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Gobi desert protected areas in the Umnugovi Aimag, Mongolia

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Abstract
The article discusses the current state of specially protected natural areas in Umnugovi aimag. The protected areas main feature is the representation of special landscapes - Gobi' true deserts and desert steppe. The choice of the most dynamically developing aimag in Mongolia for analysis is due to its inaccessibility, small population, difficult living conditions and economic activity. The study used data from the Ministry of Environment and Climate Change of Mongolia and the Umnugovi aimag administration, information from the directorates of protected areas, and the results of observations during the 2023-2025 expedition. Attention is drawn to the problems of the wild animals migrations implementation. Recommendations are given on national level protected areas expansion, increasing the status of soum's level protected areas and creating new protected areas.

Keywords: Umnugovi aimag, Gobi Desert, specially protected natural areas, wild animal migration, biotic and landscape diversity

1. Introduction

As part of a scientific project "Geo-economic and geoecological priorities of the new resource-industrial development of the regions of eastern Russia and Mongolia in the context of the aggravation of the geopolitical situation and the creation of international transport corridors" on a comprehensive comparison of the fastest-growing areas, the features of the current state of the territorial nature protection system in the Umnugovi aimag in Mongolia and in the northern part of the Irkutsk region in Russia are being considered. Each of these areas is characterized by a low population, inaccessibility and remoteness, difficult physiographical conditions for living and economic activity. While permafrost and low winter temperatures come to the fore in the northern territories, high summer temperatures and water scarcity come to the fore in the southern ones. Nevertheless, it should be noted that the volume of mining industries (coal, oil, and gas) is growing extremely rapidly, as well as the construction and modernization of roads and railways, and the volume of transportation of extracted minerals, mainly to China [1, 2, 3].

On the other hand, these socio-economic and physio-geographical characteristics allow biotic and landscape diversity to be relatively well preserved. We emphasize that the Gobi Desert area requires the organization of significant specially protected natural areas (PAs) interconnected into a single system, which is especially important for the conservation of rare wide-area and migratory animal species with specific habitat niches (in particular Gobi kulan, Mongolian gazelle, Gobi bear). The PAs size is not so significant for the northern taiga territories, but for typical forest vegetation and animals, it is necessary to create a significant number of PAs to preserve areas key to reproduction and migration routes. Large, sparsely populated spaces make it possible to avoid splitting existing animal and plant populations into smaller groups.

As for the territorial nature protection in the Gobi Desert, scientific articles have been published describing either individual PAs, the landscape structure of the desert, or the distribution of certain species of rare plants and animals [4-7]. However, the scientific literature has not yet considered the analysis of the situation in general with the protection of the PAs system in the Gobi. This was the purpose of this scientific study. This article provides information on the current state and prospects for the development of the territorial nature protection in the Umnugovi aimag based on field studies of the territory in 2023-2025.

In the future, it is important to continue to consider the problem of cross-border interaction of Gobi protected areas both in Mongolia and in the Inner Mongolia Autonomous Region in China. At the moment, only one article has been published concerning the protected areas of Inner Mongolia [8]. It should be noted that the PAs categories in Mongolia are similar to the Russian approach. Such PAs categories as strictly protected areas correspond to Russian nature reserves (zapovednik), Mongolian nature refuges (zakaznik), and natural monuments essentially coincide with similar ones in Russia. These PAs categories have appeared in Mongolia since the 1960s. But the national parks category, characteristic of the American approach to territorial nature protection, arose after the collapse of the Soviet Union in the 1990s. In addition, laws on protected areas in both Russia and Mongolia were first adopted in 1995. A more detailed comparison of the territorial nature protection systems of Russia and Mongolia was carried out by the author earlier [9-11]. It should be emphasized that the scientific publications overwhelming number devoted to the Mongolia's territorial nature protection do not take into account the soum's and aimag's level PAs.

2. Research methods

The analysis is based on the results of research carried out during the expedition period 2023-2025. During this period, research was conducted in all PAs of the Umnugovi aimag: strictly protected areas (SPA), including the core zone, a national park, a nature reserve (refuge), natural monuments, as well as aimag's and soum's significance PAs. In the course of the scientific research, landscape maps were compiled for each of the studied PAs, and the existing disparate information about individual protected areas and information about Mongolia's Red Book [12] were combined and analyzed. Primary materials from the Ministry of Environment and Climate Change of Mongolia and the administration of the Umnugovi aimag, and information provided by the directorates of individual PAs were used in the work. The analysis is based on general statistical information using cartographic and remote (drones and satellite images) methods, including the one-aspect (landscaping) atlas mapping method developed by the author [13], as well as the results of field research. The scattered data obtained in individual PAs on the migrating animal's movements are summarized. In the course of field studies, the impact of transport corridors and their condition, as well as mining enterprises in the Umnugovi aimag on of rare wild animals wide range and migration ways, was assessed using visual remote methods.

3. Result and discussion

3.1. Existing PAs in Umnugovi aimag

Territorial nature protection is represented in Gobi by aimag's and soum' s significance PAs, as well as various categories of national significance PAs: strictly protected areas (mong. - дархан цаазат газар; rus. - заповедник, eng. - nature reserve), national parks (mong. - байгалийн цогцолборт газар, rus. - национальный парк), nature refuges (mong. - байгалийн нөөц газар; rus. - заказник) [14]. According to the Ministry of Environment and Climate Change of Mongolia, as of the beginning of 2025, there are 4 national significance PAs in the Umnugovi aimag (a strictly protected area, a national park and two nature refuges), 48 - aimag's significance PAs, 132 - soum's significance PAs [15].

In general, these PAs have a substantial total area: 11 755 773,699 ha, or more than 50% of the Umnugovi aimag area (it should be noted that some of the PAs are located partially within the borders of the Umnugovi, since they are trans-boundary with neighboring aimags).

National significant PAs are distinguished by substantial areas, sufficient funding and staffing. The total area of national significant PAs in the Umnugovi aimag is 5 697 711,87 ha, aimag's significant PAs - 1 533 693,572 ha (of which the area has not been determined at all for 20 PAs; for 8 PAs, the expiration date is indicated until 2025, but information about them is available and, probably, it is planned to extend their validity), soum's significant PAs - 4 524 368,257 ha (the area has not been determined for 15 PAs, and the expiration date for 31 PAs is until 2025, but information about them is available and it is likely planned to extend their validity). Thus, the total area of national PAs is comparable to the total area of aimag's and soum's protected areas.

It is noticeable that national significant PAs do not have connecting elements - ecological corridors (Figure 1).

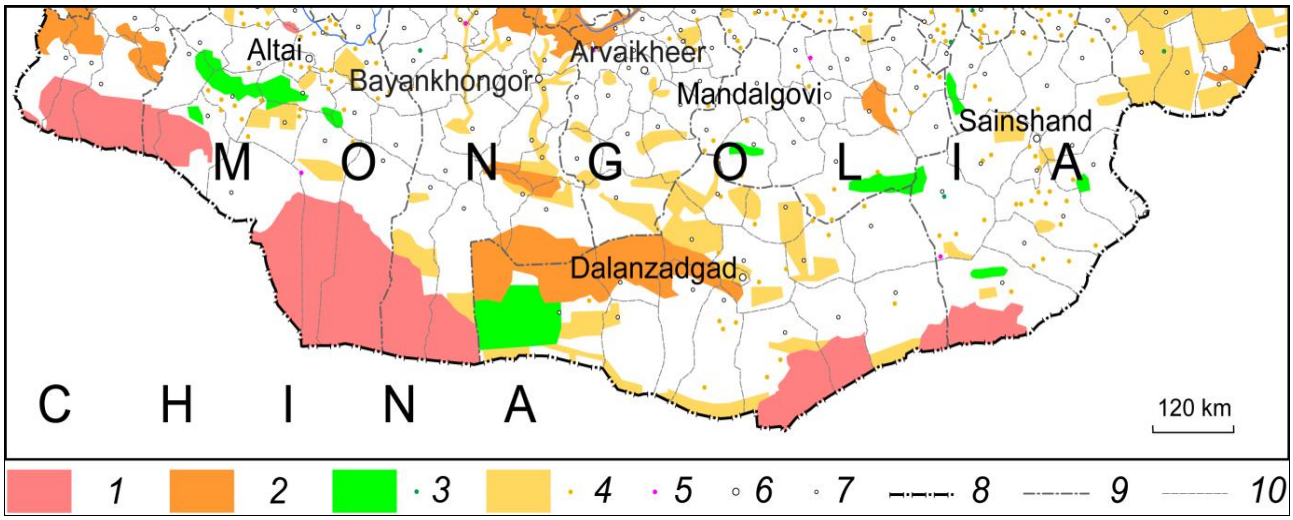

Fig 1: Specially protected nature areas in the Gobi Desert (Mongolian part)

PAs categories in Mongolia: 1 - SPA; 2 - national parks; 3 - national significance nature refuges; 4 - aimag's significance PAs; 5 - monuments; *Settlements*: 6 - aimag's centers, 7 - soum's centers; *Borders*: 8 - state, 9 - aimag, 10 - soum; The exceptions are three adjacent PAs on the border of Umnugovi and Bayankhongor aimags: Goviin Ikh "A" SPA (created 1996.05.28, the two clusters total area - 1 830 429,42 ha), Govi Gurvan Saikhan National Park (1993.11.12, 2 697 170,84 ha), and only on the Umnugovi aimag territory "Tost, Toson Bumbyn Nuruu" Nature Refuge (2019.08.14, 896 540,37 ha). Partially, the functions of ecological corridors are performed by the aimag's and soum's PAs, but they are also not enough to link all PAs into a single system.For the purpose of comparative analysis, a map of the landscape structure of each protected area was compiled using a one-aspect method. As an example, the Great Gobi SPA map is given (Figure 2) [16, 17].

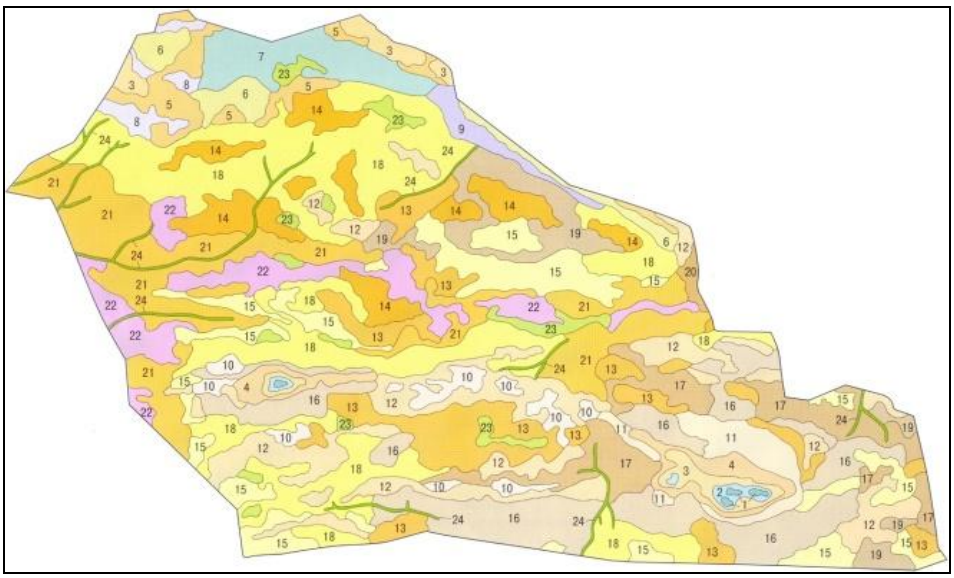

Fig 2: The Great Gobi SPA landscape structure

Types of landscapes: *Desert steppe*: 1 - Middle mountains with dominating feather grass (*Stipa*) steppes on mountain light-chestnut soils; *Grass deserts*: 2 - Middle mountains with dominating *Krascheninnikovia* or *Ajania* grass on mountain brown soils; *Steppe deserts*: 3 - Middle mountains with dominating *Stipa*, *Krascheninnikovia* and *Anabasis* brefolia grass on mountain pale-brown soils; *True deserts*: 4 - Low mountains with dominating *Anabasis* and *Sympegma* communities on mountain gray-brown soils, 5 - Hummocky topography middle dissected with *Anabasis briefolia* or *Anabasis-Sympegma* communities on weakly developed gray-brown soils, 6 - Low hummocky topography with *Sympegma* communities on weakly developed gray-brown soils, 7 - High gentle sloping plains with low *Haloxylon* stands on saline gray-brown soils, 8 - High inter-hilly plains with *Sympegma* and *Nitraria* communities on gray-brown soils locally salt-affected, 9. High sloping plains with *Ephedra* communities on gray-brown stony soils; *Extra-arid deserts*: 10 - Isolated low-mountains covered by extra-arid weakly developed soils and sparse *Anabasis* and *Sympegma* communities on slopes of northern exposition, 11 - Foothill hummocky topography with extra-arid weakly developed soils and fragments of sparse *Sympegma* and *Anabasis* communities on gray-brown weakly developed soils of northern slopes, 12 - High hamadas and low pedestal mountain in bottom of kettle depressions with sparse *Anabasis brefolia* on slopes covered by extra-arid weakly developed soils, 13 - Low hamadas with extra-arid weakly developed soils in combination with shrub communities in depressions and sairs, 14 - Low hamadas of highly dissected hummocky topography with weakly developed soils in combination with *Haloxylon* stands in depressions and sairs, 15 - Peneplain hamadas hummocky topography with extra-arid weakly developed soils and rock outcroppings in combination with *Ephedra* communities in the sairs, 16 - Stony hamadas covered by extra-arid soils with shrub communities in the sairs, 17 - Stony hamadas covered by extra-arid soils in combination with shub and saxaul communities in the sairs, 18 - Stony hamadas of high plains and areas sloping to arid-denudational depressions with extra-arid and sometimes gypsic soils in combination with *Haloxylon* stand in the sairs, 19 - Stony hamadas of high plains with extra-arid and gypsic soils in combination with *Ephedra* and *Haloxylon* communities in the sairs, 20 - Plum rock debris hamadas of elevated plains and plateaus with extra-arid strongly gypsic soils in combination with *Nitraria* communities in the sairs, 21 - Rock debris hamadas of low plains with extra-arid strongly gypsic soils in combination with *Iljinia* communities in stairs, 22 - Plum rock debris hamadas of hollows with extra-arid strongly gypsic soils and sparse plants in flattening and stairs; *Temporary moistened areas*: 23 - Complexes of stairs with *Haloxylon* stands and shrub communities on said soils, 24 - Big stairs with sparse shrub and saltwort vegetation on takyr-like saline and sandy soils.

3.2. Problems of conservation of wide range area and migratory animal species

A unified system of PAs is important primarily for creating the necessary conditions for the conservation of rare wide range area and migratory wild animal species.

A significant problem of the system for wide range area and migratory rare animal species is the separation of the Gobi Desert integrity area by the state border with China and existing transport corridors. In addition, the network of roads and railways continues to expand and be

reconstructed. The PAs system is also negatively affected by the operation of mining enterprises.

In the Gobi Desert, the most valuable wide range area and migratory species are the Mongolian or Gobi kulan (lat. - *Equus hemionus hemionus*, mon. - говийн кулан, rus. - гобийский кулан), Mongolian gazelle (lat. - *Procapra gutturosa*, mon. - монгол зээр, rus. - монгольский дзерен), Gobi bear (lat. - *Ursus arctos gobiensis*, mon. - говийн баавгай or мазаалай, rus. - гобийский бурый медведь), Altai argali (lat. - *Ovis ammon ammon*, mon. - Алтайн аргаль, rus. - алтайский горный баран), Goitered or black-tailed gazelle (lat. - *Gazella subgutturosa hillieriana*, mon. - монгол жейран, rus. - чернохвостая газель).

As an example, the results of the project "Global Initiative for Migration Research" by kulan and mongolian gazelle (Figures 3 and 4) [18], as well as scattered information about the wild ungulates migration ways from individual PAs. In relation to the kulan, 7 parts have been formed within Mongolia, separated by transport corridors and practically non-mixing populations. An analysis of the movements of the mongolian gazelle shows that without breaks railway tracks are insurmountable for this type. In addition, even the transport passages provided under the railway track, used by ungulates to cross obstacles, often turn out to be covered with sand (Figure 5).

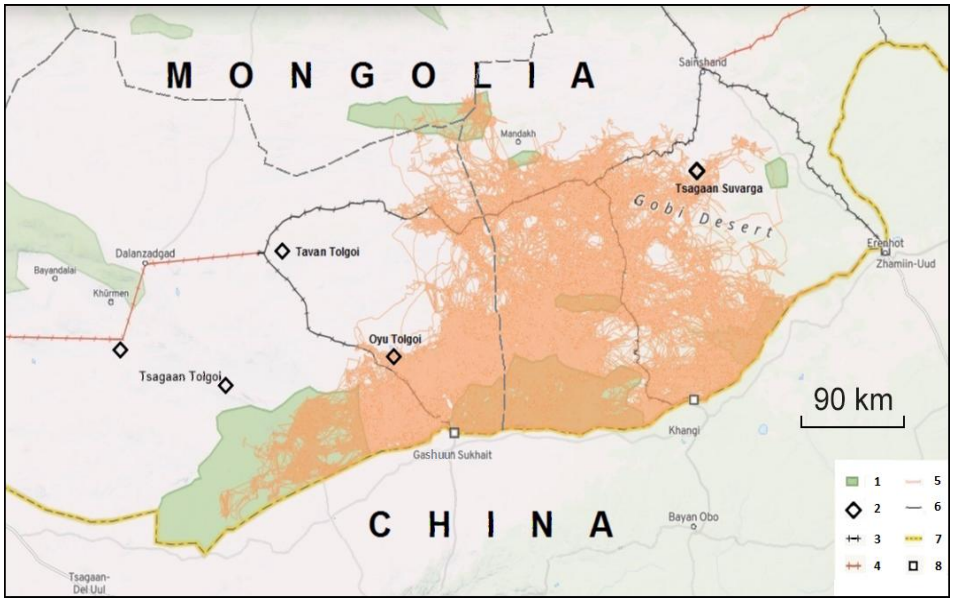

Fig 3: Transport corridors and deposits in the kulan migration area on the Umnugovi and Dornogovi aimags border

1 - protected areas; 2 - deposits; 3 - railway; 4 - planned railway; 5 - migration traffic of kulan; *Border*: 6 - aimag, 7 - state, 8 - border crossings.

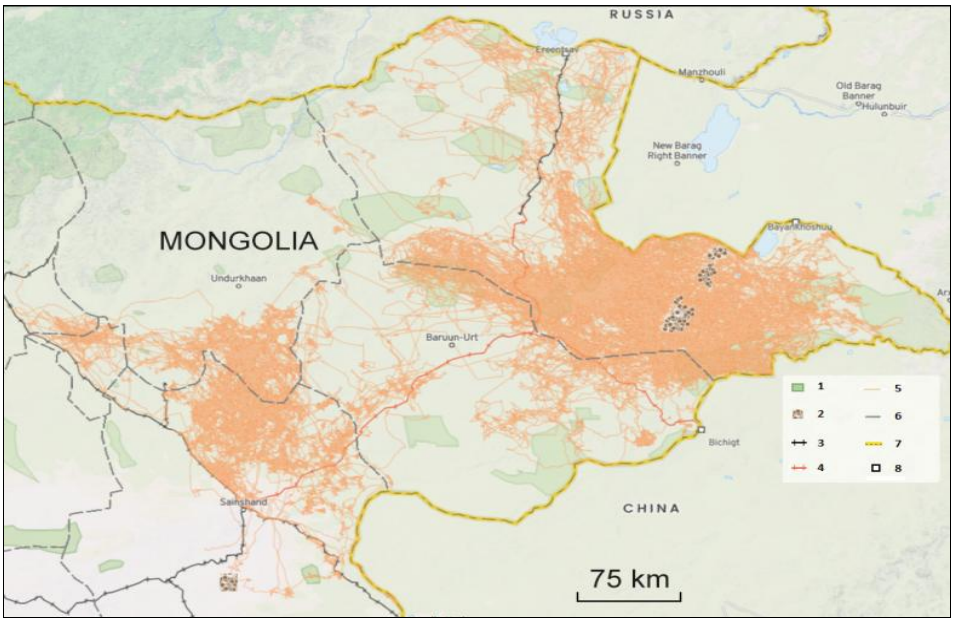

Fig 4: Transport corridors and oil wells in the mongolian gazelle migration area on the Umnugovi, Dornogovi, Khentii, Sukhbaatar, Dornod aimags territory

1 - protected areas; 2 - oil wells; 3 - railway; 4 - planned railway; 5 - migration traffic of mongolian gazelle; *Border fence*: 6 - aimag, 7 - state, 8 - border crossings.

a)

b)

c)

Fig 5: Passages under the railway in Gobi Desert

a) free of sand, b) almost covered with sand (photo by the author), c) completely covered with sand (in the Google satellite image).

Thus, the transport corridors contributing to the economic development of the Gobi Desert region significantly hinder the migration movements of wide range area and migratory animal species.

The narrowing Gobi bear range area is facilitated by agricultural activities, illegal hunting and the use of the animal's body parts in traditional oriental medicine. As an example, a picture of a gradual decrease in the bear's range area is given (Figure 6) [19, 20].

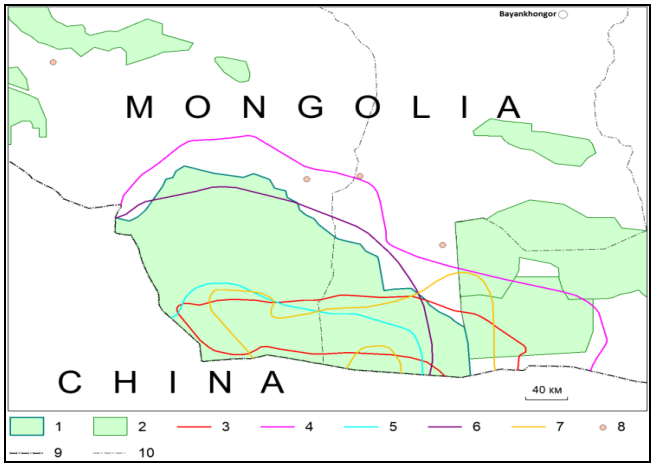

Fig 6: Past and present Gobi bear ranges

Protected areas: 1 - Goviin Ikh "A" Strictly Protected Area (Great Gobi "A" SPA), 2 - other; *Present and potential ranges*: 3 - present range; 4 - potential range outside the Great Gobi "A" SPA; *Last Gobi bear habitat*: 5 - 1980 year, 6 - 1967 year, 7 - 1954 year; 8 - Gobi bear meeting places according to A.G. Bannikov, 1954 [21]; *Borders*: 9 - state, 10 - aimag.

3.3. Threats from mining and infrastructure

There are several large deposits under development in the Umnugovi aimag and adjacent territories. Their location has a negative impact on both the state of PAs and the migration of wide range area species.

The Tavan Tolgoi (coking coal) and Oyu Tolgoi (copper, gold, silver) deposits do not allow the kulan to move in a northwesterly direction. These deposits and the main route of delivery of the products to the Gashuun Sukhait crossing on the border with China are located near the clusters of the Small Gobi Reserve. Moreover, the transport corridor to the Gashuun Suhait crossing passes through the territory of the Goviin Baga "B" SPA (Small Gobi "B" SPA) in its southwestern part. In particular, during field work in August 2024, in the SPA central environmental protection core, located 100 km from the border crossing, air pollution was noticeable at a considerable height with coal dust. When visiting the crossing, it turned out that the queue of coal trucks along the highway stretched for 26 km. Thus, the westerly and northwesterly winds dominating here carry air pollution to the SPA territory. Solitary kulans, which are rarely found here, even look outwardly stained with coal dust, and also feed on vegetation with an admixture of harmful substances.

Oil production fields are located directly in the center of the concentration of the Mongolian gazelle (dzeren) population. In particular, the field with private oil rigs located in the Dornogovi aimag, south of the Zuunbayan village, which is closest to the Umnugovi aimag border, covers an area of more than 23 km^2. The process of drilling new oil wells here is continuing intensively, which was observed in June 2023 and August 2024. Such deposits have a negative impact on dzeren migrations and on the condition of aimag's and soum's PAs. Here, almost on this aimag's border, there are deposits of Mandakhnuur and Ailbayan (coal) - to the northeast of the Ergeliin Zoo Nature Refuge with corresponding negative consequences.

The Nariin Sukhait (coal) deposit and the route to the Shivee Khuren crossing on the border with China are

located to the east of the Goviin Ikh SPA "A" (Great Gobi SPA "A"), and have maximally reduced the Gobi bear range area in the Umnugovi aimag western part. Currently, its population is mainly concentrated only within the boundaries of the reserve, that is, within the Bayanhongor and Govi-Altai aimags southern part.

The presence of a nearby economic giant in the person of China will not reduce the anthropogenic burden on the southern regions of the Gobi. The only way out in such a situation is the absolute implementation of Mongolia's environmental legislation, as well as encouraging environmentally responsible attitude of mining companies to the environment, their active participation in the restoration of natural conditions.

The most well-known approach currently is the ESG (environmental, social, corporate governance) strategy, which is a set of company management characteristics that involve enterprises in solving environmental, social and managerial problems.

3.4. Optimization of the PAs network

Within the Umnugovi aimag and the adjacent territories of the Gobi Desert, there are valuable land plots for the preservation of landscape and biotic diversity, which require the creation of new PAs to link them into a system [22]. The total area of the planned PAs 4 951 020.1 ha (it should be emphasized that of these, 4 protected areas are transboundary with the Dornogov and Bayanhongor aimags, therefore, the total area will be less within the Umnugovi aimag).

Plans for the development of the territorial nature protection system can be divided into the expansion of existing PAs and the creation of new PAs. The creation of new PAs implies both the organization of PAs for the first time, and a change of status to a higher one for existing aimag's or soum's significance PAs with or without possible territory expansion. Expansion is provided for 3 existing nationwide significance PAs, planning for the new PAs creation - for 5 land plots, and a change in status to a higher one - for 5 soum's significance PAs (Tables 1, 2, 3; Figure 7).

Table 1: Planned existing nationwide significance PAs expansion

No	Name	Area, ha	Aimag
1	Goviin Baga "B" SPA (Small Gobi "B" SPA)	1 216 743,9	Dornogovi, Umnugovi
2	Govi Gurvan Saikhan National Park	303 112,9	Umnugovi
3	Tost, Toson Bumbyn Nuruu Nature Refuge	24 821,3	Umnugovi

Table 2: The planned new PAs creation

No	Name	Area, ha	Aimag
1	Tologiin Tal	229 114,8	Umnugovi
2	Tsagaan Tolgoin Tal	17 494,1	Umnugovi
3	Khokholzekhiin sarkhia	13 955,0	Umnugovi
4	Zagiin Toirom	833 125,0	Umnugovi
5	Bugiin Khooloi - Tavan Sukhain Khondii	984 084,4	Umnugovi

Table 3. Planned the PAs status change

No	Name	Area, ha	Aimag	Note
1	Doshiin Toyrom	119 724,5	Umnugovi	the validity period is 2036.04.25, area - 27 070,03 ha
2	Bayangol	28 837,5	Umnugovi	now name is "Bayangol, Khalzan, Havirga, Dorvolj", the validity period ended on 2022.04.20, total area - 137 959,43 ha
3	Sevkhuuliin Khondii	11 319,7	Umnugovi, Dornogovi	the validity period is 2025.08.28, the area is 8 131,64 ha
4	Galbyn Govi	686 716,5	Umnugovi	the validity period is 2030.09.29, the area is 340 410,39 ha
5	Arts Bogd	481 970,5	Umnugovi	now name is "Arts bogdyn ovor hongil/Arlyn teg", formed 2014.03.25, without validity period limitation and area indication

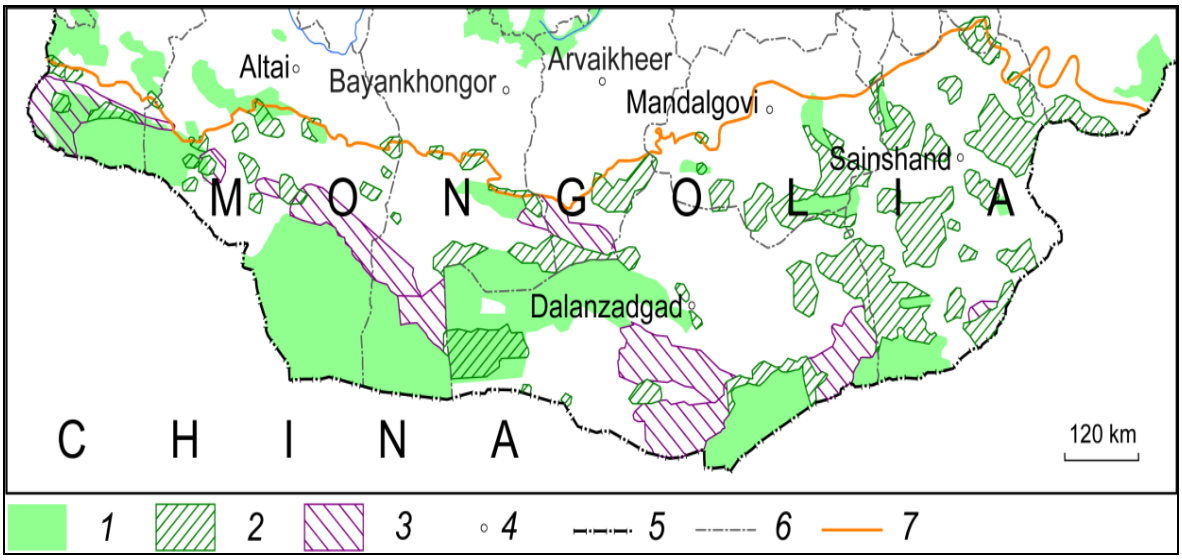

Fig 7: Planned PAs in the Mongolian part of Gobi Desert

Protected areas nationwide significance: 1 - functioning, 2 - planned, 3 - planned and coordinated with the local community; 4 - aimag centers; *Borders*: 5 - state, 6 - aimag, 7 - Gobi Desert zone.

4. Conclusion

The article attempts to consider the current situation in the field of territorial nature protection in the Umnugovi aimag based on the research conducted during the expedition

period of 2023-2025. The main feature of the protected areas in Umnugovi aimag is the representation of Gobi Desert typical landscapes : true desert, desert steppe, extra-arid desert, steppe deserts, grass deserts. The choice of the dynamically developing Umnugovi aimag for analysis is largely due to its inaccessibility, small population, and difficult living conditions for economic activity. It is these conditions that make it possible to maintain biotic and landscape diversity in relatively good condition. These territories of Mongolia's southernmost aimag experience high summer temperatures, harsh winters, and significant water shortages. It should be particularly noted that the volume of the mining industry (coal, oil and gas) is growing extremely rapidly, as is the construction and modernization of roads and railways, as well as the volume of extracted minerals transportation, mainly to China.

There are four national level PAs in the Umnugovi aimag, which are geographically almost unrelated to each other.

The total area of aimag's and soum's significance PAs is comparable to them and forms part of the necessary ecological corridors for higher rank PAs. The aimag's and soum's significance PAs total area is comparable to the national level PAs. Aimag's and soum's significance PAs perform the function of the necessary ecological corridors part for higher rank PAs.

It should be emphasized that desert communities are extremely unstable compared to forest or steppe communities. This is demonstrated by saxaul forests, which have significantly decreased everywhere in the Gobi Desert, which already requires their artificial restoration. In this regard, more significant indicators for the system of protected areas are required for the Gobi. Therefore, the article proposes options for creating new protected areas and expanding some existing PAs.

Despite the fact that the PAs in Gobi Desert are represented by categories of different status, many other valuable natural areas need to be preserved and included in new PAs. In addition, the PAs system expansion will create additional opportunities the ecological corridors creature between functioning PAs, and will revive the ranges of migratory wild animal species. The identified need to create effective crossings through transport corridors can also ensure the movement of ungulates over long distances system's normal functioning, and will also avoid division into small populations and inbreeding within reduced groups of animals. Attention is drawn to the importance of providing passages under roads and railways for animal migration, as well as the need for regular cleaning of passages from sand. It is shown that the activities of mining enterprises negatively affect the PAs state.

The article provides recommendations on increasing the area of three national level PAs, status enhancement of five soum's level PAs, and creating five new PAs within the Umnugovi aimag boundaries. In the future, it is necessary to take into account the division of the unified space of the Gobi Desert by the state border with the Inner Mongolia Autonomous Region in China when studying the territorial nature protection system.

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