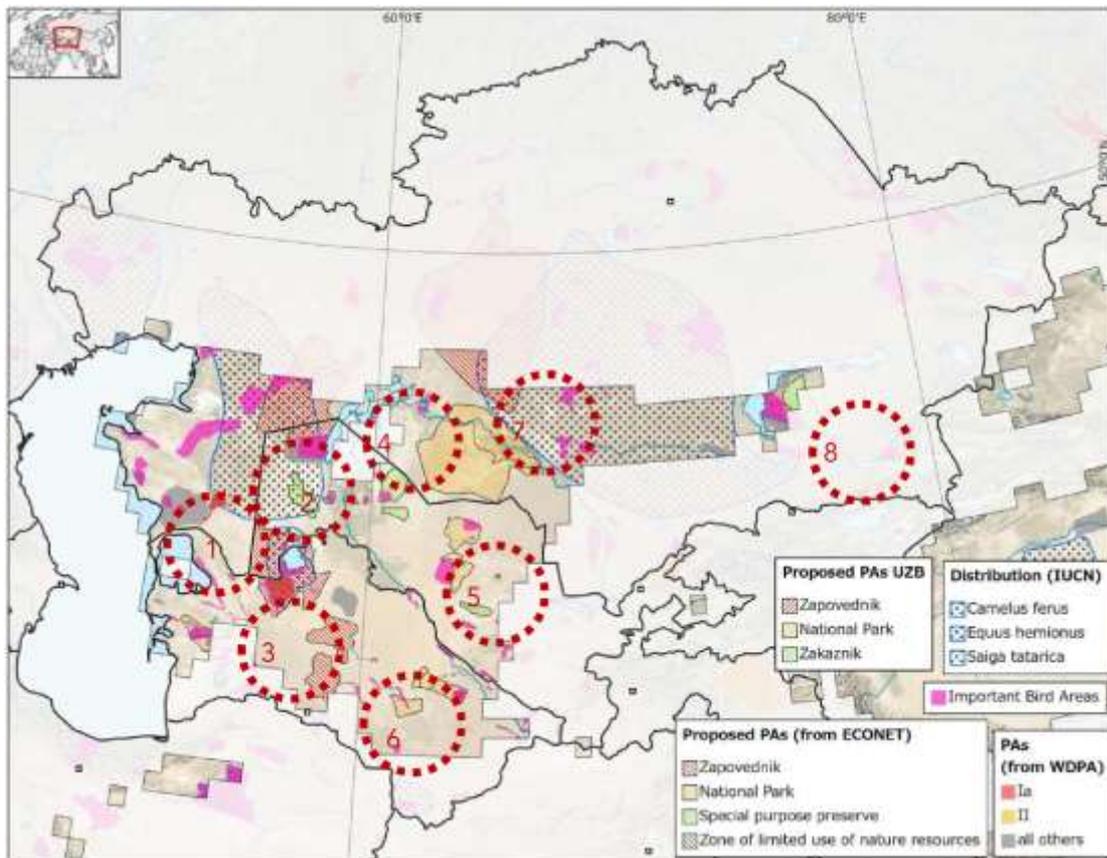


Fig 15 overlap between “priority regions” and (1) Existing PAs, (2) IBAs and (3) Spatial recommendations for PAs from the Econet project as well as the migratory range of CMS species.

Tab 1 Characterisation of the identified “priority regions” in terms of habitat diversity.

No according to map	Name of larger regions	Phytocoenochore according to Fig. 8	Description/ features	Threats
1	Western Ustyurt/ Mangyshlak	Middle Desert /Southern Desert with sagebrush and perennial saltworth communities prevailing on high diversity of substrate (stone/gypsum, clayloess, sand)	Existing PA and IBA in region; Chinks, geological processes, historic land use (desert kites) predominant and outstanding feature; partly still Saiga migratory range; UNDP project targeting to establish Mangystau PA	Increased gas Uranium, Oil and area mining in the RK (MEWR 2014)
2	Northern Ustyurt (KAZ/USB)	Middle desert with perennial saltworth prevailing	Saiga migratory range; existing PA (also IBA). Extension of PA part of Econet recommendation and national plan- already large scale project for extension at present.	Increased gas Uranium, Oil and area mining in the RK (MEWR 2014)

No according to map	Name of larger regions	Phytocoenochore according to Fig. 8	Description/ features	Threats
3	Southern Ustyurt	Southern Desert (partly middle) with high diversity of plant communities like sagebrush, psammophytes, saltwort, black and white saxaul and astragalus/convolvulus communities	Part of Kulan migratory range; on TKM side existing strict nature reserve, on UZ side gov. plan for establishment of 1.4 Mio ha strict nature reserve; chinks, geological processes, historic land use (desert kites) predominant and outstanding feature; Lake Sarykamish IBA, (part of Zhazyl Damu programme 2015-2019)	Increased Uranium, Oil and mining in the area (MEWR 2014) gas RK
4	Little Lake Aral/Aralkum desert/ Akpekti	Highly diverse range from sagebrush, saltwort, psammohytic communities, only few Saxaul communities	Barsakelmesh PA in the area; Delta of Syrdaria PA in planning, establishment of Akpekti scientific reserves in gov plan, IBA No 043, 044 in territory	
5	Central Kyzylkum	Only sand and stone desert but largest still naturel sand desert ecosystem in Uzbekistan. Lower elevation mountain ridges inside sand desert offering peculiar habitat structure.	Part of national Master plan for extension of PA network (1.1 Mio ha); part of Econet proposal for national park development, IBAs on the territory,	Mining?
6	Central Karakum	Most representative sand desert massif of Middle Asia with white saxaul prevailing. Interspersed Solontchak and stone/gypsum deserts	Newly established Central Karakum National Park (NP) protects habitat exemplary. Yet question about adequate size and functioning of NP. Econet recommendation fulfilled by establishment of NP, IBAs adjoining to the East	
7	Southern Betpak – Dala/ Muynkum desert	Middle desert with perennial saltwort and sagebrush on stone deserts of Betpak Dala and saxaul in sand of Muynkum desert	most important for main Saiga population; IBAs close by; UNDP/GEF project in region on supporting land management schemes	Increased Uranium, Oil and mining in the area (MEWR 2014) gas RK

8	Balkhash	Middle desert close to northern desert with perennial saltworth, psammophytes and white saxaul prevailing on gravel and sand. Extensive reed beds and floodplain vegetation in delta.	IBA, part of Econet recommendation but recently established national PA in the delta of Ili river and shoreline of lake Balkhash (part of Zhazyl Damu programme 2015-2019)	
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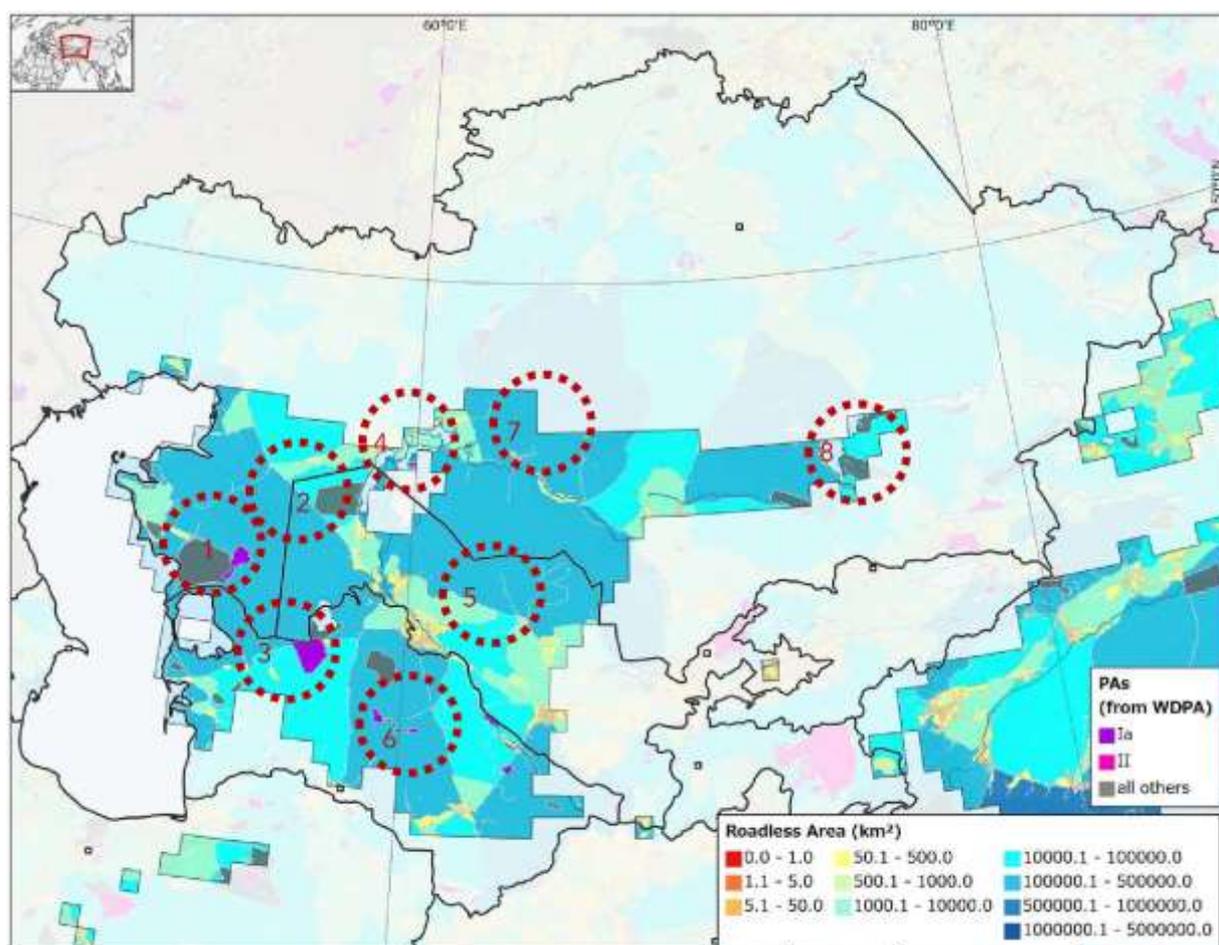


Fig 16 Road density in Bwk climate zone (Kottek et al. 2006), PAs (IUCN and UNEP-WCMC 2017).

Out of this list conservation in the following regions is or has been recently addressed via the strengthening or establishing PAs:

In Kazakhstan, UNDP/GEF implements a range of project under the Zhazyl Damu programme 20192020, focusing on desert ecosystem and in particular the southern deserts:

- Western Ustjurt (No1) - Establishment of new PA (Mangistau State Reserved Zone) covering 2,676,262 ha;
- Ili-Balkhash region (No 8) Establishment of new PA (Ile-Balkhash State Nature Reserve) covering 442,296 ha;
- Northern Ustjurt (No2): Expansion of existing PA (Ustyurt State Nature Reserve) by approximately 220,000 ha;

- Little Aral Lake Region (No 4): Expansion of existing PA (Barsakelmes State Nature Reserve) by 5,770 ha;
- Ustjurt PAs: Establishment of a wildlife corridor between Barsakelmes and Ustjurt PAs of approximately 750,000 ha;

Furthermore priority region No 7 is part of UNDPs programme; here also in Uzbekistan, UNDP/GEF projects addressed PA development topics for the priority sites:

- Northern Ustjurt (No 2) - Enlarging Saigaji State Nature Reserve and converting it into a Strict Nature Reserve

#### 4.2. Logical sequence of priority regions selected

Having said this, the consequent logic for preselection regions to work looks like the following:

1. Focus is put on the Middle Asian subdivision of Bwk climate zone of Koeppen.
2. Herein, southern deserts and middle deserts are key, as they represent the highest desert habitat diversity due to different substrate and plant species composition.
3. Southern deserts are even more emphasised as the Haloxylon dominated sand massif they represent are peculiar on a global scale and most distinctive for Central Asia. Stone, gypsum and salt deserts also occur on other place of the world often they have a lesser biodiversity.
4. The integration of the region into a governmental plan or the existence of a PA is a precondition.
5. Existing or recommended IBA's are an important valuable selection criterion, as recent biodiversity data supported the IBA designation.
6. Existing information on species of interest (CMS or others) is important although data base is insufficient, in particular for comparison between sites.

Adding to this, the following aspects also support the process of pre-section:

1. A certain diversity of landscape and habitats should be given to represents the unique diversity of Middle Asian desert.
2. Former recommendation of the priority region in other gap analysis's is an asset but no precondition.
3. Transboundary cooperation is an option to be considered, yet still unrealistic in daily practice of conservation in Central Asia.
4. Existing or just closed funding or support programmes, e.g. UNDP/GEF programmes into priority regions are rather a hindering then supporting factor for engagement due to:
  - no clear coherence of the project targets,
  - unknown history of project and target communication on site,
  - efficiency,
  - avoidance of double spending, - visibility of the project.

#### 4.3. Priority Conservation Regions to be addressed

As a consequence of 4.2., the following priority conservation regions (PCR) should be of priority interest for extended efforts into PA development:

1. Central Kyzylkum (UZ) for the reason of:
  - being a sand massif,
  - sand ecosystems underrepresented in the national PA network, offering different habitats and IBA sites, are part of the national PA extension programme; no present international projects ongoing
2. Southern Ustjurt (TKM, UZ) for the reason of:
  - holding a large variety of desert habitats,
  - offering a IBA wetlands,
  - harbouring Kulan, Ustjurt urial and eventually other species of interest,

- offering unique geological (Chinks) and archaeological features (e.g. desert kites),
  - offering transboundary cooperation potential (requires PA establishment on the UZ side)
3. Deserts and wetlands at the Little Lake Aral (KAZ) for the reason of:
- hosting a high diversity of deserts habitats,
  - chinks at the Aral Sea,
  - being an important sit for migratory birds. Although a UNDP project has recently been implemented on the delta of Syrdarya and Barsakelmesh

island, focus of additional PA work could be laid to the northern / northwestern shore and beyond.

4. Central Karakum (TKM) is fulfilling the logical from 1-5, as well as 7,8 & 10, however few data is available on species diversity. Additionally, only recently a national park has been established which provided legal conservation status. Yet, the project can still invest into enlarging the national park or supporting various other management aspects.

Second priority would be Betpak Dala (KAZ) yet here, like in all other Kazakh priority regions, many conservation initiatives have been take place in the young past or are ingoing including Northern Ustyurt in UZ. Given the limited resources available in the project, the pioneer character of the Michael Succow Foundation as well as the required visibility, the project may focus on stand alone components in regions yet having received only little international attention.

Our subjective comparison between the single priority conservation regions looks like follows (Fig 17):

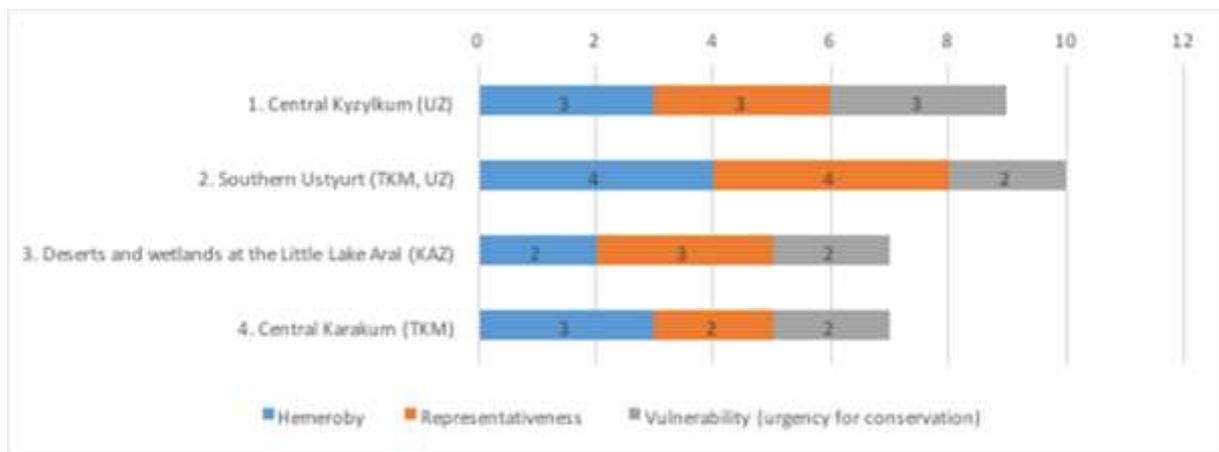


Fig 17 comparison between PCR, based on expert judgment of the author, thus being subjective. For higher rate of objectivism, the regions have to be downscaled to more particular sites.

Any final re-assessment and selection should be made according to political feasibility and emphasise of the project. Whereas KAZ had a progressive of PA establishment in the past, national efforts and political support were less in Uzbekistan and lowest in Turkmenistan.

## 5. Potential of World Natural Heritage in the cold winter desert biome of Central Asia

### 5.1. Challenges for World Heritage nominations of Middle/Central Asian landscapes

In the three Middle Asian desert countries, only Repetek (TKM) is yet mentioned on the WH tentative list. Any other region to be worked with, would first require the inclusion into the tentative list. States parties shall submit tentative lists to the Secretariat, at least one year prior to the submission of any nomination. Having said this, any nomination which focus on different regions requires the update of the national tentative list first, a process which may take one year (which, however, could be used in parallel to gather scientific data on biodiversity).

As the evaluation report of Koytendag WHS nomination (IUCN 2016) reveals, there are several challenges in regard to the nomination of Middle Asian (desert) sites. Namely these are:

- The underrepresentation of “Turanian Province, cold winter (continental) deserts and semi- deserts biome” on the World Heritage list did not add any value to the nomination<sup>4</sup>
- The level of biodiversity and in particular globally threatened species is of high relevance for the nomination - which is a challenge for the desert due to the low data availability
- Global priorities (like Zero Alliance for Extinction) is paid serious attention – a participation the deserts of Middle Asia cannot offer.
- The scientific board repeatedly underlines the higher value of a different Turkmen site for WH nomination, presumably being Badrys State Nature Reserve. Other potential candidates, e.g. Repetek are not mentioned.

Adding to this<sup>5</sup>, the OUV in regard to threatened animals and plants is evaluated at the level of:

- Globally threatened (IUCN Red Listed) taxa have OUV. Nationally threatened taxa do not, since they may be common elsewhere in their range.
- Globally threatened species have a higher OUV than globally threatened subspecies, populations or varieties since the latter may be part of more widely distributed, nonthreatened species.
- Globally threatened taxa that are not so far represented in other WH sites should have a higher OUV than those that are.
- Taxa in higher categories of threat have greater potential for OUV than those in lower, categories since their conservation is of greater immediate priority.
- Globally threatened taxa that can act as keystone or flagship species, whose effective conservation would ensure the survival of many other species occupying the same habitats, have a higher potential for OUV. In Central Asia these would include ungulates and larger carnivores, sturgeon and some waterfowl and raptors.

Having said this, as for species of global concern (e.g. CMS species), Saiga is already reflected in a WH site (Steppes of KAZ), Bactrian camel has its last range in the tentative list site of Desert Landscapes of Mongolian Great Gobi. The Kulan could be used as a focal species, as does Ustyurt Urial or Goitred gazelle, which’s number seem to sharply decline in its entire region (CMS 2014).

In principle, a solid justification and comparative analysis of the outstanding uniqueness on the level of biodiversity and species will be a challenge. Yet it is not to expect that a comparison of numbers of e.g. Gazelles with other desert regions in the range is a requirement, based on the scattered data available. However, a proof that the nominated sites holds a significant or valuable population is a strong asset.

Desert associated taxa and species for which single Middle Asian countries or single regions within countries have a key responsibility do not exist, usually the range of desert species is vast. The occurrence of raptors can be an argument, yet e.g. Saker falcon or Steppe eagle occur in a wide range, into foothills and steppe ecosystems. As for reptiles and small mammals (e.g. Jerboa) the desert host a great abundance and diversity (particularly the sand deserts). Yet only for few, site specific data on numbers and status are available.

Another, (technical) challenge for WH site nominations will be the aspect of integrity. Only few potential regions in Middle Asia have a protected area regime on the ground, being able to manage the site appropriately. Yet, without any nationally designated PA, WH sites nomination will not be eligible. The project may need to invest into establishing adequate national structures as well as updating the tentative list first.

## 5.2. Background & selection criteria

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<sup>4</sup> In any case it is questionable if the Koydandag range can be referred to as being part cold winter desert biome <sup>5</sup> according to Magin 2005

The World Heritage Convention seeks to identify, protect, conserve, present and transmit to future generations cultural and natural heritage of Outstanding Universal Value (OUV) (UNESCO 2011). Herein, according to Art 2, natural heritage is defined as:

- natural features consisting of physical and biological formations or groups of such formations, which are of Outstanding Universal Value from the aesthetic or scientific point of view;
- geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of Outstanding Universal Value from the point of view of science or conservation;
- natural sites or precisely delineated natural areas of Outstanding Universal Value from the point of view of science, conservation or natural beauty.

Outstanding Universal Value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole (UNESCO 2015).

For assessing the value, global or regional importance and irreplaceability of particular sites, usually reference is made to available international conservation prioritization schemes (Bertzky et al. 2013) such as:

1. Biodiversity hotspots and so-called 'high-biodiversity wilderness areas'
2. Global 200 terrestrial priority ecoregions
3. Centres of Plant Diversity
4. Endemic Bird Areas

Many parts of the world, including cold-winter deserts according to Udvardy biomes, are not yet represented in biodiversity WH sites (Bertzky et al. 2013). But coverage in terms of 'representativeness' as such is not the key criterion of the WH Convention, it does not qualify for a site per se. Instead the WH Convention recognizes properties of Outstanding Universal Value, whether or not they are from under-represented or over-represented realms and biomes.

The World Heritage Committee considers a property as having Outstanding Universal Value if the property meets one or more of several specific criteria.

Regarding the scope of this study, potentially nominated properties shall therefore:

- (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
- (viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
- (ix) be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
- (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation.

To be deemed of Outstanding Universal Value, a property must also meet the conditions of integrity and/or authenticity (Fig 17) and must have an adequate protection and management system to ensure its safeguarding (UNESCO 2011). For all properties nominated under criteria (vii) - (x), biophysical processes and landform features should be relatively intact.

Attributes	Outstanding Universal Value	Conditions of Integrity
Criterion N(vii)	Very best phenomena / stunning beauty	Integrated and linked elements
Criterion N(viii)	Best example of Earth's History	Complete set of features
Criterion N(ix)	Best ecological features	Sufficient size / allowing long term processes to continue
Criterion N(x)	Best natural habitats / <i>in situ</i> ecosystems / species	Viable populations / migratory routes / protected areas

Fig 18 Conditions of integrity and/or authenticity. (Magin 2005)

Practically no area is totally pristine and all natural areas are in a dynamic state, and to some extent involve contact with people. Human activities, including those of traditional societies and local communities may be consistent with the Outstanding Universal Value of the area where they are ecologically sustainable.

### 5.3. Middle / Central Asian Deserts in global prioritisation focus?

The desert ecosystems of Middle Asia score low in regard of global biodiversity value. Except for the Global 200 (WWFs proposal on globally outstanding territories), they are neither part of any of the international conservation prioritization schemes (mentioned above). Also for the site based approaches like “Alliance for Zero Extinction sites” or “Non-Avian Key Biodiversity Areas” the Middle Asian deserts are not part of.

Yet, in a study of IUCN (IUCN 2004), the Central Asian deserts have been mentioned as having potential as natural or mixed WH sites.

However, Magin (2005) although outlining the rich desert life in all of Central Asia, does not propose a concrete site to be nominate as WH sites in of the former post Soviet countries. It has to be taken into account that Magin only focus on Udvardy’s Turanian biogeographical province (2.21.8.) when addressing desert ecosystems thus neglecting the Chinese and Mongolian deserts which are also part of Koeppens Bwk climate classification as well as Udvardy’s cold winter deserts biome. It is to assume that, within the comparative analysis of the nomination as well as evaluation by IUCN the biome will play a particular role, not only the biogeographical province.

Furthermore, also Goudie & Seely (2011) do not mention any Middle Asian region of being a potential priority for tentative list development and eventually WH inscription. Yet, the authors identify the Taklamakan desert (China) as area of high potential for listing. Also they identify one “priority geomorphological sites” which may have potential as World Heritage property in Central

Asia, being Badain Jaran, China, an interior desert and already national geopark. The Great Gobi Desert in Mongolia the authors assign particular geomorphological processes or landforms as potential to demonstrate Outstanding Universal Value). In their assessment of national tentative it makes wonder that the Repetek site (Turkmenistan, listed in 2009) has not been considered for assessment. Whether the reason is that the authors may have focused on “earth science features” or not remains unclear.

At present, there are no WH sites in this ecoregion. The Uvs Nuur Basin (Mongolia, Tuva/Russia) has been mentioned at the UNESCO webpage as cold desert biome although a clear distinction to Middle Asian deserts can be made as the Uvs Nuur site is a mountainous basin with mountain- and wetland cluster being part of this WH site. The Badai-Jaran desert in China (Inner Mongolia) is an UNESCO Geopark (part of Alxa Desert Geopark) offering impressive sand dune and geological formations. Existing deserts sites on the Central Asian tentative list of natural heritage are:

1. Desert Landscapes of the Mongolian Great Gobi (Mongolia)
2. Taklimakan Desert—*Populus euphratica* Forests (China)
3. Repetek (TKM)

#### 5.4. Natural World Heritage in Middle Asian Deserts – is there an OUV?

Any World Heritage Site nomination is something about fact based story telling. To do so, the question needed to be answered in regard to Middle Asian deserts would be: which story to tell is unique and outstanding, also in comparison to surrounding biomes or alternative WH sites in the same climatic region?

Thus, what could be OUV of Middle Asian deserts, being most likely to be accepted by the convention?

There should be a story to be told about the Middle Asian deserts. Whether it is the story of its size and black sands, (partly dense vegetation covering 350.000 square kilometre in the Karakum desert – the biggest desert in Central Asia), the story of ancient oasis cultures and the historic Silk Road, the story of the oldest desert research station in the world (Repetek, TKM), or stories of migratory mammals and birds (mainly along the wetlands in the desert) of global concern as well as the diversity of desert habitats (stone, clay, salt, sand).

We propose to cluster the OUV somehow around these potential stories- which reflect the particular value of Middle Asian deserts:

- diversity of deserts (sand, stone, clay, salt, gypsum, loess) and geological processes,
- high biomass production in the sand massifs due to characteristic Saxaul,
- silk road history and the oasis culture in the Central Asian desert

Question remaining: Is one of these aspects outstanding, or does there need to be a combination? And, even if paired – where would be the location representing which/any story?

#### 5.5. Pro & Contra Arguments for Middle Asian deserts to be nominated as WHS

An *incomplete* collection of pro and contra arguments regarding nature emphasised WH nominations in Middle Asian deserts is given:

Criterion (vii): Superlative natural phenomena or natural beauty or aesthetic importanceZ

Pro	Contra
Central Asian deserts are the largest cold/temperate deserts in the world, among them the Turanian desert are the largest	Sand dunes in Middle Asia are neither high nor long enough if compared to Taklimakan desert sand formations
Chinks on Ustyurt as remnants of Tethys Ocean	

Criterion (viii): representing major stages of earth's history

Pro	Contra
Chinks on Ustyurt as remnants of Tethys Ocean	No <u>active</u> <sup>5</sup> and <u>ongoing</u> geological processes like volcanism or tectonic movements like in other WH sites
Ongoing sand dune formation (although not as impressive than in China)	
Paleozoic rocks in Kyzylkum desert	

<sup>5</sup> active processes are of major interest for the nomination, less prehistoric geological events and sights, which could also qualify for an UNESCO Geopark

Ten lithodaphic desert types (Fet & Atamuradov 1994)	
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Criterion (ix): Ecosystems/communities and ecological/biological processesZ

Pro	Contra
Vegetation richness (especially on sand) the “black desert” Karakum with Haloxylon, which is higher in comparison to e.g. Taklamakan desert	Without wetland ecosystem included the desert species communities will not be outstanding enough (e.g. Saryarka – Steppe and Lakes of Northern Kazakhstan includes globally threatened species like the extremely rare Siberian white crane, the Dalmatian pelican, Pallas’s fish eagle and a major population of Saiga)
A large and pristine part of the representative landscape	Although rich in vegetation, only limited Red List species
Central Asian Deserts (semi-deserts and steppes) have been used and grazed for millennia, making a big difference to North American deserts (West 1983)	Wetlands in TKMs sand desert often artificial (e.g. Sarykamish Lake and IBA site Kattashor - Romankul lakes are formed from collectordrainage waters)
Permanent carbon fixation due to woody plants in sand massifs	
Middle Asiam desert are rich in terms of habitat diversity, lithoedaphic types and thus particular plant and animal adaptation schemes	
Sand desert said to be the richest in Biodiversity (Magin, 2005, <a href="https://www.worldwildlife.org/ecoregions/pa131_2">https://www.worldwildlife.org/ecoregions/pa131_2</a> )	Sand desert said to be the richest in Biodiversity (Magin, 2005, <a href="https://www.worldwildlife.org/ecoregions/pa131_2">https://www.worldwildlife.org/ecoregions/pa131_2</a> ) yet spatial not explicit statement, thus hard to prove or to be used for delineation of nomination site

Criterion (x): Biodiversity and threatened species

Pro	Contra
IBA sites with good data background	Few comparative site specific data on red list species (for example on Goitred gazelles)
Goitred gazelle (IUCN VU) with declining number in e.g. Ustyurt	No plant or animal specie (with know population) with restricted range to Middle Asian desert
Ustyurt Urial and Kulan as typical and/but threatened desert species for which data is existing (at least Usyurt region)	CMS species with good or better populations also outside target region
Pro	Contra
	Rate of globally endangered species, genus, family low
	Data availability to prove biodiversity value low
In Repetek about 200 vertebrates (29 mammals, 23 reptiles, 140 birds)	Only 200 vertebrates in exemplary desert landscape of Repetek;

	<i>Passer ammodendri</i> and <i>Podoces panderi</i> typical for sand desert of Middle Assia but only IUCN LC and wide range in Middle Asia, partly Central Asia
	No particular threatened IUCN Red List bird depending on the Middle Asian desert (e.g, Houbara Bustard, Steppe Eagle, Saker Falcon) – yet, they could still be used as some argument
	Red list tree species do not occur (Eastwood et al. 2009)

As shown above, the concentration to one criterion should be avoided as an OUV could not be reached by doing so. Still, also by combining criterions, the baseline data set needs to be strengthened to enable a comparative analysis.

### 5.6. Additional arguments and linkage to cultural heritage and other ecosystems (wetlands)

If natural arguments seem to be not sufficient, linkage to cultural criterions and the chance of a mixed nomination could be considered.

For a complex nomination of a desert sites in Turkmenistan, preferable is located around the tentative list site of Repetek, some supporting arguments exist:

- Repetek Scientific Desert Research Station has been established already in 1912 and thus is (one of?) the oldest in the world; Repetek Protected Area has already been established in 1928 leading to the fact that the Karakum desert is one of the best studied deserts in the world (Walter & Breckle 1986)
- Remnants of oasis, historic settlements, caravanserai and spiritual places can be found scattered throughout the deserts, including one of the best examples:  
The Oxus civilisation – Gonur Tepe (<https://goo.gl/maps/mT4oJKXkuL2>) – “Bactria–Margiana Archaeological” Complex close to Merv as witness of bronze age civilisation (around 2000 BC); located at the delta of Murgab River, Eastern Karakum desert  
([http://www.iaw.unibe.ch/forschung/vorderasiatische\\_archaeologie/stadtentwicklung\\_und\\_landnutzung\\_in\\_gonur\\_depe\\_turkmenistan/index\\_ger.html](http://www.iaw.unibe.ch/forschung/vorderasiatische_archaeologie/stadtentwicklung_und_landnutzung_in_gonur_depe_turkmenistan/index_ger.html))

Apart from that, there are also other cultural sites, which may increase the chance for WH designation, if linkage to Cultural Heritage is to be established. Out of the existing WH and tentative list sites, the following could be relevant:

existing WH sites:

- Kunya-Urgench (TKM)
- Merv (TKM) tentative list sites:
- Desert Castles of Ancient Khorezm (UZ)
- Silk Road (all countries)
- Archaeological sites of Otrar oasis (1998)? (KAZ)
- Dehistan / Mishrian (TKM)

In particular the regional initiative to designate the Silk Road as WH offers some potential of the deserts to be included. As the example of the “Incense Route - Desert Cities in the Negev” WH in Israel shows, trading routes and its architectural remnants as well as protected area are eligible for

WH designation. The Silk route, its caravan and trading history, crossing all the vast desert massifs of Central Asia – from Iran to China and Mongolia are similar attractive and a unifying landscape element within a mixed nomination.

Alternatively, if not adjoining, emphasis could be laid on the desert- and oasis cultures of Central Asia. By doing so, not only another distinction to northern deserts can be made (no oasis culture due to better climate and vegetation conditions) but also a peculiar historic – desert/water/oasis/high culture can be underlined.

Some authors like Glantz & Figueroa (1997) discuss the potential Aral Sea to become WH site. Whereas the authors recognize the potential for various reasons, neither has the lake (remnants) been mentioned on the tentative list, nor would be clear what criterion may be used for submission. Using a WH nomination of the Aral as monument for mans disastrous nature relation may not qualify for acceptance. However, as mentioned in chapter four, from landscape perspective the northern part of Lake Aral, including the former island and protected areas of Barsaqelmesh offer a high diversity. Different desert types, Kulan, Goitred gazelles, an IBA, state governmental support are given. Yet, the negative connotation of the lakes history as well eventually weak OUV may remain contra arguments for this region.

### 5.7. Conclusion and Recommendation

A single raised bog patch is not a place of high biodiversity. But if looked at it from a wider perspective and including different sites, it becomes highly diverse and thus valuable. Similar are the desert in Middle Asia- which is a story to tell. None desert patch alone would fulfil the criterion (ix) or (x), yet a combination of the different desert habitats, including wetlands and oasis, the picture looks different.

Due to that, a nomination focusing on the diversity of deserts, including biodiversity seems most promising. Whether this “story of diversity” emphasises culture, abiotic or biotic features is a strategic decision to be taken by the institutions preparing the nomination.

Generally spoken, the Central Asian deserts support the richest desert life in all of Asia and due to that are classed as globally outstanding by WWF (Ecoregion No 134). The ecoregion is composed of a mosaic of clay, stone, salt, and sandy deserts – which consequently should be reflected in a nomination.

Nominating single cluster (if possible but not required) in spatial proximity seems advisable as well as the inclusion of other ecological valuable sites and habitats such as riparian lands and oases. Existing IBAs, as the only existing international categorisation of relevance in Middle Asian deserts should be part of any nomination to increase chances.

Having said this, the following options for the Turanian biogeographical province occur:

1. Regional cluster and serial nomination of Middle Asian sand massifs with Black and White Saxaul (Karakkum, Kyzylkum, Muynkum) under criterion ix & x

A nomination of the sand deserts of Middle Asia would stand the comparative analysis to some extent, as there is nothing comparative – black sand due to high productivity – in Central Asian deserts, these territories are highly representative for Middle Asia.

This serial and cluster nomination could be centred around the Repetek BR, the only desert site on WH tentative list in Middle Asia and perhaps the best preserved Saxaul stands<sup>6</sup>. Pro Arguments is the good representation of the characteristic, biomass rich expression of the largest Middle Asian Desert. Due to the high biomass availability and ecological niches a (in comparison to other deserts) high biodiversity is expected – which needs to be classified still. The history of Repetek station is an added value but the IBAs west of Repetek will certainly count more and need to be included. Adding to this cluster could be a site in Central Kyzylkum for which the Palaeozoic rock escarpments are characteristic, existing IBAs will support the nomination. The same would be valid for a site

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<sup>6</sup> as „uniqueness“ is one of the key aspects of OUV

(to be defined) in the Ili-Balkhash Delta (KAZ). Here to a particular expression of Saxaul dominated, biomass and biodiversity rich habitat can be found, linked to a large and important wetland complex.

The challenge of this nomination might be the weak outstanding value of species under criterion (x), thus focus need to put on ecosystems under criterion (ix), criterion (vii) should also be stressed, although superlative natural phenomena are hard to justify for the sand massifs. As for this, the Taklamakan or Gobi Sand massifs are more impressive.

This option certainly would require the least coordination efforts on national as well as regional level, in particular as with Repetek BR a protected area and tentative list site already exists. A national nomination by TKM could be a start, UZ and KAZ then could follow in a series of nominations.

Choosing this option would also mean to exclude other representative cold winter deserts biome of equal value like the plateau and chink formation in the western part of Udvarý's Turanian province. As the Middle Asian sand massif would compete with Mongolian and Chinese deserts as well as with other cold winter deserts in Southern Hemisphere (within the comparative analysis), adding value by including deserts diversity could result in higher likelihood for success (Option 2).

## 2. Cluster of desert diversity, e.g. of Southern Ustyurt<sup>7</sup> under criterial vii, viii and x

The nomination would focus on the very heterogeneous expression of Cold Winter Deserts but also highlights like 100m high cliffs and globally threatened species. This serial and cluster nomination would require an update of the tentative list in Uzbekistan, Kazakhstan and Turkmenistan first. Also, for the criterion of integrity a protected area would need to be established in Uzbekistan. However, being a serial nomination, KAZ and TKM could start, as here PAs already exist (Kaplankyr Zapovednik in TKM, Ustyurt Zapovednik in KAZ). To proceed immediately and to strengthen the WH nomination for KAZ, a first and easier nomination of UNESCO Geopark could be a strategic option. Another prerequisite would be to enlarge the Kaplankyr Zapovednik - to include representative, sand dominated desert sites, which occur less (in close proximity) on the Ustyurt plateau in KAZ and UZ. Due to the complexity of the nomination, and the inclusion of criterion (viii), there is little comparative in Middle Asia and also Central Asia. The story of i) Tethys ocean with the cliffs (where globally threatened birds like the Sager Falcon breed), ii) the sand deserts and the other desert diversity, iii) Ustyurt Urial, Kulan, Goitres Gazelles - key animal species for the region and iv) protected areas may offer chances for success. Lake Sarykamysh, an IBA site eventually to be included into the nomination, would require some attention and repeated counts at migratory and wintering season.

A nomination should pay attention that each of the component part contributes to the Outstanding Universal Value of the property as a whole in a substantial, scientific, readily defined and discernible way and should reflect the relevant cultural, social, landscape, ecological, evolutionary or habitat connectivity (UNESCO 2015). Having said this, the different objectives should representatively enclose the different landscape feature of the Turanian deserts, e.g. one site with the cliffs and mammals, one with the IBA sites, one with floristic diversity and characteristic Saxaul on sand etc.

## 3. Linking the desert landscape and its oasis culture (distinction to surrounding landscapes) to a cultural nomination, preferable the Silk Road nominations process in all countries or oasis cultures e.g. around Merv (Geno Tepe, Repetek) in TKM

The Silk Road is of OUV, no doubt. A nomination process, currently in preparation, will certainly be accepted. This may offer chances for linking the cultural heritage of this trading route to the landscape it formerly run through and which formed and influenced the character of this route, its oasis, its culture, habits and people. If seen as an integrated approach, the desert cluster as of Option (1) could benefit from the cultural OUV. Challenge for this approach will be the negotiation and coordination with the ongoing Silk Road work as well as lacking sites on the tentative list being most appropriate; cultural options for UZ would need to be assessed.

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<sup>7</sup> could also be extended to include Mangyshlak region, northwest of Ustyurt

The final decision for progress needs to be taken by the implementing institutions, also based on political feasibilities. Transnational nominations and the required coordination, as well as national pride can be a hindering factor (less if an independent serial nomination is envisaged). In case of TKM, international recognition via WH designation can also be a lever for the work on the ground. Whether the rejected nomination of Koytendag creates political obstacles for any other nomination in TKM needs to be assessed prior starting the process. As any serial nominations, can be phased over several nomination cycles, coordination with the Committee is advised to ensure guidance and good planning.

## 6. Bibliography

- AlHirsh, I., Battisti, C. and Schirone, B., 2016. Threat analysis for a network of sites in West Bank (Palestine): An expert-based evaluation supported by grey literature and local knowledge. *Journal for Nature Conservation*, 31, pp.61–70. Available at: <file://www.sciencedirect.com/science/article/pii/S161713811630019X>.
- Bertzky, B. et al., 2013. *Terrestrial Biodiversity and the World Heritage List: Identifying broad gaps and potential candidate sites for inclusion in the natural World Heritage network.*, Gland, Switzerland and Cambridge, UK.
- Cantú-Salazar, L. and Gaston, K.J., 2010. Very Large Protected Areas and Their Contribution to Terrestrial Biological Conservation. *BioScience*, 60(10), pp.808–818.
- CAREC, Zoi Network and Flermoneca, 2015. *The State of the Environment in Central Asia*, 52pp.
- CMS, 2014. *Convention on the Conservation of Migratory Species of Wild Animals - PROGRAMME OF WORK FOR THE CENTRAL ASIAN MAMMALS INITIATIVE (2014-2020)*. 9 pp. Available at: [http://www.cms.int/sites/default/files/document/Doc\\_05\\_Draft\\_Programme\\_of\\_Work\\_0.pdf](http://www.cms.int/sites/default/files/document/Doc_05_Draft_Programme_of_Work_0.pdf)
- Cowan, P.J., 2007. Geographic usage of the terms Middle Asia and Central Asia. *Journal of Arid Environments*, 69(2), pp.359–363. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S0140196306002916> [Accessed January 23, 2014].
- De Pauw, E. (2007) *Principal biomes of Central Asia*. In: Lal, R., Suleimenov, M., Stewart, B.A., Hansen, D.O. and P. Doraiswamy (eds), 2007. *Climate Change and Terrestrial Carbon Sequestration in Central Asia*, Taylor and Francis.
- Dinerstein, E. et al., 2017. An Ecoregion-Based Approach to Protecting Half the Terrestrial Realm. *BioScience*, 67(6), pp. 534-545.
- Eastwood, A., Lazkov, G. and Newton, A., 2009. *The red list of trees of Central Asia*, Cambridge.
- Fet, V. and Atamuradov, K.I., 1994. *Biogeography and Ecology of Turkmenistan*, Springer.
- Glantz, M.H. and Figueroa, R.M., 1997. Does the Aral Sea merit heritage status? *Global Environmental Change*, 7(4), pp.357–380.
- Goudie, A. and Seely, M., 2011. *World Heritage Desert Landscapes: Potential Priorities for the Recognition of Desert Landscapes and Geomorphological Sites on the World Heritage List*, Gland, Switzerland.
- Groves, C.R. et al., 2002. Biodiversity Conservation : Putting into for Planning. *BioScience*, 52(6), pp.499–512.
- IUCN and UNEP-WCMC, 2017. *The World Database on Protected Areas (WDPA)*, Online, March 2017, Cambridge, UK: UNEP-WCMC. Available at: [www.protectedplanet.net](http://www.protectedplanet.net).
- IUCN, 2016. *IUCN World Heritage Evaluations 2016*, IUCN report for the World Heritage Committee, 40<sup>th</sup> session, Istanbul, Turkey 10-20 July 2016. 176 pp. Available at: <http://whc.unesco.org/archive/2016/whc16-40com-inf8B2-en.pdf>
- IUCN, 2004. *The World Heritage List: Future priorities for a credible and complete list of natural and mixed sites. A Strategy Paper prepared by IUCN*. April 2004, 18 pp., Available at: [https://www.iucn.org/sites/dev/files/import/downloads/ouv2004\\_english.pdf](https://www.iucn.org/sites/dev/files/import/downloads/ouv2004_english.pdf)
- Kashkarov, R.D., Welch, G.R. and Brombacher, M. (eds)., 2008. *Important Bird Areas in Uzbekistan – Priority sites for conservation.*, Tashkent, Uzbekistan.
- Kottek, M., J. Grieser, C. Beck, Rudolf, B. and Rubel, F., 2006. World Map of the Köppen-Geiger climate classification updated. *Meteorologische Zeitschrift*, 15, pp.259–263.
- Krever V., Stishov M. and Onufrenya, I., 2009. *National protected areas of the Russian Federation: GAP analysis and perspective framework*. WWF-Russia, The Nature Conservancy, MAVA, Moscow, 80 pp.
- Krever, V., Pereladova, O., Williams, M. and Jungius, H., 1998. *Biodiversity conservation in Central Asia: An Analysis of Biodiversity and Current Threats and Initial Investment Portfolio*, Moscow, 112 pp.

- Lal, R., Suleimenov, M., Stewart, B.A., Hansen, D.O. and Doraiswamy, P., (eds) 2007. *Climate Change and Terrestrial Carbon Sequestration in Central Asia*, Taylor and Francis.
- Magin, C., 2005. *World Heritage Thematic Study for Central Asia -A Regional Overview*, 77 pp. Available at: [https://www.iucn.org/sites/dev/files/import/downloads/central\\_asia.pdf](https://www.iucn.org/sites/dev/files/import/downloads/central_asia.pdf)
- Myers, N. et al., 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403(6772), pp.853–858. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/10706275>.
- Olson, M.D. and Dinerstein, E., 1998. The Global 200 : A Representation Approach to Conserving the Earth’s Most Biologically Valuable Ecoregions. *Conservation Biology*, 12(3), pp.502–515.
- Pfadenhauer, J.,S. and Klötzli, F.A., 2014, *Vegetation der Erde: Grundlagen Ökologie, Verbreitung*. Springer-Verlag.
- Rachkovskaya, E.I., Volkova, E.A. and Khramtsov, V.N., 2003. *Botanical Geography of Kazakhstan and Middle Asia (Desert Region)*, St. Petersburg. 424 pp.
- Runge, C.A. et al., 2015. Protected areas and global conservation of migratory birds. *Science*, 350(6265).
- Schmitt, C.B., 2011. A Tough Choice: Approaches Towards the Setting of Global Conservation Priorities. In: Zachos, F.E., and J.C. Habel (eds) 2011. *Biodiversity Hotspots*. Springer-Verlag, Berlin Heidelberg.
- Schroeder, F.-G., 1998. *Lehrbuch der Pflanzengeographie* UTB für Wi., Wiesbaden: Quelle and Meyer.
- Schweizer, M. et al., 2014. Conservation Action Based on Threatened Species Capture Taxonomic and Phylogenetic Richness in Breeding and Wintering Populations of Central Asian Birds. *PLoS ONE*, 9(10).
- Stadelbauer, J., 2003. Mittelasien – Zentralasien : Raumbegriffe zwischen wissenschaftlicher Strukturierung und politischer Konstruktion. *Petermanns Geographische Mitteilungen*, 147(5), pp.58–63.
- Udvardy, M.D.F., 1975. *A Classification of the Biogeographical Provinces of the World*, Morges, Switzerland.
- UNDP 2015. *5th National Report of the Republic of Uzbekistan on conservation of Biodiversity*, Uzbekistan, 62 pp.
- UNESCO, 2015. *Operational Guidelines for the Implementation of the World Heritage Convention, (July)*. United Nations Educational, Scientific and Cultural Organization.
- UNESCO, 2011. *Preparing World Heritage Nominations (Second edition)*, United Nations Educational, Scientific and Cultural Organization.
- Walter, H. and Breckle, S.W., 1986. *Ökologie der Erde Bd 3. Spezielle Ökologie der Gemäßigten und Arktischen Zonen Euro-Nordasiens*, Stuttgart: Gustav Fischer Verlag.
- West, N.E., 1983. Comparisons and contrasts between the temperate deserts and semi-deserts of three continents. In: West, N.E. (ed), 1983 *Ecosystems of the World (Vol 5): Temperate Deserts and Semi-Deserts*. Elsevier Science Publishers. Amsterdam
- Zhang, Chi, Lu, Dengsheng, Chen, Xi, Zhang, Yuanming, Maisupova, Bagila and Ye Tao, 2016. The spatiotemporal patterns of vegetation coverage and biomass of the temperate deserts in Central Asia and their relationships with climate controls. *Remote Sensing of Environment* 175, pp.271– 281.

## 7. Appendices

### WHS Tentative Lists

States Parties shall submit Tentative Lists to the Secretariat, at least one year prior to the submission of any nomination. Tab 2

Country	Sites

Turkmenistan	<ul style="list-style-type: none"> <li>• <u>Dehistan / Mishrian (1998)</u></li> <li>• <u>Badhyz State Nature Reserve (2009)</u></li> <li>• <u>Syunt Hasardag State Nature Reserve (2009)</u></li> <li>• <u>Dinosaurs and Caves of Koytendag (2009)</u></li> <li>• <u>Repetek Biosphere State Reserve (2009)</u></li> <li>• <u>Amudarya State Nature Reserve (2009)</u></li> <li>• <u>Hazar State Nature Reserve (2009)</u></li> <li>• <u>Silk Roads Sites in Turkmenistan (2010)</u></li> </ul>
Uzbekistan	<ul style="list-style-type: none"> <li>• <u>Zaamin Mountains (2008)</u></li> <li>• <u>Gissar Mountains (2008)</u></li> <li>• <u>Desert Castles of Ancient Khorezm (2008)</u></li> <li>• <u>Silk Roads Sites in Uzbekistan (2010)</u></li> </ul>
Kazakhstan	<ul style="list-style-type: none"> <li>• <u>Turkic sanctuary of Merke (1998)</u></li> <li>• <u>Megalithic mausolea of the Begazy-Dandybai culture (1998)</u></li> <li>• <u>Barrows with stone ranges of the Tasmola culture (1998)</u></li> <li>• <u>Petroglyphs of Eshkiolmes (1998)</u></li> <li>• <u>Petroglyphs of Arpa-Uzen (1998)</u></li> <li>• <u>Paleolithic sites and geomorphology of Karatau mountain range (1998)</u></li> <li>• <u>Archaeological sites of Otrar oasis (1998)</u></li> <li>• <u>Cultural landscape of Ulytau (1998)</u></li> <li>• <u>Northern Tyan-Shan (Ile-Alatau State National Park) (2002)</u></li> <li>• <u>State National Natural Park "Altyn-Emel" (2002)</u></li> <li>• <u>Aksu-Zhabagly state natural reserve (2002)</u></li> <li>• <u>Silk Road (2012)</u></li> <li>• <u>Petroglyph Site of Sauyskandyk (XVIII BC – III AD) (2016)</u></li> </ul>

China	<ul style="list-style-type: none"> <li>• <u>Chinese Section of the Silk Road: Land routes in Henan Province, Shaanxi Province, Gansu Province, Qinghai Province, Ningxia Hui Autonomous Region, and Xinjiang Uygur Autonomous Region; Sea Routes in Ningbo City, Zhejiang Province and Quanzhou City, Fujian Province - from Western-Han Dynasty to Qing Dynasty (2008)</u></li> <li>• <u>Taklimakan Desert—Populus euphratica Forests (2010)</u></li> <li>• <u>China Altay (2010)</u></li> <li>• <u>The Chinese Section of the Silk Roads (2016)</u></li> </ul>
Iran	<ul style="list-style-type: none"> <li>• <u>Hyrcanian Forest (Caspian Forest) (2007)</u></li> <li>• <u>Qeshm Island (2007)</u></li> <li>• <u>Arasbaran Protected Area (2007)</u></li> <li>• <u>Sabalan (2007)</u></li> <li>• <u>Khabr National Park and Ruchun Wildlife Refuge (2007)</u></li> <li>• <u>Alisadr Cave (2007)</u></li> </ul>
Country	Sites
	<ul style="list-style-type: none"> <li>• <u>Silk Route (Also as Silk Road) (2008)</u></li> <li>• <u>The Natural-Historical Landscape of Izeh (2008)</u></li> <li>• <u>Touran Biosphere Reserve (2008)</u></li> <li>• <u>Hamoun Lake (2008)</u></li> <li>• <u>Harra Protected Area (2008)</u></li> <li>• <u>Damavand (2008)</u></li> </ul>
Mongolia	<ul style="list-style-type: none"> <li>• <u>Mongolian Daurian Landscape (2012)</u></li> <li>• <u>Desert Landscapes of the Mongolian Great Gobi (2014)</u></li> <li>• <u>Cretaceous Dinosaur Fossil Sites in the Mongolian Gobi (2014)</u></li> <li>• <u>Eastern Mongolian Steppes (2014)</u></li> <li>• <u>Highlands of Mongol Altai (2014)</u></li> <li>• <u>Sacred Mountains of Mongolia (2015)</u></li> </ul>