Nomination

# TUGAY FORESTS OF THE TIGROVAYA BALKA NATURE RESERVE

(Republic of Tajikistan)

Proposal for Inscription on
THE UNESCO WORLD HERITAGE LIST

**Prepared by:**

- The Committee on Environmental Protection under the Government of the Republic of Tajikistan
- Academy of Sciences of the Republic of Tajikistan
- Tigrovaya Balka Nature Reserve
- Institute of Geography of the Russian Academy of Sciences

**With support of:**

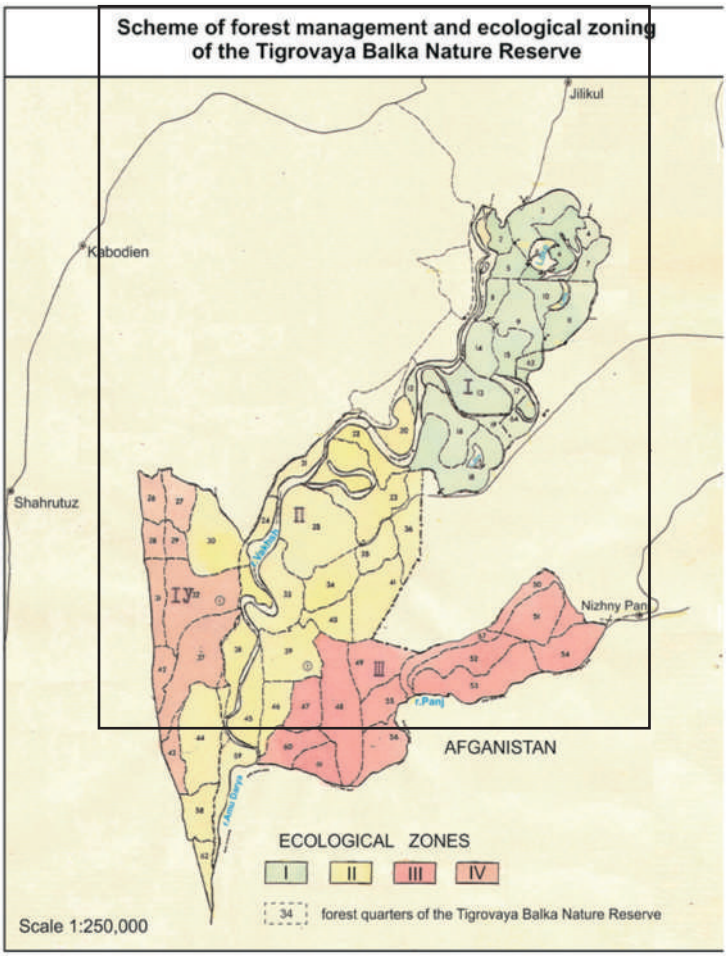
- UNESCO Cluster Office in Almaty
- World Wildlife Fund (WWF)
- Natural Heritage Protection Fund

2022

## CONTENTS

# EXECUTIVE SUMMARY

| | |
|---|---|
| **State Party** | Republic of Tajikistan |
| **State, Province or Region** | The Khatlon Region, the Kabodien (right bank of Vakhsh) and Dusti (former Dzhilikulsky, left bank) districts |
| **Name of Property** | Tugay forests of the Tigrovaya Balka Nature Reserve |
| **Geographical coordinates to the nearest second** | The latitude and longitude coordinates of a point at the approximate centre of the nominated property:<br><br>37°12′17″ north latitude, 68°20′29″ east longitude. |
| **Textual description of the boundary(ies) of the nominated property** | The boundaries of the nominated property matches the boundaries of the Tigrovaya Balka Nature Reserve. |



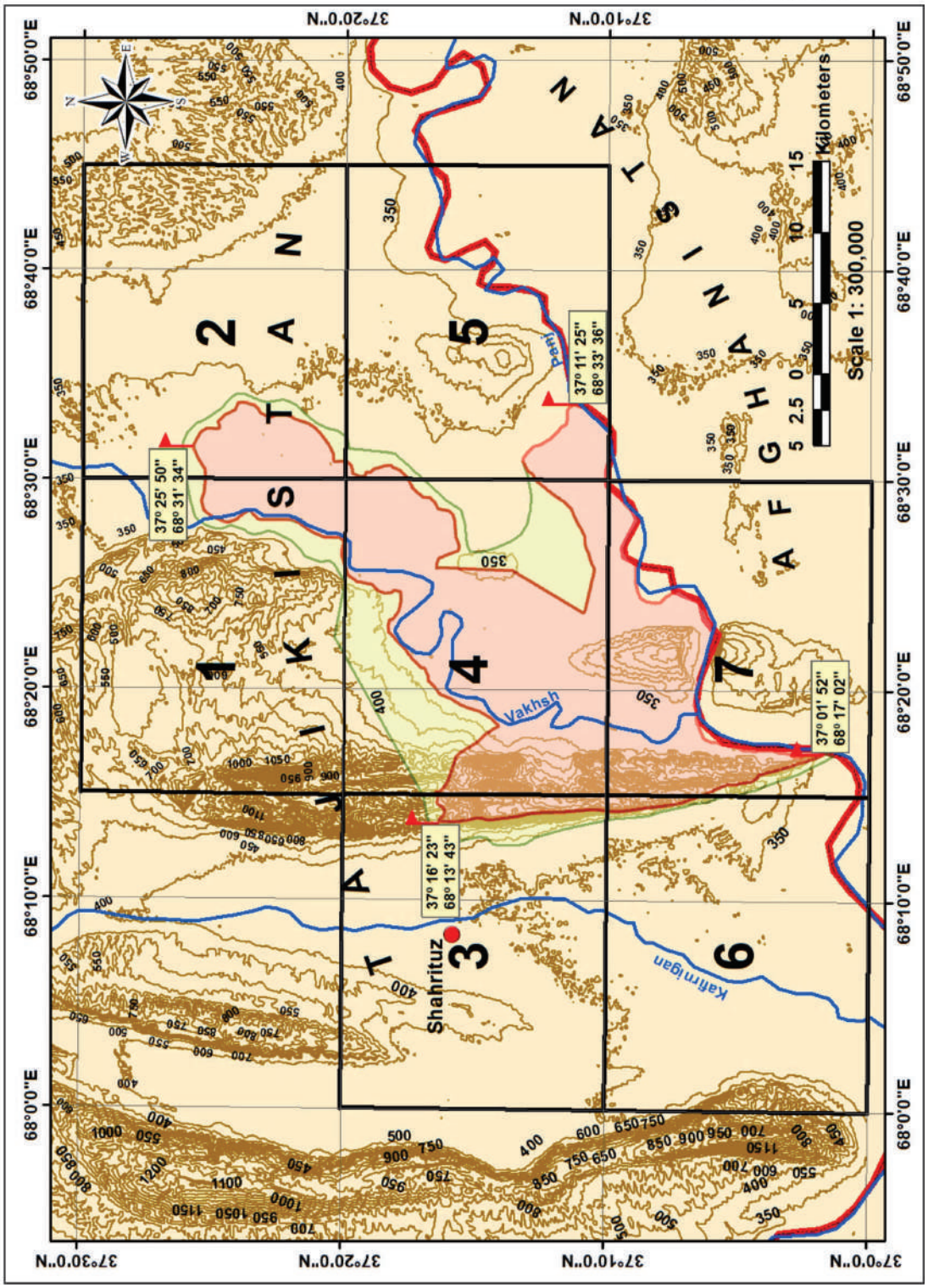

Scheme of forest management and ecological zoning of the Tigrovaya Balka Nature Reserve

In the north, the nature reserve borders on the farmlands. The border there runs through forest quarters No. 1, 2, 3. In the east, the border of the reserve mainly coincides with the administrative border of the Jaihun (the former Kumsangirsky) administrative district, and then, at the extreme eastern point of the reserve with coordinates 68°33'36″ east longitude, 37°11'25″ north latitude, it meets the state border of the Republic of Afghanistan. Further, the border runs south-west, coinciding with the state border with the Republic of Afghanistan along the Panj and Amu Darya rivers, to the extreme southern point of the reserve with coordinates 68°17'02″ east longitude, 37°01'52″ north latitude. Further, the border of the reserve turns sharply to the north and goes along the border of quarters No. 62, 58, 43, 37, 42, 31, 28, 26 to the extreme western point with coordinates 68°13'43″ east longitude, 37°16'23″ north latitude. Then, the border generally runs south-east to the Vakhsh river valley along the border of quarters No. 27 and 30. Further, in the general northwest direction, the border runs along the right side of the Vakhsh valley along the border of quarters No. 24, 21, 20, 12, and goes to the starting point of the description, i.e. to the beginning of the northern boundary of quarter No. 1.

**A4 or A3 size map(s) of the nominated property, showing boundaries and buffer zone (if present)**

Topographic map with epy accurate boundaries of the nominated property and its buffer zone. Scale 1:50 000. A map on 7 sheets of A1 format is attached to the nomination dossier.

Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone



**Criteria under which property is nominated (itemize criteria)**

(ix), (x)

**Draft Statement of Outstanding Universal Value**

**a) Brief synthesis**

The nominated territory is located in the interfluve area of the Vakhsh, Panj and Kafirnigan rivers, at the border of Afghanistan, where the largest river in Central Asia – the Amu Darya – takes its origin. The territory covers a vast area of tugay ecosystems, along the banks of the Vakhsh River, the territory of the hilly sandy Kash-ka-Kum desert, the Buritau eminence, as well as the low mountains of the southern spurs of the Aruktau range – the Hodja-Kaziyon mountains. The area of the Tigrovaya Balka Nature Reserve is 49,786 hectares and the area of its buffer zone is 17,672 hectares.

The reserve is a unique desert-tugay reservation of dry Central Asian type subtropics, where a natural Asiatic poplar tugay vegetation complex is preserved. The complex is composed of water-resistant and thermophilic summer-green salt-tolerant trees and shrubs, such as the Asiatic poplar or blue poplar, the dzhida or oleaster, the multiramose tamarix, and rare and endangered animals inhabiting it, such as the Bactrian deer, whose population in the reserve exceeds 300 heads, the goitered gazelle, the striped hyena, the gray monitor, the Tajik black-and-gold pheasant, and many waterfowl birds. Tugay forests occupy an area of 24.1 thousand hectares in the reserve and this is the only place in the world where the Asiatic poplar tugay ecosystem has been preserved in its original state on a vast territory.

**b) Justification for Criteria**

*Criterion (ix):*
The natural complex of Tigrovaya Balka is an outstanding example of continuous ecological and biological processes taking place in the evolution and development of desert-tugay biocenoses and their characteristic plant and animal communities. The reserve has an amazing variety of landscapes with coexisting jungles, sandy and saline semi-deserts, piedmont semi-savannas, and various wetlands, dynamically adapting to changes in the hydrological regime of the territory.

*Criterion (x):*
The Tigrovaya Balka Nature Reserve is the last large reserve on the planet that preserves the natural communities of Asiatic poplar tugay flora and fauna that have not been significantly suffered from anthropogenic impact. The reserve serves as a genetic reservation for rare and endangered plant and animal species inhabiting its territory, making a significant contribution to the preservation of the region's biodiversity.
In the Tigrovaya Balka Nature Reserve, the largest in Central Asia forest area of the Asiatic poplar or the blue poplar (*Populus pruinosa* Schrenk) is preserved, which in the community with the dzhida or the oleaster (*Elaesgnus angustifolia* L), the multiramose tamarix (*Tamarix ramosissima* Ledeb.), and others, occupies the floodplain and above-floodplain river terraces of the reserve.
In addition to the relict ecosystems, the unique objects preserved in the reserve include animals from the Red List of the IUCN, such as the Bactrian deer (*Cervus elaphus bactrianus*), the goitered gazelle (*Gazella subgutturosa*), the Persian leopard *(Panthera pardus ciscaucasica)*, and the striped hyena (*Hyaena hyaena*).

**c) Statement of Integrity**
The Tigrovaya Balka Nature Reserve is an integral natural complex, the main components of which are inseparably associated with each other by the common origin, historical fate, and dynamics of natural development, and includes the elements necessary to confirm its Outstanding Universal Value. The reserve presents ecosystems of tugai floodplain forests, sandy and saline semi-deserts, foothill low-grass semi-savannas and wetlands, with the entire spectrum of flora and fauna representatives characteristic of them.
By its size (49,786 hectares) the nominated property is sufficient to support the sustainable functioning of tugay ecosystems and fully represent characteristics and processes that reflect their significance. The buffer zone of the reserve (17,672 hectares) provides additional guarantees of the integrity of the nominated property.
Biophysical processes and properties of the natural landscape of the Tigrovaya Balka Nature Reserve are indirectly affected by economic activities (irrigated agriculture and cattle grazing) conducted in adjacent territories, but so far they have not been significantly disturbed.

In recent years, both plant communities of the nominated property and the inhabitants, primarily the IUCN Red List species – the Bactrian deer, the goitered gazelle, and the striped hyena – have demonstrated recovery dynamics.

**e) Requirements for protection and management**

The nominated territory has had the status of a state nature reserve since 1938, the highest nature protection status of the Republic of Tajikistan, corresponding to IUCN category Ia.
The Tigrovaya Balka Nature Reserve is a structural subdivision of the State Committee for Environmental Protection under the Government of the Republic of Tajikistan and operates in accordance with the Law of the Republic of Tajikistan "On Specially Protected Natural Territories" of 27.11.2014.
The protection of the territory and the observance of the protected regime is carried out by a special inspection service, consisting of 30 rangers and 5 senior rangers. The protection of the territory is carried out by the methods of daily rounds of the forest guard (by the forces of rangers) and night raid patrols.
Operational protection and preservation of attributes that express the Outstanding Universal Value of the Tigrovaya Balka property is carried out on the spot by the management of the reserve on the basis of medium-term management plans. Thus, the "Management Plan of the state reserve Tigrovaya Balka and the adjacent territory for the period 2022-2026" defines specific measures for protection, scientific research, monitoring of the state of conservation, environmental education and interaction with the local population, the timing of their implementation, performers, sources of funding and expected results.
The nature protection institution Tigrovaya Balka Nature Reserve has the necessary material and human resources to ensure the preservation and further natural development of a unique complex of ecosystems.

The existing economic burden on the ecosystems of the reserve is associated with the development of agriculture and animal husbandry in the adjacent territories.
Compliance with the reserve regime, infrastructure, and staffing make it possible to self-renew the ecosystems of the reserve and restore the number of background species of plants and animals.

There is no doubt that the inscription of the Tigrovaya Balka Nature Reserve on the World Heritage List will significantly increase attention to the territory, contribute to its successful protection and conservation.

**Name and contact information of official local institution / agency**

Organization: The Committee on Environmental Protection under the Government of the Republic of Tajikistan
Address: 5/1 Shamsi str., Dushanbe city, Tajikistan
Tel: (99237) 236-40-59
Fax: (99237) 236-13-53
E-mail: info@tajnature.tj
Web address: www.tajnature.tj

**Tigrovaya Balka Nature Reserve (*photo by A. Butorin)***

# 1
# IDENTIFICATION OF THE PROPERTY

**Tigrovaya Balka Nature Reserve** (*photo by F. Rakhimov*)

## 1.a Country (and State Party if different)

Republic of Tajikistan

## 1.b State, Province or Region

The Khatlon Region, the Kabodien (right bank of Vakhsh) and Dusti (former Dzhilikulsky, left bank) districts.

## 1.c Name of Property

Tugay forests of the Tigrovaya Balka Nature Reserve.

## 1.d Geographical coordinates to the nearest second

The latitude and longitude coordinates of a point at the approximate centre of the nominated property.

37˚12′17″ north latitude, 68˚20′29″ east longitude.

## 1.e Maps and plans, showing the boundaries of the nominated property and buffer zone

A1. Location of the nominated property on the map of the Republic of Tajikistan. Scale 1: 5,000,000.
A2. Topographic map with the boundaries of the nominated property and its buffer zone. Scale 1:50 000. A map on 7 sheets of A1 format is attached to the nomination dossier.

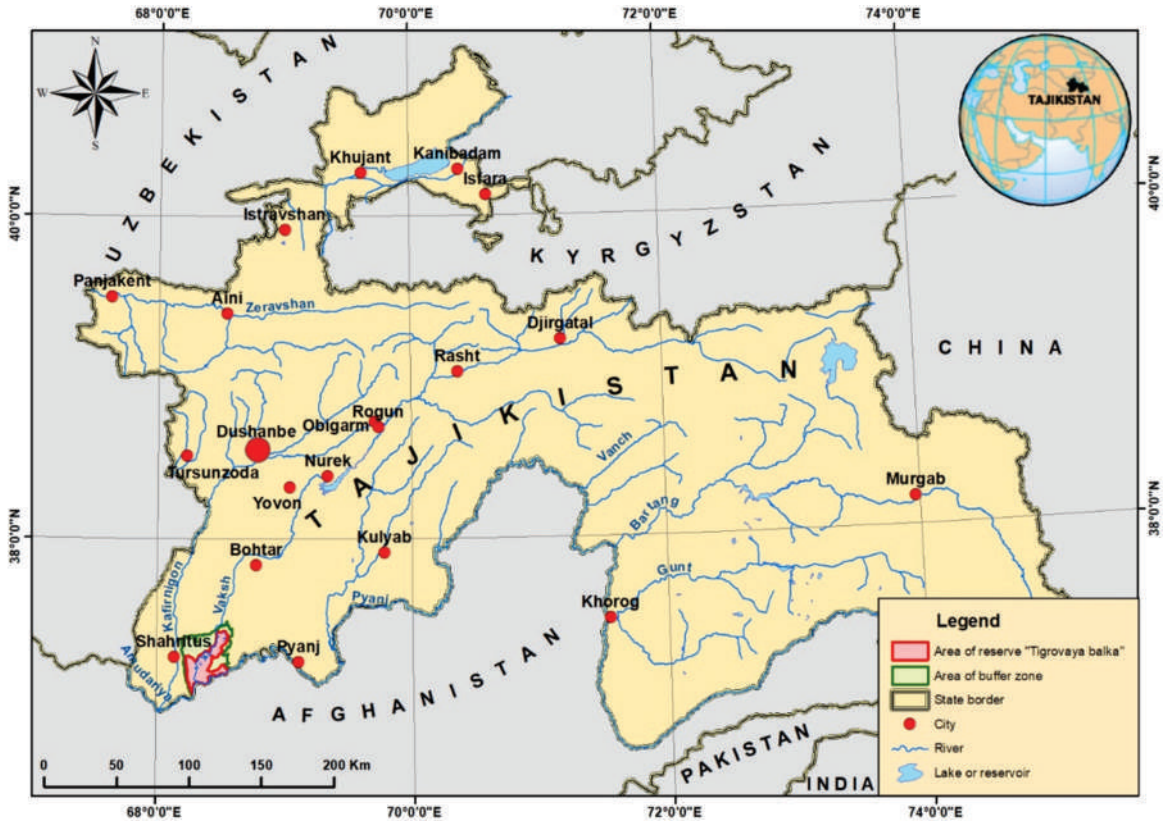



**Fig. 1. Location of the Tigrovaya Balka nominated property on the map of the Republic of Tajikistan**

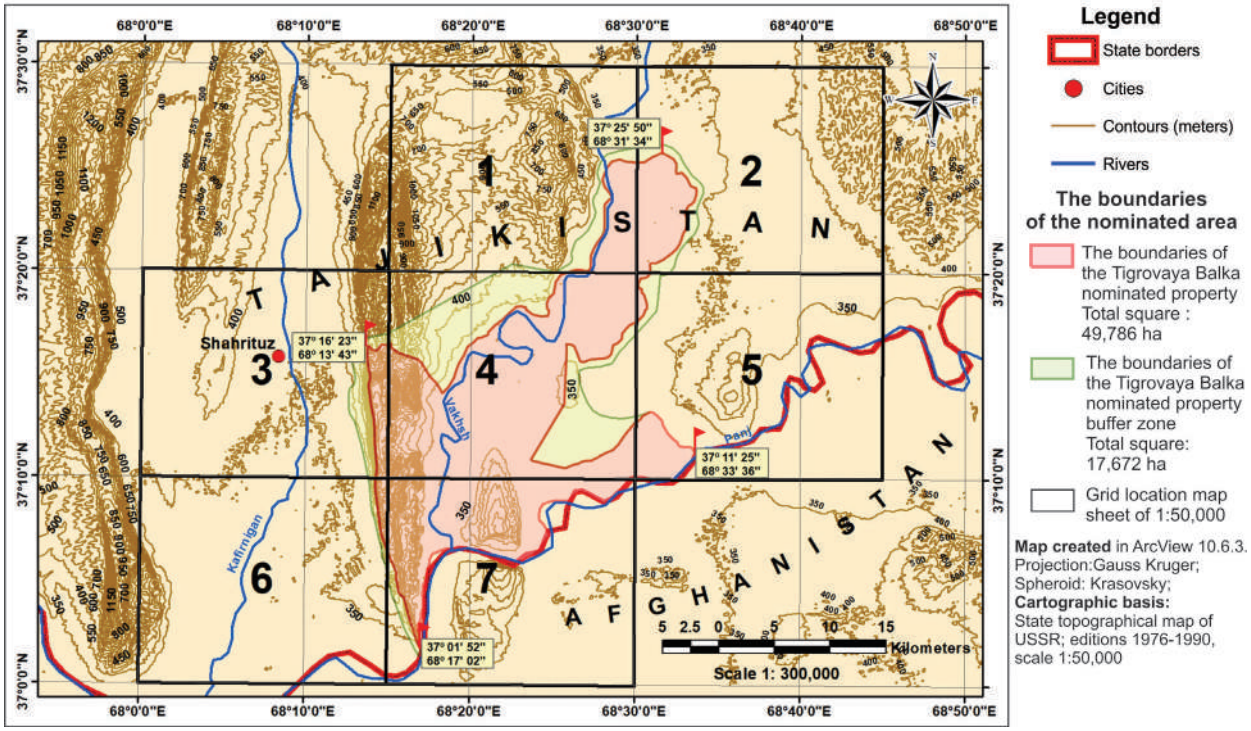



**Fig. 2. Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone**

## 1.f Area of nominated property (ha.) and proposed buffer zone (ha.)

The area of the nominated property is 49,786 hectares.
The buffer zone area is 17,672 hectares.

**Bactrian deer -** ***Cervus elaphus bactrianus*** **Lydekker** ***(photo by N.V.Marmazinskaya)***

# 2
# DESCRIPTION

**Tigrovaya Balka Nature Reserve (*photo by A. Butorin*)**

## 2.a Description of Property

The nominated territory is located within the boundaries of the Tigrovaya Balka Nature Reserve, in the desert zone between the Vakhsh, Panj, and Kafirnigan rivers, at the border of Afghanistan, where the largest river in Central Asia – the Amu Darya – takes its origin. The territory covers a vast area of Asiatic poplar tugay ecosystem on the left and right banks of the Vakhsh, the territory of the hilly sandy Kashka-Kum desert, the Buritau eminence, as well as low mountains of the southern spurs of the Aruktau range – the Hodja-Kaziyon mountains. From east to west, the reserve stretches from the Kashka-Kum desert to the Hodja-Kaziyon mountains (8-12 km). From north to south, it stretches from the Panj to the village of Jilikul (35-50 km).

The reserve occupies an area of 49.786 thousand hectares, including 24.1 thousand hectares of forest lands (47.3%) and 25.7 thousand hectares of non-forest lands (52.7%). The forested area occupies 16.1 thousand hectares (31.6%), open woodlands and glades (level lands) – 8.0 thousand hectares (15.7%). Water bodies occupy 21.4% of the total area of the reserve.

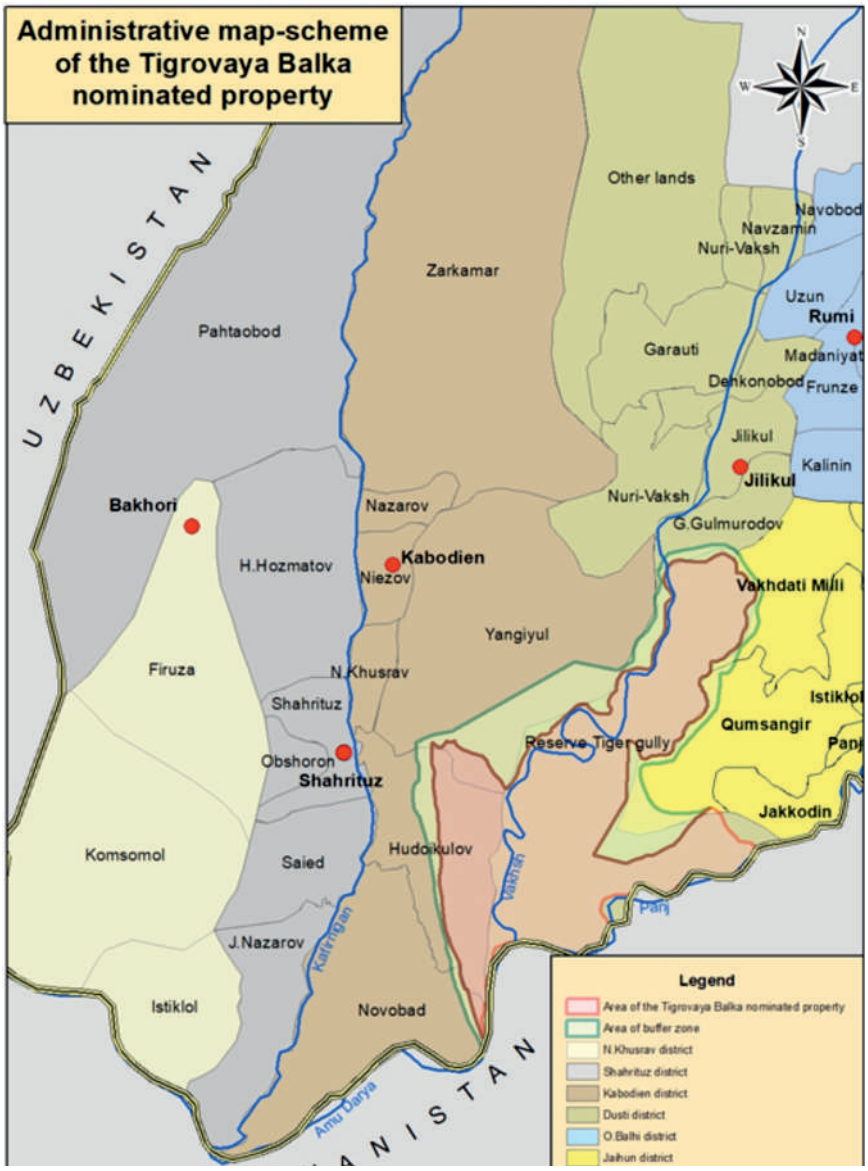



**Fig. 3. Administrative map-scheme of the Tigrovaya Balka nominated property**

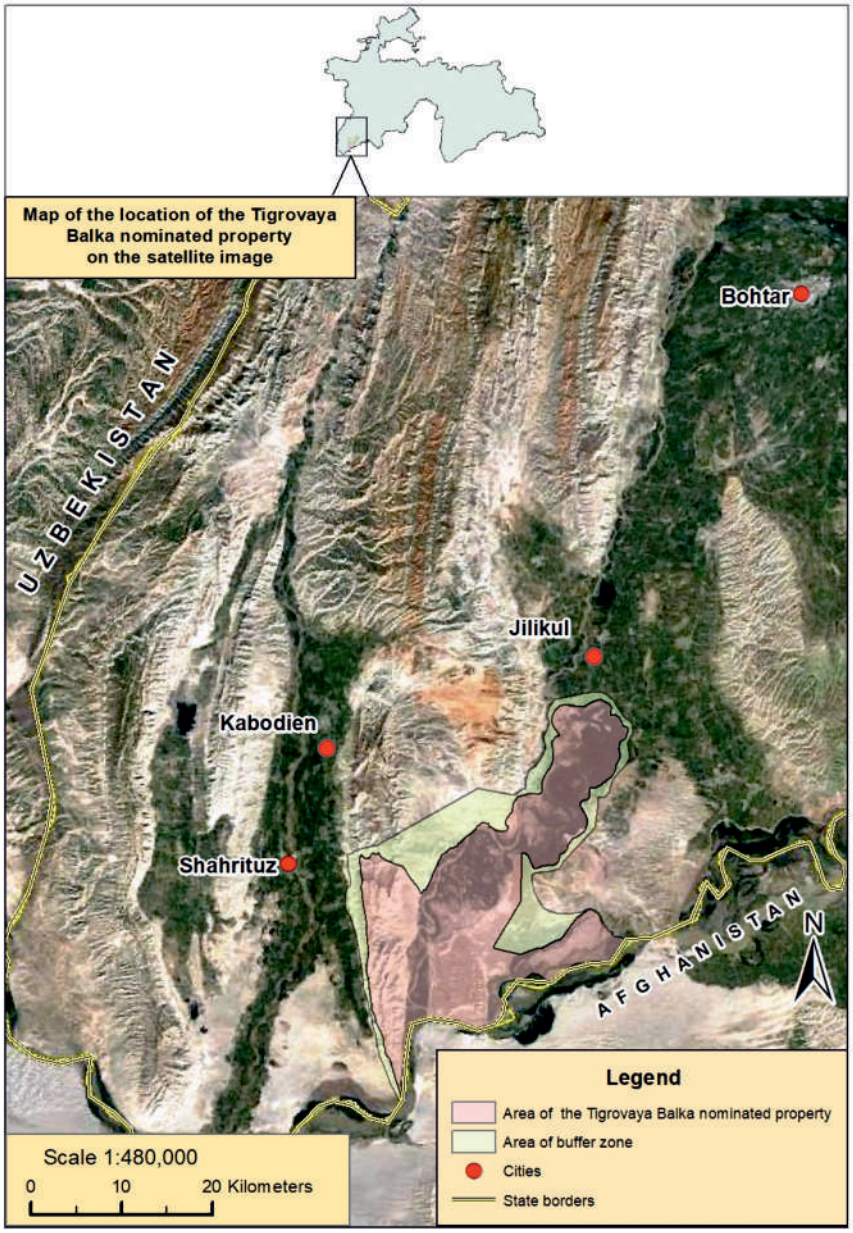



**Fig. 4. Location of the Tigrovaya Balka nominated property on the satellite image.**

## Physical and geographical characteristics
## Geological structure and relief

The Vakhsh valley was formed at the end of the Paleogene, during the Depression period. The Buritau massif, composed of Paleogene limestones, dates back to that time. The Kara-Dum massif is an anticline and is composed of Neogene rocks. Other ranges in the lower reaches of the Vakhsh originated at the end of the Neogene and are synclinal formations.

Other landforms in the lower reaches of the Vakhsh were formed in the Quaternary period. Most part of the Tigrovaya Balka Nature Reserve is located on river terraces. These terraces were formed in two stages. At the first stage, up to the mid-Quaternary period, there was a decrease in the base level of erosion of the Vakhsh (during this period 3-6 terraces were formed).

By the end of the mid-Quaternary period, the base level of erosion of the Vakhsh had risen sharply. Thus, the second and first river terraces turned out to be nested in the depression eroded in the accumulative deposits of the third terrace. The change in erosion and accumulation was caused by the tectonic movements in this area. The third terrace appeared in the mid-Quaternary period, the second – in the upper Quaternary period, and the first – in the Holocene.

Accumulative deposits of the third terrace were not fully eroded by the river. Their thickness in the lower reaches of the Vakhsh varies and is not determined on the territory of the reserve. The level of the tops of the Kashka-Kum hilly sand ridges corresponds to the third river terrace.

The first and second river terraces are best represented.

**Fig. 5. The second over-floodplain terrace in the Vakhsh River valley** ***(photo by A. Butorin)***

The second terrace in the delta of the Vakhsh rises 7-8 meters above the level of the river (up to 3-4 m above the first terrace). This terrace has no sources of moisture other than atmospheric and groundwater recharge. It is covered with desert and solonchak soils vegetation. In the vicinity of the Kara-Dum massif and the Kashka-Kum desert, eolian hilly sandy formations have been formed, which are fixed by shrubs, herbaceous vegetation and are a form of accumulation of modern and ancient alluvial sandy deposits.

The first river terrace has a much more complex relief and is divided into several (up to 5) floodplain terraces with a height of 0.5 to 3-4 m above the river level.

Floodplain terraces are divided from each other by the waterways of dried-up and active arc-shaped channels. The thickness of the floodplain terraces is highest in the Jilikul area. Downstream, the terrace has a lesser thickness.

In addition to the fact that the first river terrace is composed of floodplain terraces of various heights, there are also a number of local, very interesting landforms, such as dunes, hills of eolian soil, and sand accumulated by vegetation, drainless depressions, and other small landforms.

Dunes are the drifting forms of accumulation of modern sandy alluvial deposits of the river. The Vakhsh valley in the area of the reserve has a meridional direction, while the orientation of the dunes is close to the latitudinal. Drifting dunes are characteristic of the southeastern part of the reserve and are located northwest of the foot of the Buritau massif.

Hills of eolian soil and sand accumulated by vegetation are found on flat, takyr-like surfaces and solonchak soils, on the areas undergoing desertification between the Buritau massif and the Kashka-Kum desert (southeastern part of the reserve).

Drainless depressions on solonchak soils are of various sizes. Their occurrence is associated with groundwater.

**Relief**

The entire area, where the reserve is located, is a vast low-lying plain. The territory of the reserve is characterized by soft landforms and well-developed river valleys, separated by a number of low Babatag, Tuyuntau, Aktau, Rangontau, Karatau ranges. The overwhelming part of them has gentle flat slopes and small absolute heights.

The Vakhsh River, breaking into creeks and flowing along the floodplain, formed numerous oxbow lakes. Geomorphologists distinguish 6 terraces in the Vakhsh valley, of which 3 are within the boundaries of the reserve.

The sandy area of the Kashka-Kum desert and the Buritau mountains stretches along the left bank of the Vakhsh from north to south. Along the right bank of the Vakhsh, the southern spurs of the Aruktau range – the Hodja-Kaziyon mountains – enter the territory of the reserve.

The absolute elevations of the Vakhsh valley within the nature reserve reach 325 m above sea level. Certain points on the left bank area of the Tigrovaya Balka Nature Reserve, turning into the Kashka-Kum desert, rise to 530 m, and only the Hodja-Kaziyon mountains reach heights of 1000-1200 m above sea level.

## Hydrography and hydrological conditions

The hydrological network of the Tigrovaya Balka Nature Reserve is formed by the Panj and Vakhsh rivers and their tributaries. The main water artery is the Vakhsh, the basin of which occupies most of the nominated territory and plays a major role in the formation of its aquatic ecosystem (lakes, channels).

In the past, annually in July-August floods occurred on the Vakhsh when snow and glaciers melted intensively in the mountains. Before the regulation of the river flow in 1968, over the summer period, more than 75% of the annual runoff took place in the reserve, regardless of the dryness of the year, of which 21-22% and in July. The same runoff took place in the autumn-winter and spring periods (from September to May). Currently, the flow of the Vakhsh is regulated by hydraulic structures – the Vakhsh cascade of hydroelectric power plants.

Nevertheless, the river receives additional surface feeding from temporary streams that run mainly from the slopes of the Hodja-Koziyon Range, which cause the floods necessary for tugays.

**Fig. 6. Canyon-shaped valley of the temporary stream flowing into the Vakhsh River *(photo by A. Butorin)***

**Fig. 7. Traces of the Vakhsh River floods on the high floodplain** ***(photo by A. Butorin)***

The Vakhsh has a length of 524 km and in its upper and middle course flows mainly in a narrow valley, which in some places turns into a deep canyon. 170 km from the mouth and 120 km from the northern border of the reserve, the river flows into the Vakhsh valley, where it breaks up into creeks, the water of which above the protected area is used for irrigation and water supply.

**Fig. 8. The Vakhsh River in the central part of the Tigrovaya Balka Nature Reserve** ***(photo by A. Butorin)***

The Vakhsh is fed mainly by glaciers and snow, and rains to a lesser extent. High water is observed during the period of intensive melting of glaciers, i.e. from May to September. Low water season occurs in November-April. The average annual water discharge in the lower reaches is 640 m³/sec, with the highest in July of 4150 m³/sec and the lowest in February of 120 m³/sec. Waters of the Vakhsh, like other Mid-Asian rivers, were previously distinguished by high turbidity (4.16 kg/m³) but after the construction of the Nurek hydroelectric power plant, they became transparent and blue. At the mouth, the Vakhsh river has a waterway width of 305 meters, a depth of 3.5 meters, and a sandy bottom.

8 hydroelectric power plants were built on the river: Perepadnaya (1958, 29.5 MW), Golovnaya (1962, 240 MW), Tsentralnaya (1964, 15.1 MW), Nurek (1972, 3000 MW), Baypazinskaya (1986, 600 MW), Sangtudinskaya HPP-1 (2008, 670 MW), Sangtudinskaya HPP-2 (2011, 220 MW), Rogun (2018, 3600 MW).

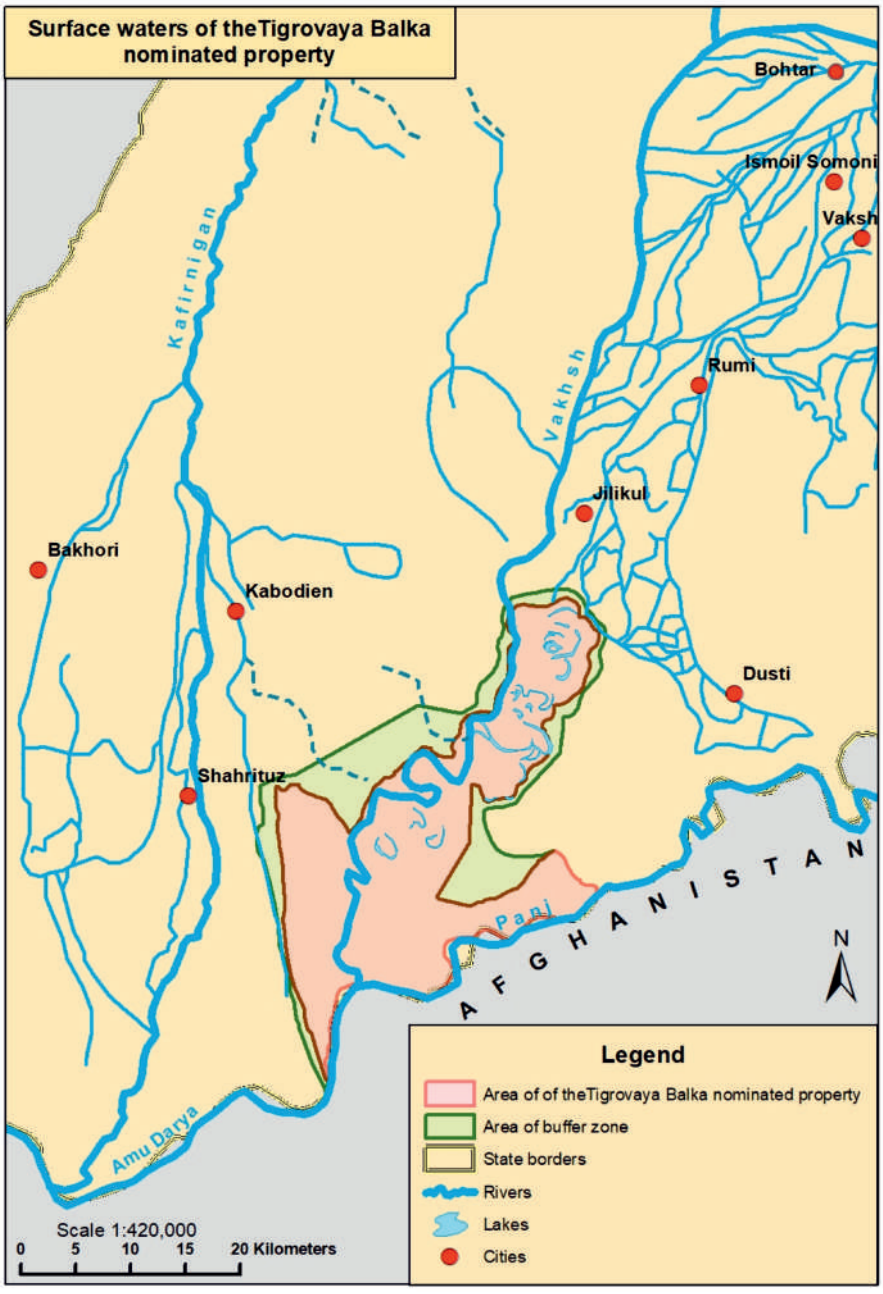



**Fig. 9. Surface waters of the nominated territory**

The Panj River flows through the southwestern part of the reserve, at the same time being the border with Afghanistan. It plays a certain role in the functioning of the aquatic ecosystem of the reserve.

The Panj waterway in the area adjacent to the reserve has a width of about 500 m and a depth of up to 7 m. The left bank is low with creeks. The right bank is steep in some places, up to 3-4 m high. In low places along the right bank, groundwater discharges are observed, the level of which rises significantly during floods.

Currently, part of the plain is flooded by river waters during the Panj river flood discharge.

**Table 1**

**Key indicators of hydrological characteristics for rivers runoffs of the Tigrovaya Balka reserve**

| Rivers | Length, km | Water discharge, $m^3$/sec | | | Annual average runoff, bln. $m^3$ |
|---|---|---|---|---|---|
| | | Minimum | Maximum | Annual | |
| Vaksh | 524 | 120 | 4150 | 640 | 19,2 |
| Kafirnigan | 387 | 31,3 | 1640 | 163 | 5,23 |
| Panj | 921 | 500 | 4300 | 1020 | 31,7 |

**Fig. 10. The Vakhsh River in the Palvontugay area of the Tigrovaya Balka Nature Reserve** *(photo by N. Mirzoev)*

**Reserve lakes**

120 km from the northern border of the reserve, the Vakhsh flows out from the mountains into the Vakhsh valley with up to six terraces. The third terrace is the biggest in the lower reaches of the river, which south of Bokhtar city (formerly Kurgan-Tyube) reaches 18-20 km in width, and, near the Jilikul village, it drops off with a sharp ledge to the expanding second terrace and has a width of 7-8 km. The height of the ledge of the third terrace is 5-7 m above the second one.

The second terrace rises 6-8 meters above the river level. Here one can found the lakes of the northern part of the Tigrovaya Balka Nature Reserve: Jilikul, Bolshoye Gulikovskoe, Maloe Gulikovskoe, Tukhloe, Kirpichnoe, Korchovoe, and a number of other smaller lakes. The terrace and the lakes located on it have never been flooded with river waters and are filled mainly with wastewaters from agricultural fields.

To the south of the second terrace, the third terrace wedges out, which descends in a high ledge (about ten meters) to the Darya-Kul' lake, located on a high floodplain.

**Fig. 11. The Darya-Kul' lake** ***(photo by A. Butorin)***

The first terrace, as a rule, is not distinguished, since there are only its numerous isolated hills on the high floodplain of the lower reaches of the Vakhsh that do not form a single area. Historically, oxbows and lakes were formed in the lower reaches of the Vakhsh. Most of them are located on the territory of the Tigrovaya Balka Nature Reserve.

In the northern part of the Tigrovaya Balka Nature Reserve, there are 16 large floodplain lakes, and in the southern part, there are 5 large and several small lakes, the total area of which makes 21.4% of the total territory of the reserve. The sizes of some of the reserve lakes are shown in Table 2.

**Table 2**

**Characteristics of some lakes of the Tigrovaya Balka Nature Reserve (according to data for 2019 - 2021)**

| № | Lake name | Sizes | | Average depth, m |
|---|---|---|---|---|
| | | length, m | width, m | |
| 1. | Maloye Gulikovskoye | 3000 | 200 | 8 |
| 2. | Podkovye | 850 | 320 | 4-5 |
| 3. | Tukhloye | 500-600 | 70-80 | 4-5 |
| 4. | Bazovskoye | 1500 | 150 | 4 |
| 5. | Daryakul | 5500 | 200 | 7 |
| 6. | Bolshoye Gulikovskoye | 5 000 | 200 | 4 |
| 7. | Khalka-Kul’ | 3000 | 100-150 | 6 |
| 8. | Dedovo | 3000 | 500 | 5 |
| 9. | Korchovoye | 1800 | 1500 | 7 |
| 10. | Kirpichnoye | 500 | 200 | 4 |
| 11. | Jilikul | 1500 | 250 | 3.5 |
| 12. | Balabanovskoye | 1200 | 210 | 11 |
| 13. | Fomkin Zaton | 2300 | 130 | 5 |
| 14. | Bolshoy Aykul | 1200 | 150-200 | 3-4 |

The length of the lakes of the Tigrovaya Balka Nature Reserve can reach 2-6 km, more often 3-4 km, and their width is 100-200 meters on average. The maximum depth of some lakes can reach 6.5-8 m.

Most lakes are concentrated in the zone of tugay vegetation. There is also a group of lakes there, including Tukhloye, Kirpichnoye, Korchovoye, Bolshoye, and Maloe Gulikovskoye. All of them have saltish water. The irrigation canals of the Dusti region flow here. The second group of lakes is located 5-7 km downstream, including Podkovye, Bazovskoye, and several more unnamed boggy lakes. A large irrigation canal runs here, not far from the Hunter’s House lodge.

**Fig. 12. The irrigation canal of the Dusti district, feeding the lakes of the reserve *(photo by N. Mirzoev)***

Bazovskoye and Balabanovskoye lakes are located to the south of Staraya Pristan. The road from Staraya Pristan to the central lodge of the reserve goes along the eastern shore of the Darya-Kul' lake. The length of the lake is over 5 km and the width is 150-200 m. To the west of the Darya-Kul' lake, there are Novoye, Podkovye, and Fomkin Zaton lakes. In the area of Korolevskaya Dacha lodge there are Khalka-Kul', Dedovo, Bolshoy Aykul, and Goluboye lakes. The Kabanye Lake is located to the south of the central lodge. There is a lot of vegetation along the shores of the lakes, the composition of which is heterogeneous in different areas.

On some lakes, tugay vegetation communities are well presented, on others – reed thickets (*Phragmites communis*). Semi-submerged aquatic vegetation consists of reed (*Phragmites communis*), sugar reed (*Saccharum spontaneum*), elephant grass (Typha elephantina), narrow typha (*Typha angustata*), and submerged species of pond grass (Potamogeton pectinatus, Potamogeton natans), etc.

At present, the lakes are fed by groundwater and wastewater from the irrigation systems of the Jaikhun (former Kumsangir) and Dusti (former Jilikul) regions. Water is discharged into the lakes through 9 irrigation canals in the amount of 14 million $m^3$/year (data from the scientific department of the reserve for 2016).

In the 1970s, to maintain the hydrological regime of the tugay ecosystems of the reserve, branches were made from the main bypass channel, built in the early 30s for the development of cotton farming. The main channel currently supplies water from the Vakhsh (about 75-80% of the total volume) and from irrigation channels of the agricultural land located north of the reserve (about 20-25%) through a system of branches to the lakes of the central part of the reserve.

**Fig. 13. A branch from the main channel, designed to feed the floodplain lakes of the Tigrovaya Balka Nature Reserve** ***(photo by N. Mirzoev)***

Thanks to this bypass, now water in the lakes are more mineralized than that in the Vakhsh but fresher than in the receiving lakes. Studies have shown that a sharp decrease in the water level of the lakes has often been observed over the past 20 years, which is associated with the lack of floods, the use of water for irrigation of agricultural land near the reserve, and the overgrowing of bypasses. Against this background, some lakes dry up seasonally and their shores turn into swamps.

In 2010, the reserve workers cleaned the canal, and thus the water level in the Khalka-Kul' lake was raised by 4.5-5 m. In recent years, the water level in the lake has decreased to 4 m due to the overgrowth of water supply canals and creeks with vegetation. In general, the most important condition for preserving the vital activity of the population of aquatic organisms in the reserve is the regulation of the level regime of the lakes.

**Fig. 14. The old Khalka-Kul' Lake framed by Asiatic poplar tugay vegetation** ***(photo by A. Butorin)***

**Water mineralization**

Until the early 60s of the last century, spring-summer floods repeatedly occurred on most parts of the territory of the Tigrovaya Balka Nature Reserve. Over the past 50-60 years, as a result of the construction of the reservoir cascade (Nurek, Baipazinskoye, Sangtuda 1, Sangtuda 2, Golovnoye), the flow regime of the Vakhsh river has changed.

At present, there are no floods, which affects the water mineralization. A significant part of the runoff of the Vakhsh (about 1/3) is used for irrigation and 1/5 of the river runoff in the lower reaches is formed by wastewater, which leads to an increase in mineralization and pollution of river waters. The lakes vary greatly throughout the year in terms of the size of the water area and water mineralization.

The brine mostly contains chlorine and sodium, pH-7.5-7.7. The high mineralization of floodplain lakes is partly due to the fact that they are located in the terminal segment of the cascade landscape-geochemical system of the Vakhsh valley and receive part of the secular inflow of salts with waters from the upper sections of the cascade.

In 2015, water mineralization of the first group of lakes, located in the northern part of the reserve, ranged from 2 to 4 g/l (from north to south: Jilikul - 2.4 g/l, Korchovoye and Bolshoye Gulikovskoye - 3.5 g/l, Tukhloye - 3.9 g/l). Water is of sulfate-sodium type. It is characterized by weak variability in autumn compared to winter. The average pH is 8.2-8.3.

The second group includes the lakes of the central part of the reserve, i.e. Bolshoy Aykul, Dedovo, Goluboye, Khalka-Kul'. They have not been flooded for a long time, and they have evolved further from oxbows to salt lakes. The salt concentration is in the range of 4-6 g/l in winter and 5-7 g/l in summer. Water is of sulfate-chloride-sodium type.

The third group includes the Bolshoye Goluboye and Maloye Kabanye lakes located in the southern part of the reserve. They are also of ancient origin, but they have reached the last stage of evolution – the stage of brines. These lakes are completely isolated from the river and other lakes, although there are traces of channels that connected these lakes with the more northern ones. The lakes, creeks and spillways of the first group mainly reflect the geochemistry of the original water bodies.

The mineralization of the bypass (3.3 g/l) exceeds that of the northernmost lake, Jilikul (2.4 g/l), therefore, the discharge of irrigation water increases the salinity of the lakes in the northern part of the reserve.

According to the literature data, a tendency of an increase in the mineralization of water in the lakes of the southern part of the reserve and, conversely, a decrease in the mineralization of water in the lakes of the northern part is noted.

Finally, it's worth noting that unique natural aquatic ecosystems with the presence of a significant number of fish endemics and other aquatic organisms have been preserved on the territory of the Tigrovaya Balka Nature Reserve. Also, the lakes and wetlands of the reserve are the wintering grounds for more than 50 species of migratory birds. However, due to the impact of anthropogenic factors, the aquatic ecosystems of the reserve have undergone significant changes. Great changes in the structure of the floodplain lakes of the reserve have been taking place since the 60s of the XX century as a result of regulation of the Vakhsh.

**Groundwater**

The aquifer of modern alluvial deposits is located in the floodplain sediments of the Vakhsh and Pyanj rivers and on the above-floodplain terrace. The water-bearing area of modern alluvium is represented by sands, sandy loams, and loams with the inclusion of gravel and pebble stones. The thickness of water-bearing rocks is 50 meters or more.

The depth of the groundwater level on the floodplain in most cases ranges from 0.5 to 2.5 m, less often from 2.5 to 4 m, and on the high floodplain (3rd terrace) – from 3 to 4 m.

The slope of the flow on the floodplain towards the Vakhsh and Panj rivers is 0.008-0.002 m. The amplitude of groundwater fluctuations is no more than 1.0-1.5 m.

The groundwater level (GWL) in the floodplain depends on the water level in the Vakhsh, seasons of the year, and the flow of waste irrigation water.

Lack of floods from the Vakhsh led to a significant decrease in the level of groundwater. The discharge of irrigation water in the northern part of the floodplain (up to the Kashka-Kum upland) causes an

increase in groundwater in summer to a depth of 1.0-1.5 m and partially floods the vegetation cover.

The area with a GWL of more than 4.0 m occupies 41.6% of the entire territory. Here, GWL does not affect soil-forming processes. GWL of less than 1.0 m occupies 21.6% of the area.

The mineralization of groundwater on the territory of the reserve varies from 1 to 75 g/l and more. Low-mineralized groundwater (1-3 g/l) occurs in the near-channel part of the Vakhsh and the central part of the floodplain, in the area of the drying up Goluboye lake. Mineralized groundwater can be found in the area of highly saline soils and solonchak soils. Very saline groundwater – brines (mineralization of more than 50 g/l) are found on a small area of 436.4 hectares (1.5%).

The mineralization of groundwater in the floodplain of the Panj river is slightly higher than in the floodplain of the Vakhsh.

**Climate**

The climatic conditions in the Tigrovaya Balka Nature Reserve can be characterized by long hot summers, short winters, a large range of daily temperatures, and scarcity of precipitation during the cold season. Dusty southwestern winds, so-called 'afghanets', are not uncommon in Tigrovaya Balka.

In winter, air masses of temperate latitudes prevail, in summer – tropical ones. The average annual air temperature is + 14-17 ° C. The temperature of the coldest month (January) is + 0-2 ° C, the hottest (July) – + 28-32 ° C. The frost-free period lasts for 250-310 days, and that with the air temperature higher than + 10 ° C – 200-250 days. The sum of active temperatures is 4500-5800 ° C per year.

Summer begins in May and lasts until mid-September. During this period, thermal depression prevails. The maximum air temperature in July sometimes reaches + 46-48 ° C. Due to the stable clear weather, the influx of solar radiation is very large. The temperature on the soil surface can reach + 70-75 ° C. During June-August, the air temperature is kept almost at the same level. Often the so-called 'afghanets' wind blows. It is strong (up to 15-20 m/s) dry wind of the western direction, accompanied by dust storms.

In the last decade of September, autumn usually begins with moderately warm, dry, and clear weather. Greenery appears with the first small precipitation, the cycle of autumn-winter vegetation of many species of herbaceous plants begins.

Winters are mild and short, which is typical for dry subtropical zones. The number of days with negative temperatures ranges from 26 to 83. Only part of December, January and the first half of February can be considered winter months, although occasional cold snaps occur in March as well. There are practically no periods with a constant air temperature below 0 °. Frosts and snowfalls are very short and are quickly replaced by relatively warm rainy weather.

Precipitation is unevenly distributed throughout the year. Up to 70% of precipitation fall in the winter-spring months, more often in the form of rain. Annual precipitation usually does not exceed 200 mm.

The relative air humidity in the spring-summer period varies from 40 to 25%. In autumn the air is even drier, but in winter the air humidity reaches 70-80%.

### Soils

The floodplain within the reserve consists of the following types of soils: alluvial meadow (from the original stage to tugay and desertifiable), meadow boggy, and solonchak soils. Alluvial meadow (floodplain, tugay) soils develop on a low above-floodplain and on high floodplain terraces of the Vakhsh on relatively young sediments. The layered fine-earth sandy loam or sandy cover, usually of small thickness (up to 1-1.5 m), is underlain by pebbles. The groundwater level is usually at a depth of no more than 1.5 m. In most cases, the soils are saline to one degree or another. They are mainly mineralized with sulfates. On these soils, a powerful natural tugay, tree, and shrubbery vegetation is developed. In more humid places the sedge and reed can be found.

On the most ancient terrace (the Kashka-Kum desert), the relief of which has been greatly changed by wind erosion, primitive and underdeveloped sandy desert soils have formed of gras-covered and loose sod subtypes according to the degree of fixation. Light and dark gray soils are typical for the low mountains of the reserve (the Hodja-Kaziyon mountains).

Gray-brown fine earth solonets soils are characteristic of the solonchak communities of the reserve and the adjacent Kara-Dum desert. On the surface, these soils have a layered light color (2-3 cm). Under it, there is a compacted blocky or coarse brown horizon with a thickness of 15-20 cm, which then turns into a light, weakly compacted rock. By the nature of the distribution of water-soluble salts, gray-brown soils are classified as solonchak soils with a maximum of salts below the brown compacted horizon (30-40 cm). In these soils, accumulations of gypsum can be found at some depth. In structure, gray-brown soils, mainly light loamy, are distinguished by significant stratification. The sand fraction predominates, the content of the silt fraction is insignificant.

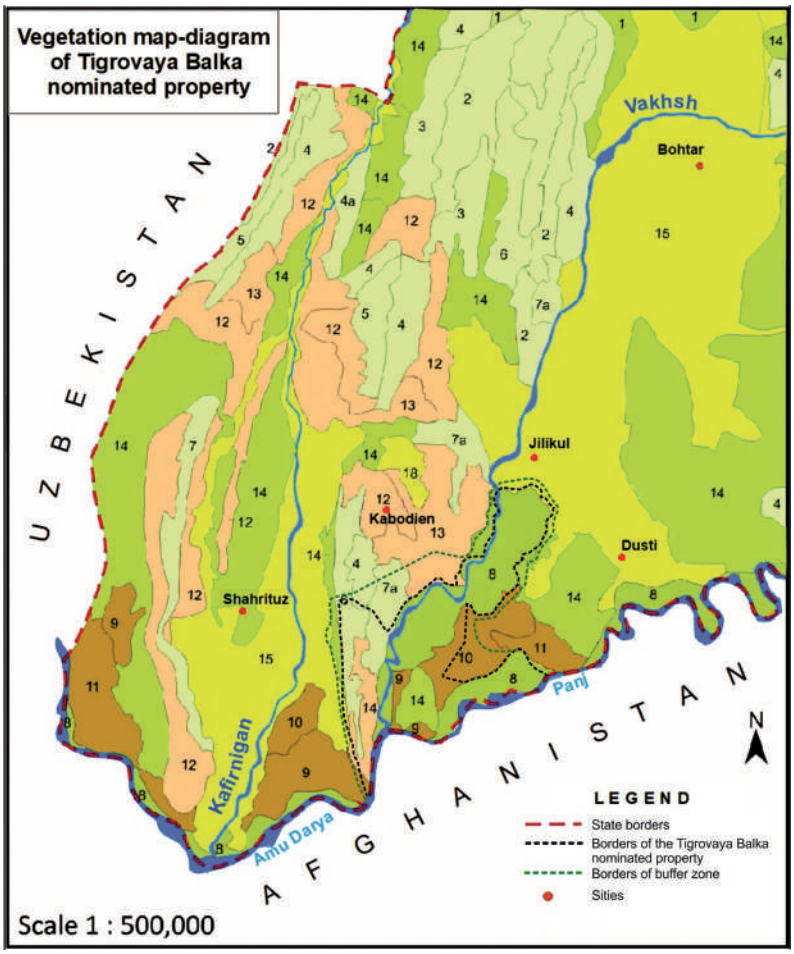
Gray-brown sandy soils are characteristic of the Kashka-Kum desert. These soils are characterized by a homogeneous, sandy texture along with the entire profile. The upper horizon is slightly dark. Further, there is a homogeneous profile without clear horizons, with a humus content of less than 1% and high carbonate content.

On the low floodplain, the groundwater level is close to the surface – up to 2 m, and on the upper one it is lower – 2.5-5 m. About 60% of the reserve's territory is fed by groundwater from a depth of up to 4 m, the rest of the territory – from a greater depth.

**No extractable resources were found in the nominated area.**

### Vegetation cover

The peculiar environmental conditions of the nominated territory lies in the proximity of groundwater on floodplain terraces, continuously fed and refreshed by river water (and in the recent past, by periodic floods on the Vakhsh), providing vegetation with moisture around the year, and in the duration of summer drought, which causes a high dryness of air. These contrasting ratios of soil and atmospheric moisture characterize the conditions for the existence of tugay vegetation.



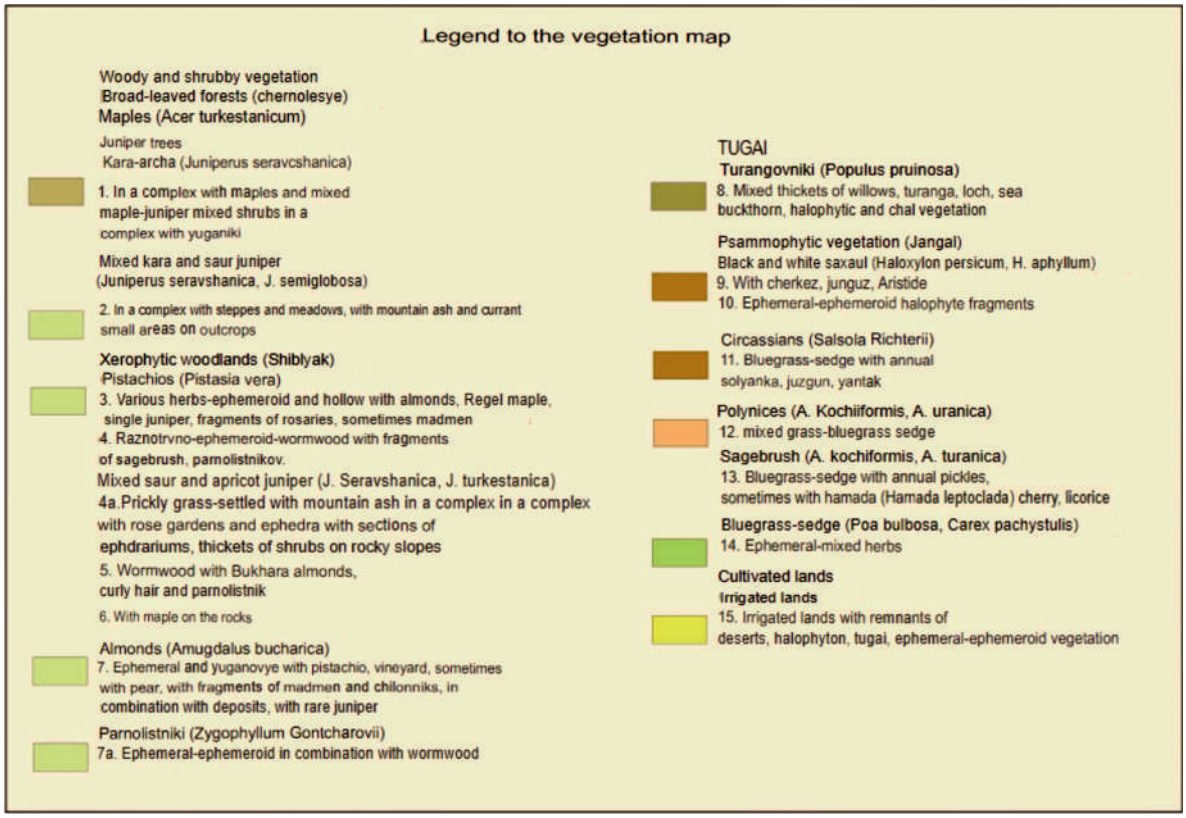




**Fig. 15. Vegetation of the Tigrovaya Balka nominated property**

Tree vegetation of the reserve is represented by Asiatic poplar, oleaster and Asiatic poplar oleaster communities.

**Asiatic poplar forests** are almost pure poplar communities consisting of Populus pruinosa, sometimes with a small admixture of Aryan poplar (Populus ariana). They occupy about 83% of the total area of tugays of the reserve.

The average height of the tree layer is 6-12 m, the maximum is up to 16 m. The density of stands is from 0.6-0.7 to 0.9. The total projective cover of herbaceous vegetation reaches 60-70%, and its height is 70-150 cm. There is almost no undergrowth or it consists of rare bushes of the multi-branched tamarix shrubs (*Tamarix ramosissima*), *Halostachys belangeriana*, Russian box thorn (*Lycium ruthenicum*), etc.

The herbaceous cover is represented by kayak (*Imperata cylindrica*), kamys (*Erianthus ravennae*), common licorice (kzyl-miya) (*Glycyrrhiza glabra*), Siberian swallowwort (*Cynanchum sibiricum*), stellar swallowwort (*Cenanchum stellatum*) common reed (nai) (*Phragmites communis*), etc. In saline areas, the herbaceous cover consists of solonchak shoreweed (azhrek) (*Aeluropus litoralis*), creeping shoreweed (*Aeluropes repens*), etc.

**Oleaster forests** are clean, closed-canopy stands of narrow-leaved oleaster or dzhida (*Elaeagnus angustifolia*). They account for about 14% of the total area of tugays. Trees reach 6-8 m in height. In the riverbed part of the valley, they occupy small areas on the 1st and 2nd terraces. They are usually short-lived and are the first to disappear when the groundwater drops.

There is almost no herbaceous vegetation due to the strong shading of the soil. Grasses thrive only on the forest edges. These are common licorice (*Glycyrrhisa glabra*), *Erianthus ravennae*, alang grass (Imperata cylindrica), gray camel thorn (*Alhagi canescens*), Siberian swallowwort (*Cynanchum sibiryrchomit*), dogbane (*Trachomitum scabrum*), etc.

**Poplar and oleaster forests** in the floodplain of the Vakhsh river are found in separate small areas. They usually have an open canopy. The main role in their structure belongs to the oleaster. The species composition of grasses is the same as in Asiatic poplar and oleaster forests.

In tugay, herbaceous vines and a parasitic plant – Lehman's dodder (zahrpechak) (*Cuscuta lehmanniana*) are widely spread.

On the most saline soils of the reserve, with a relatively close occurrence of groundwater, **communities of shrubs – halophytes** – develop. The most common shrubs are *Tamarix hispida, Halostachys belangeriana,* Russian box thorn (chingil) (*Lycium ruthenicum*), small-leaved seepweed (*Suaeda microphylla*). The herbaceous cover is composed of solonchak shoreweed (azhrek) (*Aeluropus litoralis*), oriental seepweed (*Salsola orientalis*), *S. micranthera, S. dendroides,* Fergana wormwood (*Artemisia ferganensis*), Amu Darya bean caper (*Zygophyllum oxianum*), gray camel thorn (*Alhagi canescens*), etc. The height of the shrub layer ranges from 1.2 to 3 m, and in some areas, it reaches 4-5 m.

On non-saline or slightly saline areas of the river valley, in places of shallow groundwater, there are shrub associations formed by other types of tamarixs (yulgun), e.g. *Tamarix meyeri* and *Tamarix ramosissima.*

**Desert vegetation** in the reserve is found within the Kashka-Kum sandy area. It is represented by an open shrub layer, which is formed by saxaul (*Haloxylon aphyllum*), several species of juzgun (*Calligonum griseum, C. microcarpum*) and cherkiz (*S. richteri*). In some areas, one can find bean caper (*Zygophyllum Gontscharovoii*), ellenia (*Aellenia subaphylla*), hammada (*Hammada leptoclada*), and some other types of shrubs. Small grasses prevail in the herbaceous vegetation. In early spring, when the soil is sufficiently moistured, ephemerals flourish, e.g. sedge (*Carex physodesm*) and bluegrass (*Poa bulbosa*); ephemeral forbs are represented by species of *Astragalus* and *Vulpia, Trisetum cavanillesii*, fenugreek

(*Trigonella geminiflora*), *Anisanthe tectorum*, wormwood (*Artemisia scopaeformis*).

On the Buritau upland and in the Hodja-Kaziyon mountains, the vegetation is represented by **low-grass semi-savannas with shiblyak.** A very small area of the reserve is occupied by **pistachio woodlands.** In addition to pistachios (Pistscia vera), almonds (*Amigdalus bucharica*) are common in these communities.

**Meadows** in the reserve occupy 18-19% of the territory and are represented by reed and azhrek communities. **Herbaceous bogs** are formed by communities of imperata, erianthus and kalam (Saccharum spontaneum).

As a rule, oxbow lakes are surrounded by a solid ring of reeds. In contrast, the bulrush does not form any significant thickets. In all lakes there is very little cattail. Among the submerged vegetation, water milfoil and fennel-leaved pondweed predominate. Fish grass is occasionally found.

**Tugay forests**

Being influenced by the water-salt regime of floodplains, which undergoes significant changes, tugay forests react to the behavior of the river. In their evolution, they pass through the stages of emergence, development, and decay. At the same time, their interrelation is traced by nomadic tugays that follow the river and are its derivatives. The type of tugay community is always a product of the system of its interaction with the river. The emergence of tugay forest stands is associated with fresh river sediments and is determined by the degree of moisture in the shallows and the mechanical composition of the sediment surface. Sandy loams and loamy soils, formed with a uniform decline in water, are the most optimal ones for the settlement of tugay vegetation.

Tugay areas are usually located along the coastline of rivers and are linked to river terraces, water bodies, channels, and other elements of the hydrographic network.

All tugay types are divided into three groups on the basis of water availability, namely, groups of wet, moist, and dry tugays are distinguished. In addition, relict tugays are noted.

The most common types of tugay forest are:

Asiatic poplar tamarix tugays, occupying 40% of the forested area;

Asiatic poplar oleaster reed tugays, occupying 20%;

Asiatic poplar licorice tugays, occupying 13%;

Relict tugays, occupying 14%.

These four main types cover 87% of the total forested area. In addition, there are pistachios with an admixture of Bukhara almonds, which are widespread in the mountainous part of the reserve. However, they occupy a small area, rarefied and depressed.

Asiatic poplar tamarix tugays, Asiatic poplar oleaster reed tugays, and Asiatic poplar licorice tugays correspond to tall-grass tugay types of lands with good protective properties and satisfy the wildlife of the reserve as a food base and a fauna habitat. Relict tugays belong to the desert type of land for wild fauna.

**Fig. 16. Asiatic poplar tamarix tugay** ***(photo by A. Butorin)***

**Fig. 17. Asiatic poplar oleaster reed tugay** ***(photo by A. Butorin)***

**Fig. 18. Asiatic poplar licorice tugay** ***(photo by A. Butorin)***

**Tugay forests as forage lands**

Tugay on the left bank of the Vakhsh river occupies 17 thousand hectares within the reserve. Of these, only 11.6 thousand hectares can be considered an area suitable for the habitation of Bactrian deer, wild boar, tolai hare, Tajik pheasant, and other wild animals of the jungle. The remaining 5.5 thousand hectares are occupied by lakes, swamps, territory flooded with wastewaters from cotton fields.

Reed thickets dominate on 1 thousand hectares, which is about 8% of the total area. As a rule, they form difficult-to-pass marshy thickets. Possessing high protective conditions, they are at the same time of little value as forage lands. Only in the spring period young reed shoots serve as food for deer and wild boar. Pure perennial reed beds are generally little visited by animals. Roughly the average quality class for these lands is determined at the level of 3-4.

Tamarix Asiatic poplar tugay occupies 4 thousand hectares, which is 34% of the total area. These are characteristic habitats of the tolai hare, pheasants are occasionally found. Sparse tamarix serves as a feeding place for the Bactrian deer and wild boar in spring. Their lairs are often found in dense thickets of tamarix. The average quality class of this type of land is 2-3.

Licorice Asiatic poplar tugay occupies almost 3 thousand hectares or more than 25% of the forested area. Deer and hares are found in Asiatic poplar tugays; wild boars and pheasants come here to feed.

Oleaster tugay occupies an area of 1.6 thousand hectares, i.e. 14% of the total area. This is the best type of animal habitat. The oleaster fruits in winter are the main food for many representatives of tugay fauna. The quality class is 1.

And, finally, 18-19% of the tugay territory is occupied by meadows (about 2 thousand hectares). The protective conditions of the meadows do not deserve high marks, but they have excellent forage qualities. The average quality class is 2.

The list of rare, endemic and relict plants of the Tigrovaya Balka Nature Reserve is provided in Appendix C1.

**Fauna**

The fauna of the Tigrovaya Balka Nature Reserve is characteristic of South-West Tajikistan and differs in species composition from the fauna of other regions of the Republic of Tajikistan (RT).

**Fish fauna** of the Tigrovaya Balka Nature Reserve and the Vakhsh river within its borders is relatively poor and is represented mainly by carps. Carp (*Cyprinus carpio* L.), Turkestan barbel (*Luciobarbus conocephalus*, Kessler), Aral barbel (*Luciobarbus brachycephalus*, Kessler), Bukhara roach (*Rutilus rutilracinus bucharensis*, Nicholspi), pike asp (*Aspius aspius iblioides*, Kessler), Samarkand khramulya (*Capoeta capoeta heratensis*, Kessler), ostroluchka (*Capoetobrama kuschakewitschi*, Kessler), catfish (*Silurus glanis*, L.) and occasionally spined loach (*Sabanejewia aurasa aralensis*, Kessler) can be found here (19).

In the lakes of the Vakhsh floodplain, one can find a very interesting fish called small mosquito fish (*Gambusia holbrooki*, Girard). Fish eat malaria mosquito larvae. It has been introduced to the lower reaches of the Vakhsh river in 1938, bred, and is now abundant in all lakes.

Aral shovelnoses (*Pseudoscaphirhynchus kaufmanni*, Kessler) must be mentioned as well. It is the most ancient fish of Central Asia. It belongs to the sturgeon family and is the closest relative of the shovelnose, found in the Mississippi River in North America and the Yangtze River in China (19).

**Amphibians** are represented by green toads (*Bufotes viridis*, Laurenti) and marsh frogs (*Pelophylax ridibundus*, Pallas).

**Reptiles** of the Tigrovaya Balka Nature Reserve are presented in the richest and varied manner. The most numerous order of herpetofauna of the reserve is the order of lizards that includes 22 species, 8 of which live only in the South-Western region of Tajikistan – in the reserve and its environs. These are Tajik gecko (*Alsophylax tadjikiensis*, Golubev), Eversman's fringe-toed gecko (*Crossobamon eversmanni eversmanni*, Wiegmann), toad-headed agama (*Phrynocephalus mystaceus*, Pallas), Sogdian toad agama (*Phrynocephalus interscapularis sogdianus*, Cernov), reticulate racerunner (*Eremias grammica*, Lichtenstein), black-spotted lizard (*Eremias nigrocellata*, Nikolsky), Boetger's netted toad agama (*Phrynocephalus strauchi*, Nikolsky). Most lizards are typically desert species.

Snakes are relatively common in the reserve. They are well represented in the Tigrovaya Balka Nature Reserve by 12 species, including poisonous snakes, such as Mid-Asian cobra (*Naja oxiana*, Eichwald), Mid-Asian gyurza (*Macrovipera lebetina turanica*, Cernov) and carpet viper (*Echis multisquamatus*, Cherlin).

The desert areas of the reserve are rich in reptiles. One can find here common the wonder gecko (*Teratoscincus scincus*, Schlegel) and the fringe-toed gecko (*Crossobamon eversmanni eversmanni*, Wiegmann), steppe agama (*Trapelus sanguinolentus*, Pallas), several species of toad agamas (*Phrynocephalus interscapularis sogdianus*, Cernov; *Phrynocephalus mystaceus*, Pallas и *Phrynocephalus strauchi*, Nikolsky), gray monitor lizard (*Varanus griseus*, Daudin), etc.

Long skinks (*Eumeces schneideri*, Daudin), Asian lidless skinks (*Ablepharus pannonicus*, Fitzinger) and small lidless skinks (*Ablepharus grayanus*, Stoliczka) live in the reserve. In the floodplain thickets with tall herbaceous vegetation, there are cross-barred Asian wolf snakes (*Lycodon striatus bicolor*, Nikolsky), multicolored Asian wolf snakes (*Hemorrhois ravergieri*, Menetries) and patterned Asian wolf snakes (*Elaphe dione*, Pallas). Poisonous snakes include Mid-Asian cobra (*Naja oxiana*, Eichwald), Mid-Asian gyurza (*Macrovipera lebetina turanica*, Cernov). In deserts, the Mid-Asian cobra (*Naja oxiana*, Eichwald) is found in places with shrubby vegetation, in the foothills and in low mountains it lives on

the southern slopes with trees and shrubs. The water snake (*Natrix tessellata*, Laurenti) can be found in all lakes, along the channels, and in the Vakhsh.

The Mid-Asian turtle (*Agryonemis horsfieldi*, Gray) is an endangered species of the reserve, one of the most ancient species of the republic's fauna.

The herpetofauna of the foothills and low mountains of the reserve is somewhat poorer. The Turkestan agama (*Laudakia lehmanni,* Nikolsky), the glass-lizard (*Pseudopus apodus*, Pallas), and others live here.

The gray monitor lizard (*Varanus griseus*, Daudin) is found in all areas of the reserve, but prefers fixed sands and semi-desert foothills. At present, it has become a very rare species, but its number in the reserve has been recovering in recent years. The cat snake (*Boiga trigonata melanocephala*, Annandale) is also endangered cat species.

The development of the Vakhsh valley and the river floodplain deprived many species of reptiles of their natural habitats, which led to a decrease in their number and range. It is the territory of the reserve that is their last «island of safety».

**Fig. 19.** ***Tenuidactylus bogdanovi (photo by A. Bragin)***

**Fig. 20. Barred wolf snake - *Lycodon striatus (photo by A. Bragin)***

**Fig. 21. *Varanus griseus (photo by A. Bragin)***

**Fig. 22.** ***Teratoscincus scincus (photo by A. Bragin)***

**Birds** are dominating in the reserve in terms of the diversity of species composition among all the vertebrates.

Ornithologic fauna of tugay forests is the richest and most diverse. Asiatic poplar forests with old hollow poplars attract white-winged woodpeckers (*Dendrocopos leucopterus leptorynchos*, Severtzow), rollers (*Coracias garrulus semenovi*, Loud et Tschusi), hoopoes (*Upupa epops epops* L.), tits (*Parus major bokharensis* Licht), eastern stock doves (*Columba eversmanni* Bp.), house sparrows (*Passer indicus*, Sharpe) and saxaul sparrows (*Passer ammodendri korejewi*, Zar.et Harms.). There are also a few herons (*Egretta alba* L.), night herons (*Nycticorax nycticorax* L.), snake eagles (*Circaetus ferox* (Gm.)) and black vultures (*Aegypius monachus* (L.)) nesting on the trees. Penduline tit (*Remiz pendulinus* Sev.) nests can be found on the thin hanging branches of the dzhida. Rufous bush robins live in the tamarix bushes, which are spread on the outskirts of tugay on solonchak soils, and red-backed shrikes (*Lanius collurio* L.) build their nests in the thorny bushes of wolfberry.

In the thickets of tugays, one can find a black-gold or Tajik subspecies of the common pheasant (*Phasianus colchicus bianchi* L.) – a narrow endemic of Southwestern Tajikistan. According to the expert evaluation of ornithologists, 1200-1500 pheasant species live in the reserve. The reserve is a kind

of genetic reservation for this pheasant species, from where it migrates throughout the territory of the Vakhsh valley and in general in the southern regions of the Republic of Tajikistan.

There are a lot of birds on oxbow lakes, half overgrown with reeds and cattails. Great and little dabchicks nest here. There are nests of mallard ducks (*Anas platyrhyncha* L.), common shovelers (*Anas clypeata* L.), rufous-crested ducks (*Aythya rufina* Pall.), herons (*Egretta alba* L.), and other birds. Pygmy cormorants (*Microcarbo pygmaeus* (Pallas)), common pochards (*Aythya ferina* L.), and tufted ducks (*Aythya fuligula* (L.)) spend winter on non-freezing lakes. There are also mallard ducks (*Anas platyrhyncha* L.), gray ducks (*Anas strepera* L.), common teals (*Anas crecca* L.), common goldeneyes (*Bucephala clangula* (L.), smews (*Mergus albellus* (L.), common mergansers (*Mergus merganser* L.) Gray herons (*Ardea cinerea* L.), small herons (*Egretta garzetta* (L.)) and great white herons (*Egretta alba* L.) can be found in coastal reeds.

On the lakes and channels of the left-bank part of the reserve, a large number of waterfowl game birds winter, and almost half of them are coots (*Fulica atra* L.) and diving ducks (*Aythya rufina* (Pall.)). Today, from 7 to 28 thousand birds winter in the reserve annually.

Ornithologic fauna of the sandy and clayey semi-deserts of the reserve is relatively poor. In the sandy desert, there are streaked scrub warblers (*Scotocerca inqueta platyura* Sev.), some diurnal birds of prey, and occasionally houbara bustards (*Otis undulata macqueeni* Gray), which has become a very rare species. In the grass-saltwort desert buzzards, occasionally crested larks (*Galerida cristata iwanowi* Zar. Et Loud), solitary specimens of the steppe kestrel (*Falco naumanni* (Fleischer) can be found.

The diversity of the semi-desert low mountains of Hodja-Kaziyon is also poor. A fairly constant inhabitant of these places is the desert owl (*Otus brucei* Hume.), nesting in holes or in crevices between stones. The steep slopes of the ravines are inhabited by blue rock pigeons (*Columba livia* L.) and eastern stock doves (*Columba eversmanni* Bp.), common kestrels (*Falco tinnunculus* L.), rollers (*Coracias garrulus semenovi* Loud et Tschusi), common bee-eaters (*Merops apiaster* L.), and blue-cheeked bee-eaters (*Merops superciliosus persicus* Pall.) Occasionally white marks can be viewed under the nesting niches of vultures (*Neophron percnopterus* L.) and griffon vultures (*Gyps fulvus fulvus* (Habl.)) Crows (*Corvus corax laurencei* Hume) nest on the cliffs. On alluvial benches, small flocks of feeding see-see partridges (*Ammoperdix griseogularis* Brandt) are found. In the gorges, in addition to common wheatears (*Oenanthe picata capistrata* Blyth), one can also find noisy nuthatches (*Sitta tephronota* Sharpe.) and fidgety warblers (*Scotocerca inqueta platyura* Sev.)

Summer ornithologic fauna of the reserve is relatively poor. There are about 60 nesting bird species. In various Asiatic poplar forests, as well as along the edges of tugay thickets, one can find the following nesting species: snake eagles (*Circaetus ferox* (Gm.), striated scops-owls (*Otus brucei* Hume.), turtle doves (*Streptopelia turtur* Bp.), eastern stock dove (*Columba eversmanni* Bp.), white-winged woodpeckers (*Dendrocopos leucopterus leptorynchos* Severtzow), rollers, hoopoes, magpies, orioles, tits and warblers. In total, more than 240 species of birds nest, winter and migrate in the reserve. The Red List of the Republic of Tajikistan (2015, 2017) and neighboring countries includes 55 rare and endangered species found in the reserve (26).

**Fig. 23.** ***Phasianus colchicus bianchii (photo by Eduard Jelen)***

**Fig. 24.** ***Clamydotis undulata (photo by R.Sh. Muratov)***

**Fig. 25. Common redshank -** ***Tringa totanus (photo by F. Rakhimov)***

**Fig. 26. Eurasian coot -** ***Fulica atra (photo by F. Rakhimov)***

**Fig. 27. Pallid scops owl - *Otus brucei (photo by F. Rakhimov)***

Of 84 currently known species of **mammals** of Tajikistan, 45 have been registered in the Tigrovaya Balka Nature Reserve. Of these, the Mid-Asian leopard (*Panthera pardus ciscaucasica*, Satunin), goitered gazelle (*Gazella subgutturosa*, Gueldenstaedt), the Bactrian deer (*Cervus elaphus bactrianus*, Lydekker), striped hyena (*Hyaena hyaena*, L.) are entered in the IUCN Red List , and in the Red List of the Republic of Tajikistan (2015, 2017) (in addition to species included in the IUCN Red List ), the porcupine (Hystrix indica, Kerr), the weasel (*Mustela nivalis*, L.), the marbled polecat (*Vormela peregusna*, Gueldenstaedt), the Mid-Asian otter (*Lutra lutra* L.), the jungle cat (*Felis chaus oxiana*, Heptner), the urial (*Ovis vignei bochariensis*, Nasonov), etc, are included.

The Tigrovaya Balka Nature Reserve is named after the Caspian tiger (*Panthera tigris virgate*, Illiger), which disappeared in the middle of the last century. Once upon a time, the Persian leopard (*Panthera pardus ciscaucasica*) permanently lived here, now this animal only visits the reserve from the adjacent areas.

From the order of insectivores, in addition to the eared hedgehog (*Hemiechinus auritus*, Gmelin) and several species of shrews, a rare species - the white-toothed shrew (*Suncus etruscus*, Savi) lives in the reserve, whose weight does not exceed 1.2-1.7 grams. It is an of Southern Tajikistan.

The most common predators of tugays are the jackal (*Canis aureus aureus* L.) and the jungle cat (*Felis chaus oxiana*, Heptner). Thanks to their omnivorous nature, jackals can thrive all year round. Night tugay without jackals howling seems lifeless.

The striped hyena (*Hyaena hyaena*, L.) is very rare, but it has also become more often seen by researchers (22).

Other reserve predators include, the steppe wolf (*Canis lupus campestris*, Dwigubski).

The Turkmen corsac (*Vulpes corsac turkmenica,* Ognev) is found in open desert places and in low mountains.

The order of lagomorphs is represented only by the tolai hare (*Lepus tolai*, Pallas). In foothills and tugays, on numerous animal paths, one can meet the largest rodent in Central Asia - the porcupine. This common species for the reserve has become rare and scarce.

Of small rodents, the little jerboa (*Allactaga elater*, Lichtenstein), the red-tailed gerbil (*Meriones libycus*, Lichtenstein), the midday gerbil (*Meriones meridianus*, Pallas) live in the desert. The house mouse (*Mus musculus* L.) is numerous in tugay, the pest rat (*Nesokia indica*, J.E. Gray) is less common. In the low mountains, one can find the footprints of the common mole-vole (*Ellobius talpinus*, Pallas). In the Kashka-Kum desert, one can see the long-clawed ground squirrel (*Spermophilopsis leptodactulus*, Lichtenstein).

The ungulates are represented by the typical inhabitants of tugays, including the Bactrian deer or hangul (Cervus elaphus bactrianus, Lydekker) and the wild boar (*Sus scrofa*, L.) (the smallest of its subspecies).

The Bactrian deer (Cervus elaphus bactrianus, Lydekker) belongs to the most characteristic representatives of the floodplain forests of Central Asia and, of course, this is a great value of the reserve. In Tajikistan, he lived in the floodplains of the Panj, Vakhsh, Kafirnigan, Amu Darya and Syr Darya rivers. The destruction of tugays led to a catastrophic reduction in its population.

**Fig. 28. Bactrian deer - *Cervus elaphus bactrianus* Lydekker *(photo by A. Butorin)***

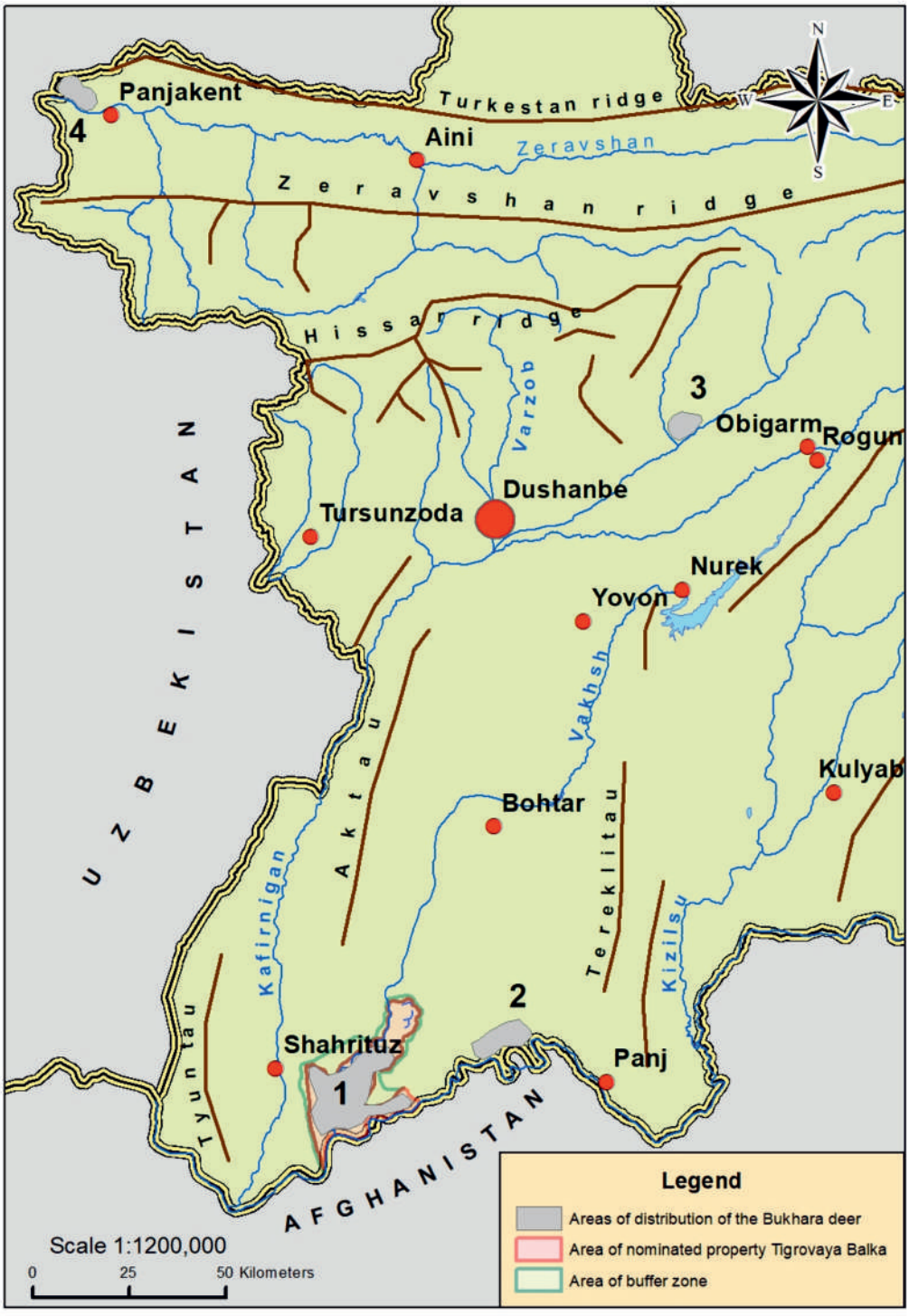



**Fig. 29. Dispersal of the Bactrian deer in Tajikistan:**
1 - Tigrovaya Balka Nature Reserve (right and left banks of the Vakhsh River), 2 - along the border near the village Nizhniy Panj, 3 – Ramit Nature Reserve, 4 - Zeravshan Nature Reserve.

Slender antelopes or goitered gazelle (*Gazella subgutturosa,* Gueldenstaedt) prefer semi-fixed sands of the Kashka-Kum desert. The number of gazelles also continues to decline due to the development of the Kashka-Kum desert and currently amounts to no more than 40 specimens (8).

**Fig. 30. Goitered gazelle, the Kashka-Kum stow of the Tigrovaya Balka Nature Reserve** ***(photo by R.Sh. Muratov)***

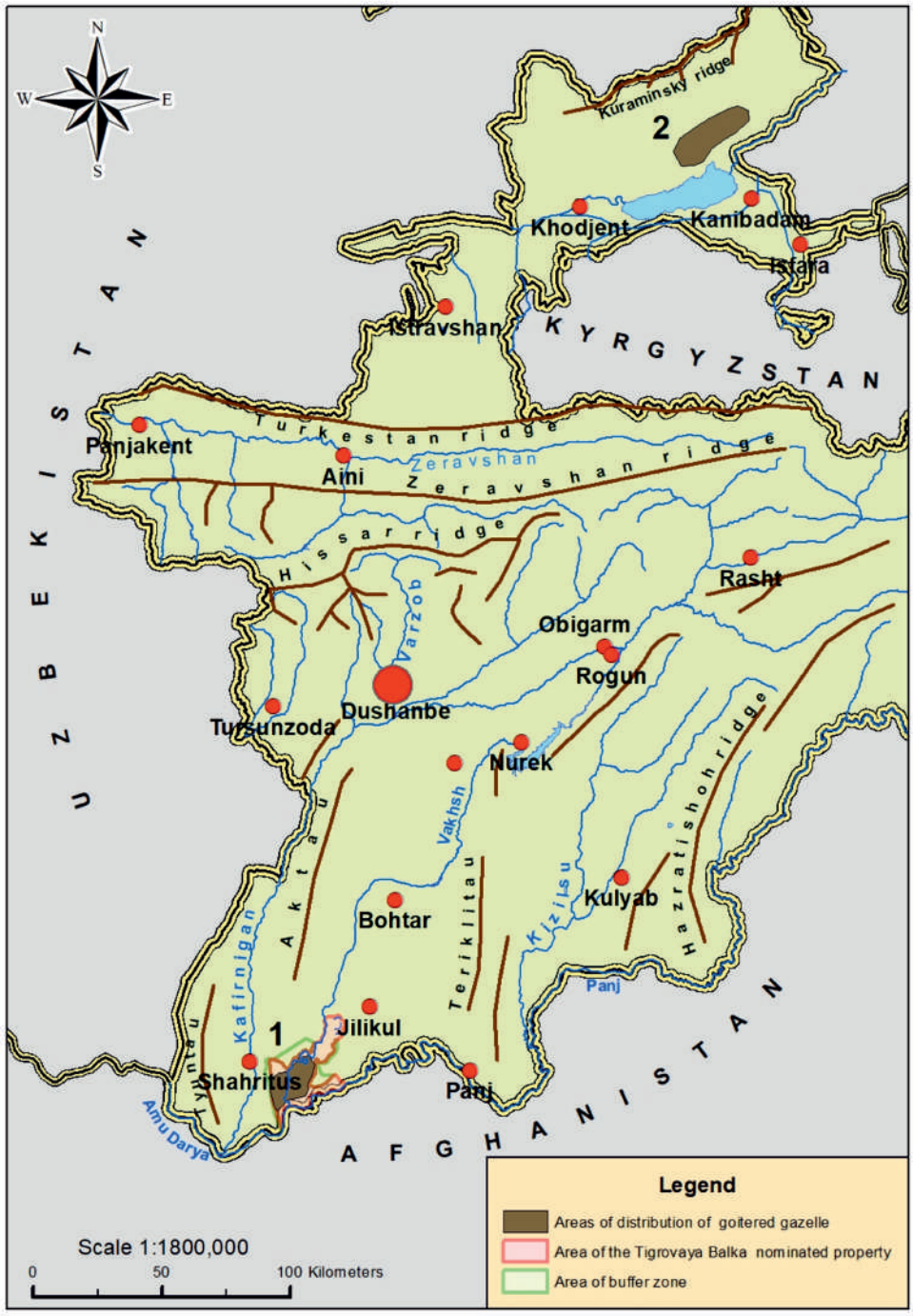



**Fig. 31 Dispersal of goitered gazelles in Tajikistan:**
1 - Tigrovaya Balka Nature Reserve, Kashka-Kum stow, 2 - the right bank of the Kairakkum reservoir.

In the low mountains of the reserve, on the right bank of the Vakhsh River, in the foothills of Hodja-Kaziyon, along the gentle hilly mountains with pistachio woodlands, one can still find a small population of wild rams - urials (*Ovis vignei bocharіensis*, Nasonov), the number of which, according to expert estimates, is 250-300 individuals (8).

The list of rare and endangered species of animals found in the Tigrovaya Balka Nature Reserve is provided in Appendix C2.

**Reserve ecosystem**

Analysis of fauna and vegetation cover of the reserve and the conditions of habitation of animals made it possible to identify the following ecosystems within the reserve.

**The ecosystem of the semi-desert landscape** is represented within the hilly-ridge sandy area of Kashka-Kum. This is a low-plain, very hot zone of desert-ephemeral vegetation that develops in spring and winter, and desert dwarf semishrubs that grow in summer. The main background, defining ephemeral vegetation, is bluegrass and sedge from *Poa bulbosa* and Carex pachystilis.

**Fig. 32. Semi-desert landscape of the Kashka-Kum massif *(photo by F. Rakhimov)***

Ephemeral wild grasses are represented by *Astragalus, Vulpia, Trisetum cavanillesii, Leptaleum filifolium*, etc. If to speak about semishrubs of this region, wormwood (*Artemisia scotina*) grow in summer on fine soils, Hammada leptoclada – on saline soils, juzgun (*Calligonum griseum*), cherkez (*Salsola richteri*), saxaul (*Haloxylon persicum*) – on the sandy soils. Territories of the ecosystem outside the reserve are used as winter and spring pastures.

The background species of the ecosystem's fauna are sunwatcher, toad-headed agama, common wonder gecko, desert monitor, carpet viper, stone curlew, houbara bustard, long-clawed ground squirrel, sandpiper, marbled polecat, gazelle.

**The ecosystem of low-grass piedmont semi-savannas and shiblyak** is widespread in the Buritau eminence and in the Hodja-Kaziyon mountains. It is dominated mainly by ephemeretum, such as Taneatherum erinitum, *Aegilops tritriucalis, Hordeum spontaneum* and *H. bulbosum.* The dominant plants include vulpia, awn, annual astragalus, fenugreek and ephemeroid, such as Bukhara anemone (*Anemone bucharica*) and buttercups (*Ranunculus leptorrhynchus* and *R.tenuilobus*).

**Fig. 33. Low-grass semi-savanna in the foothills of Hodja-Kaziyon** ***(photo by A. Butorin)***

The upper tier, along trails and rock benches, was occupied by shiblyak or xerophilous woodland of pistachio (Pistacia vera), almonds (*Amygdalus spinosissima*), etc. At present, pistachio woodlands occupy very small areas on the territory of the reserve, but they can be restored.

Background species of animals include steppe agama, lidless skink, long skink, glass-lizard, Mid-Asian cobra, black snakes, kite, common crested lark, common wheatears, fox, wolf, urial.

**The ecosystem of the tugay** complex is widespread in floodplains of rivers dominated by Asiatic poplar (*Populus pruinosa*) and oleaster or dzhida (*Elaeagnus angustifolia*) tugays, which alternate with thickets of giant reed (*Phragmites communis*), erianthus (*Erianthus ravennae*), sugar cane (*Saccharum spontaneum*) in the low areas. A significant part of this ecosystem is strongly influenced by humans.

**Fig. 34. Asiatic poplar tugay forest in the floodplain of the Vakhsh River** ***(photo by A. Butorin)***

Background species of animals are Mid-Asian blunt-nosed viper, green toad, pheasant, magpie, great tit, white-winged woodpecker, penduline tit, porcupine, jackal, Bactrian deer, jungle cat, striped hyena.

**The ecosystem of reservoirs or wetlands** of the reserve is spread along the Vakhsh and Panj rivers and numerous lakes located on the lower sections of floodplains. The formation of lakes (about 40 large and small) is associated with lateral erosion in easily eroded loess soils of rivers and with accumulative processes. The lakes are fed exclusively during the flood period when they are temporarily connected to the river, as well as during filtration at high water levels in the river. With the development of irrigation and hydropower construction on the Vakhsh, runoff has been withdrawn for irrigation. The flood peaks were reduced. As a result, many oxbow and floodplain lakes in the lower reaches of the Vakhsh have reduced their sizes.

**Fig. 35. Wetlands near the cordon Brick Lake** ***(photo by F. Rakhimov)***

Oxbow lakes are densely overgrown with aquatic vegetation, i.e. watermilfoil, various types of pondweed, hornweed, buckwheat, and in some places fish grass. The species composition of fish is rather poor. Almost exclusively carps are found here, e.g. sazan, Turkestan and Aral barbel, Bukhara roach, Syrdarya riffle minnow, Turkestan gudgeon, pike asp, as well as catfish, and occasionally the Aral spined loach. Vakhsh is inhabited by large and small Aral shovelnoses, Aral barbel, pike asp.

One can find nutria (Myocastor coypus) in the lakes of the reserve. It was brought here in the fall of 1949 and rooted very well. The Mid-Asian otter can be also met. Water snakes are common. The lakes of the reserve are a wintering place for more than 50 species of birds arriving from Western Siberia, Kazakhstan, and Kyrgyzstan.

## 2.b History and Development

### History of geological development

The Vakhsh valley was formed at the end of the Paleogene, during the Depression period. The Buritau massif, composed of Paleogene limestones, dates back to that time. The Kara-Dum massif is an anticline and is composed of Neogene rocks. Other ranges in the lower reaches of the Vakhsh originated at the end of the Neogene and are synclinal formations.

Other ground forms in the lower reaches of the Vakhsh was formed in the Quaternary period. Most part of the Tigrovaya Balka Nature Reserve is located on river terraces. These terraces were formed in two stages.

At the first stage, up to the mid-Quaternary period, there was a decrease in the base level of erosion of the Vakhsh (during this period 3-6 terraces were formed).

By the end of the mid-Quaternary period, the base level of erosion of the Vakhsh had risen sharply. Thus, the second and first river terraces turned out to be nested in the depression eroded in the accumulative deposits of the third terrace. The change in erosion and accumulation was caused by the tectonic movements in this area. The third terrace appeared in the mid-Quaternary period, the second – in the upper Quaternary period, and the first – in the Holocene.

The history of studying the nature of the reserve dates back to the second half of the

### History of development and protection

Back in the early twentieth century, the Vakhsh River valley was one of the under-populated and poorly explored corners of Tajikistan. The banks of the river were overgrown with tugay forests, and settlements were extremely rare. Tugays were widespread in the floodplains of the Kafirnigan, Vakhsh, Kyzylsu, and Panj rivers in Southwestern Tajikistan. The aspect of floodplain lands, tugay forests, and adjacent deserts began to change in the 30s when the development of the Vakhsh valley began. A road and a light narrow-gauge railroad were built, connecting the Vakhsh and Gissar valleys. The Vakhsh and Kumsangir main channels and a widely branched irrigation network were built. Many settlements arose in the Vakhsh valley in a short period of land development.

Already at the beginning of the development of the Vakhsh valley, the participants of the Tajik comprehensive expedition proposed to create a reserve in the lower reaches of the Vakhsh, which should have included both tugays and part of the Kashka-Kum desert. In 1937, the State Hunting Inspectorate of the Tajik SSR organized a special expedition aimed to choose a place for organizing a nature reserve in the Vakhsh valley.

The Tigrovaya Balka Nature Reserve was established on November 4, 1938, in accordance with the decree of the People's Commissariat for Agriculture of the Tajik SSR to preserve the natural complex peculiar to the southern deserts and floodplains of the Mid-Asian rivers, protect rare animals, and conduct diverse scientific research. Initially, the area of the reserve covered 50 thousand hectares. On January 14, 1941, the Tigrovaya Balka Nature Reserve was transferred to the Tajik branch of the Academy of Sciences of the USSR, which was later transformed into the Academy of Sciences of the Tajik SSR. During the war years, by 1945-1946, the protected area spontaneously decreased to 5-7 thousand hectares. In 1951, the area of Tigrovaya Balka was expanded again to 27 thousand hectares, and then, in 1953, it was again reduced to 20.9 thousand hectares. In 1959, the territory of the reserve was increased to 41 thousand hectares and it was transferred to the jurisdiction of the State Committee for Forestry of the Tajik

SSR. In 1968, the area of the reserve covered 48.4 thousand hectares, and in 1970 – 52.2 thousand hectares.

In 2004, as a result of the merger of the Ministry for Nature Protection of the Republic of Tajikistan and Tajikles State Forest Enterprise into a single State Committee for Nature Protection and Forestry of the Republic of Tajikistan, the reserve was transferred to the newly organized State Institution – Tajik National Park Specially Protected Natural Areas, which in 2008 was transformed into the State Institution for Specially Protected Natural Areas of the Committee for Environmental Protection under the Government of the Republic of Tajikistan.

As a result of the transfer of part of the land to agricultural enterprises in previous years, the area of the Tigrovaya Balka Nature Reserve totaled 49,786 hectares.

In the historical aspect, the significant influence of anthropogenic factors on ecosystems within the lower reaches of the Vakhsh river began during the industrial period and the development of virgin lands in the Vakhsh valley in the 50s-60s, after the creation of the reserve. By the 90s, the degree of anthropogenic impact on the environment had increased significantly. In the period 1990-2005, the ecological state of ecosystems of the lower reaches of the Vakhsh, including protected areas, has significantly deteriorated due to the socio-economic crisis that happened back then, despite the decline in the industrial development of the Vakhsh valley. Currently, most of the territory occupied in the past by tugay vegetation has been developed. Tugays survived only in the lower reaches of the Vakhsh River, in the Tigrovaya Balk Nature Reserve, and a narrow strip along the Panj River, along the state border of Tajikistan with Afghanistan.

**History of scientific research**

XIX century. Since the establishment of the reserve in 1938, many scientists have worked here, such as soil scientists, zoologists, botanists, geologists, sociologists, etc, including E.N. Blagoveshchensky, P.D. Gunin, Yu. Gorelov, V.A. Stal'makova, O.B. Pereladova, V.V. Knyaz'kov, S.T. Blagoveshchenskaya, M.Yu. Medvedev and many others. Even during the Great Patriotic War and in the post-war years, scientific research in the reserve was continued under the general guidance of Academician M.N. Narzikulov. In 1959 he edited the collection of works called the Tigrovaya Balka Nature Reserve issued by the Institute of Zoology and Parasitology. The reserve and its history are associated not only with natural complexes but also with the people who protected it. Until now, the reserve staff remembers the young Leningrad zoologist R.L. Potapov, who for several years not only pursued science, studying fauna but also served there, protecting wild animals from poachers.

The reserve is a kind of testing ground where the most relevant scientific problems and objectives, related to the justification, development, and implementation of measures for the protection of nature, are solved. Over the past 83 years, dozens of expeditions of scientists and specialists of various profiles have worked here. Based on their research, numerous conferences, symposia, and meetings were held; monographs, reports, collections of articles were published.

A consistent study of the vegetation cover of the territory began in 1932 after the organization of the Tajik comprehensive expedition. The Vakhsh geobotanical team included botanists N.F. Goncharova, Yu.S. Grigorieva, V.A. Nikitin.

Brief information about reserve's flora and vegetation is available in the works of P.N. Fedchenko (1903-1933), Lipsky (1902-1913), Goncharova (1934), P.N. Ovchinnikov

(1941,1947,1948), Vasileva (1934), I.T. Vasilchenko (1935), Vvedensky (1934-1935), and others.

The results of studying flora and vegetation cover of the reserve are presented in the works of Yu.I. Molotkovsky "A brief description of the vegetation of the Tigrovaya Balka Nature Reserve" (1982); G.N. Sapozhnikov "Let's create reserves in Tajikistan" (1967,1973); A.G. Chukavina (1985); Medvedev (1981, 1982); S. Blagoveshchenskaya, (1978, 1979, 1980, 1981), etc.

The staff of the Institute of Botany of the Academy of Sciences carried out stationary observations. They also kept Nature Records and studied flora and vegetation of the reserve. Since the 1970s, the researchers of the Department for Rational Use of Natural Resources of the Academy of Sciences have been studying the dynamics of flora.

From 1952 to 1980, the Department of Geobotany of the Institute of Botany of the Academy of Sciences headed by G.T. Sidorenko studied and mapped pastures and hayfields (1952-1980).

Data concerning the state of the dynamics of flora and vegetation is provided in the works of F.N. Rusanov (1930), S. Shuvalova (1930), N.F. Goncharova (1937), F.L. Zapryagaeva (1937), K.V. Stanyukevich (1963), Yu.N. Molotkovsky (1968-1969), A.S. Davlatov (1970,1976,1977,1979), and others.

Materials on the productivity and water regime of tugay forests of Tigrovaya Balka are contained in the works of the prominent scientist Yu.N. Molotkovsky (1969, 1983, 1985). Valuable information about the state of vegetation and flora of tugay communities of Tigrovaya Balka is provided in the works of A.S. Davlatov (1964, 1974, 1979, 2004, 2005, 2006). He also studied the diversity of flora and the state of vegetation of Tigrovaya Balka.

From 2002 to the present, the staff of the Department of Ecology of the Faculty of Biology (A.S. Davlatov, M.D. Darvaziev) have been studying flora and vegetation of Tigrovaya Balka and continued their monitoring observations.

Materials on the study of fauna of Tigrovaya Balka are provided in the works of I.A. Abdusalyamova (1971), Atoeva (1967), Bayeva (1975), Bogacheva (1959), Gadzhei (1962), Grishenko (1976), Jalilov (1966-1969), Zhumanov (1977), Izatulloev (1975), Kuimy (1973 ), Nazirkulov (1952, 1962, 1974, 1969), Khaitov (1978), Svetovidov (1952), Sapozhnikova (1983), S.I. Isakova (1970, 1976, 1979), and others.

Information on fauna of vertebrate animals of the reserve is also contained in a number of fundamental monographic works (Chernov, (1956); I.A. Abdusalyamov (1971, 1973, 1977); Saidaliev (1979); Sokov (1992)). The fauna of invertebrate animals of the reserve is still poorly studied.

In 1959, R.L Potapov studied ornithologic fauna of the Tigrovaya Balka Nature Reserve. The results of these studies were published in the monographic summary "Review of summer ornithologic fauna of the Tigrovaya Balka Nature Reserve" (Potapov 1959) and in a number of articles. Further, birds of the reserve were studied by I.A. Abdusalyamov. (1971, 1973, 1977), V. Bidos (1985), R.Sh. Muratov (2021), F. Rakhimov (2021), and others.

The study of the soil cover of Tajikistan, including Tigrovaya Balka, was started in 1913. Some materials are found in the short notes of Goevsky (1913). He studied swampiness and salinity of the lands of the northern part of the Vakhsh valley. General information about soils is reflected in the reviews of D.N. Tarasov (1939-1940), A.V. Nikolaeva and O.A. Grobovskaya (1946).

Materials concerning the genesis of the soils of the reserve are contained in the works of A.N. Rozanov (1937,1940), Tarasov (1937-1939, 1941), and others.

Materials on the study of the dynamics of the biological cycle are provided in the work of soil scientists of the Tajik branch of the Academy of Sciences of the USSR (P.N. Kerzum, O.A. Grobovskaya, E.A. Riznitsin (1946)).

Valuable materials about the soils of the region are contained in the works of Rozanov (1950), M.A. Pankov (1930), F.M. Panamareva (1931), and others. Information about the soils of the studied area is provided in the work of soil scientists of the Vakhsh soil-amelioration station of the Tajik branch of the Academy of Sciences of the USSR, S.T. Kudalieva, A.T. Sundukov (1939-1948), and others. The staff of the Institute of Soil Science of the Academy of Sciences of the Republic of Tajikistan P.A. Kerzum (1983), S.I. Vasilchikova (1983), A.A. Sadriddinov (1983), and others also studied the soils of the Tigrovaya Balka Nature Reserve.

The study of soil formation and salt accumulation in the reserve began long ago. At different times, the soils of the reserve were studied by E.N. Blagoveshchensky (1959), R.S. Leontyeva (1989), R.S. Kabylov (1966, 1970), Yu. Molotkovsky (1973,1975), E.G. Vaksman, and S.I. Vasilchikova et al. (1978,1980,1986), S.P. Lomov et al. (1980,1983,1984,1985), and others.

**Fig. 36. Entomologists studying ferul formations in the Tigrovaya Balka Nature Reserve** ***(photo by M. Salimov)***

**Watering point at a temporary channel of the Vakhsh River** ***(photo by A. Butorin)***

# 3
# JUSTIFICATION FOR INSCRIPTION

**Tigrovaya Balka Nature Reserve (*photo by F. Rakhimov)***

## 3.1.a Brief synthesis

The nominated territory is located in the interfluve area of the Vakhsh, Panj and Kafirnigan rivers, at the border of Afghanistan, where the largest river in Central Asia – the Amu Darya – takes its origin. The territory covers a vast area of tugay ecosystems, along the banks of the Vakhsh River, the territory of the hilly sandy Kashka-Kum desert, the Buritau eminence, as well as the low mountains of the southern spurs of the Aruktau range – the Hodja-Kaziyon mountains. The area of the Tigrovaya Balka Nature Reserve is 49,786 hectares and the area of its buffer zone is 17,672 hectares.

The reserve is a unique desert-tugay reservation of dry Central Asian type subtropics, where a natural Asiatic poplar tugay vegetation complex is preserved. The complex is composed of water-resistant and thermophilic summer-green salt-tolerant trees and shrubs, such as the Asiatic poplar or blue poplar, the dzhida or oleaster, the multiramose tamarix, and rare and endangered animals inhabiting it, such as the Bactrian deer, whose population in the reserve exceeds 300 heads, the goitered gazelle, the striped hyena, the gray monitor, the Tajik black-and-gold pheasant, and many waterfowl birds. Tugay forests occupy an area of 24.1 thousand hectares in the reserve and this is the only place in the world where the Asiatic poplar tugay ecosystem has been preserved in its original state on a vast territory.

The outstanding universal value of the territory is determined by its location in the Southern Pamir-Alai and Hindu Kush mountain systems, where in the lower reaches of four large rivers (Panj, Vakhsh, Kafirnigan, Puli Khumri) hot climatic conditions with a huge wet mass on the surface of the earth and in a significant airspace were formed. In these physical and geographical conditions, a special intrazonal, intermountain oasis with a peculiar landscape was formed. It is here where mountain thorn and shrub woodland ecosystems are combined with desert-sandy and wetland, savanoid ecosystems, and salt-tolerant tree-shrub communities with water resistant big sod grasses. This diversity of ecosystems has been preserved in the Tigrovaya Balka Nature Reserve since its creation in 1938.

The Tigrovaya Balka Nature Reserve is a living memory of tugay forests, impenetrable thickets of trees and shrubs, which existed relatively recently on vast areas. The reserve is of great scientific and scientific-educational significance. The massif of Asiatic poplar tugay forests preserved here makes it possible to assess the current scale of anthropogenic impact on nature and evolution of landscapes of the planet as a whole.

## 3.1.b Criteria under which inscription is proposed (and justification for inscription under these criteria)

The territory is nominated based on criteria (x) and (ix).

***Criterion*** *ix:*

The natural complex of Tigrovaya Balka is an outstanding example of continuous ecological and biological processes taking place in the evolution and development of desert-tugay biocenoses and their characteristic plant and animal communities. The reserve has an amazing variety of landscapes with coexisting jungles, sandy and saline semi-deserts, piedmont semi-savannas, and various wetlands, dynamically adapting to changes in the hydrological regime of the territory.

The territory is of global scientific importance as a testing ground for studying the evolution of terrestrial ecosystems, primarily desert and semi-desert ones.

***Criterion x:***

The Tigrovaya Balka Nature Reserve is the last large reserve on the planet that preserves the natural communities of Asiatic poplar tugay flora and fauna that have not been significantly suffered from anthropogenic impact. The reserve serves as a genetic reservation for rare and endangered plant and animal species inhabiting its territory, making a significant contribution to the preservation of the region's biodiversity.

In the Tigrovaya Balka Nature Reserve, the largest in Central Asia forest area of the Asiatic poplar or the blue poplar (*Populus pruinosa* Schrenk) is preserved, which in the community with the dzhida or the oleaster (*Elaesgnus angustifolia* L), the multiramose tamarix (*Tamarix ramosissima* Ledeb.), and others, occupies the floodplain and above-floodplain river terraces of the reserve. The poplar itself is a relic of turgay forests of the tertiary hygrophilic formations of the East Asian Paleocene, preserved under conditions of post-Tertiary aridization in river valleys among deserts.

In addition to the relict ecosystems, the unique objects preserved in the reserve include animals from the Red List of the IUCN, such as the Bactrian deer (*Cervus elaphus bactrianus*), the goitered gazelle (*Gazella subgutturosa*), the Persian leopard *(Panthera pardus ciscaucasica)*, and the striped hyena (*Hyaena hyaena*). The nominated property is the only place in Tajikistan where the Bactrian deer can still be found in its natural habitats.

The reserve is home to more than 60 species of rare and endangered vertebrates in Tajikistan and Central Asia. There are 55 globally threatened bird species in the reserve species (26). The lakes of Tigrovaya Balka are a wintering place for more than 85 species of semiaquatic and fish-eating birds, arriving here from Northern Kazakhstan, Kyrgyzstan and Western Siberia. These are great and pygmy cormorants, red, gray and white herons, ospreys, gulls, terns, dabchicks, several species of waders, etc.

The Red Book of the Republic of Tajikistan includes the gray monitor, the Mid-Asian cobra, the blunt-nosed viper, the black vulture, the snake eagle, the osprey, the red-capped falcon, the Tajik pheasant, the houbara bustard, the marbled polecat, the Mid-Asian otter, Bukhara mouflon (urial), etc.

The following rare and endangered species of fauna of the Republic of Tajikistan are found in the reserve:

- fish: the little Aral shovelnose, the big Aral shovelnose, the pike asp, the Aral and Turkestan barbel;
- reptiles: the Central Asian tortoise, several species of geckos, toad agamas, the desert lacerta, the Tatary sand boa, the carpet viper, etc.;
- birds: the white stork, the stone curlew, the black-bellied sandgrouse, the vulture, the griffon vulture, etc.;
- mammals: the white-toothed shrew, the weasel, the jungle cat, the Indian porcupine, the long-clawed ground squirrel, etc.

**Fig. 37. The border between tugay and meadow vegetation on the floodplain and semi-savanna on the over-floodplain terrace *(photo by A. Butorin)***

## 3.1.c Statement of Integrity

The principles of integrity of the natural complex of tugay ecosystems between the Vakhsh and Panj rivers were observed yet in 1938 while creating the Tigrovaya Balka Nature Reserve, the boundaries of which coincide with the boundaries of the nominated property.

The integrity justification is given in accordance with the Operational Guidelines.

Paragraph 88:

(a) The Tigrovaya Balka Nature Reserve is an integral natural complex, the main components of which are inseparably associated with each other by the common origin, historical fate, and dynamics of natural development, and includes the elements necessary to confirm its outstanding world value. The reserve is the last large reservation on the planet that preserves the natural communities of Asiatic poplar tugay flora and fauna.

(b) By its size (49,786 hectares) the nominated property is sufficient to support the sustainable functioning of tugay ecosystems and fully represent characteristics and processes that reflect their significance. The buffer zone of the reserve (17,672 hectares) provides additional guarantees of the integrity of the nominated property.

(c) Various forms of human activity (grazing, haymaking, felling, hunting) that existed before the establishment of the reserve in 1938 had minimal impact on the protected area itself. However, the active agricultural development of the Vakhsh Valley, which began in the 30s of the XX century, almost everywhere near the boundaries of the reserve has transformed natural ecosystems into an agricultural landscape.

The ecosystems of the protected area are, to a certain extent, subject to the consequences of changes in the hydrological regime of the Vakhsh River associated with the construction of a cascade of hydroelectric power plants in its mountainous section 120 km above the northern border of the reserve. A significant deterioration in the ecological state of tugay ecosystems took place in the period 1990-2005 as a result of socio-economic crisis that happened in the Republic of Tajikistan. In recent years, both plant communities of the nominated property and the inhabitants, primarily the IUCN Red List species – the Bactrian deer, the goitered gazelle, and the striped hyena – have demonstrated recovery dynamics.

Paragraph 90:

Biophysical processes and properties of the natural landscape of the nominated property are indirectly influenced by human activities on the adjacent territories, but have not been significantly disturbed to date.

Paragraph 94:

Tigrovaya Balka includes all the elements necessary to demonstrate the main aspects of the processes that are of fundamental importance for the conservation of ecosystems and their biodiversity. The reserve includes ecosystems of tugay floodplain forests, sandy and saline semi-deserts, foothill low-grass semi-savannas and wetlands.

Paragraph 95:

The largest existing massif of Asiatic poplar tugay forests is preserved in its natural state within the boundaries of the nominated territory. It occupies 47.3% of the total area of the reserve or 24,100 hectares. The reserve includes areas of diverse fauna and flora, typical for both the ecoregion of the Central Asian mountain steppes and forests from the Global 200 list, and for the ecosystems listed in paragraph 94.

Tigrovaya Balka is not only the main habitat for the endangered Bactrian deer, the goitered gazelle, and the striped hyena, but for vulnerable representatives of fauna, such as the pike asp, the big and little Aral shovelnose, the gray monitor, the cobra, the cat snake, the barred Asian wolf snake, the urial, Tajik subspecies of pheasant, the see-see partridge, the snake eagle, the houbara bustard, the spoonbill, stone curlew, the steppe kestrel, etc.

## 3.1.e Protection and management requirements

The requirements for the protection and management of the Tigrovaya Balka Nature Reserve are regulated by Law of the Republic of Tajikistan No. 788 «On Specially Protected Natural Areas» of December 26, 2011. The law defines the legal, organizational and economic foundations for functioning of Special Protected Natural Areas of the Republic of Tajikistan, establishes their objectives and goals, mode of operation and zoning. Depending on the purposes of creation, the peculiarities of the regime of protection and use, the Law establishes a classification of protected areas, according to which state natural reserves (including Tigrovaya Balka) fall into the highest category (category Ia according to the IUCN classification).

Economic and other activities that violate the development of natural processes, threaten the state of natural complexes and properties, and are not related to the fulfillment of the objectives and goals assigned to the reserves are prohibited on

the territory of state nature reserves.

The authorized state body, the Committee for Environmental Protection under the Government of the Republic of Tajikistan is in charge of management of the Tigrovaya Balka Nature Reserve, as well as control over its condition and compliance with the protection regime.

The powers of the Committee for Environmental Protection include:

- implementation of a unified state policy in the field of specially protected natural areas;
- organization of monitoring of specially protected natural areas;
- implementation of state control;
- development of programs and regulations for specially protected natural areas;
- filing of claims for compensation for damage caused to specially protected natural areas as a result of non-compliance with environmental legislation;
- exercise of other powers determined by the legislation of the Republic of Tajikistan.

Routine protection and preservation of attributes, reflecting the outstanding universal value of the Tigrovaya Balka property is carried out by the directorate of the reserve based on medium-term management plans. Thus, the Management Plan for the Tigrovaya Balka Nature Reserve and the adjacent territory for the period 2022-2026 provides for specific activities, timing of their implementation, executors, sources of financing, and expected results (Appendix B4). The reserve has necessary material and human resources (the staff consists of 56 employees) to ensure the preservation and further natural development of the complex of ecosystems. Detailed additional information on the activities of the reserve is contained in paragraphs 5c, 5e and 5f.

The nominated property suffers some negative impact from agricultural activities in its immediate vicinity (paragraph 4.b (i)). It's also worth noting the significant anthropogenic pressure on the ecosystems of the reserve during the socio-economic crisis in the Republic of Tajikistan in 1990-2005. However, since the mid-2000s, the necessary measures have been taken on site both to prevent the existing anthropogenic impact and to restore the damaged ecosystems of the reserve. The positive recovery trend is evidenced by the data of monitoring observations (paragraph 6c). Compliance with the reserve regime, infrastructure, and staffing make it possible to self-renew the ecosystems of the reserve and restore the number of background species of plants and animals.

There is no doubt that the inscription of the Tigrovaya Balka Nature Reserve on the World Heritage List will significantly increase attention to the territory, contribute to its successful protection and conservation.

## 3.2 Comparative Analysis

**Global Analysis – biogeographic realms and terrestrial biomes (Udvardy, 1975, RESOLVE Ecoregions 2017, Global 2000)**

The Tigrovaya Balka Nature Reserve is located in the center of the Palearctic, which is one of the largest biogeographic realms on the Earth. This is a truly vast area, stretching from the hot deserts of North Africa to the Arctic tundra of Siberia and the Russian Far East, with over 80 World Natural Heritage sites located there, which fully correlates with the figure of 218 heritage sites located globally.

Moving down to the regional level to Central Asia (and this is also a huge territory in terms of area, especially this geographical term is understood in its broadest sense, see

below), one may find that the main areas here are covered with mountains (Montane Grasslands & Shrublands biome), steppes (Temperate Grasslands, Savannas & Shrublands biome) and deserts (Deserts & Xeric Shrublands biome). There are still relatively few World Natural Heritage sites here, unacceptably few if to be exact, no more than a dozen in total, which is a disproportionate-ly small percentage of the total number of such properties located globally.

Therefore, Central Asia is perceived, if not as a vast "blank spot" on the world map of the distribution of World Natural Heritage sites, then at least as an area with a reduced density of such sites. The very few natural UNESCO monuments of this region represent, first of all, the mountain biome (Tajik National Park, Western Tien Shan, Xinjiang Tien Shan, Golden Moun-tains of Altai), the steppe biome to a lesser extent (Saryarka – Steppe and Lakes of Northern Ka-zakhstan, Uvs Lake Basin, Landscapes of Dauria), and the desert biome to a minimum extent (Uvs Lake Basin).

Consequently, from this point of view, the assignment of the status of a UNESCO mon-ument to the Tigrovaya Balka Nature Reserve, located just in the arid "core" of Eurasia, at the junction of steppes and deserts, seems to be extremely relevant. This would give the global placement of World Natural Heritage sites a slightly more uniform character and, also, would bring the world a little closer to the solution of the important task that the organizers of the UNESCO World Heritage List once set for themselves, i.e. it would allow reflecting the diversi-ty of natural landscapes of all major parts of the Earth as fully as possible.

**Identification of the region under the study**

The composition and boundaries of Central Asia, as a significant land area, are understood in the broadest sense of this term (especially since there is no consensus among scientists on this mat-ter).

First of all, this is about the countries that are traditionally included in the concept of Central Asia (Kazakhstan, Turkmenistan, Uzbekistan, Kyrgyzstan, Tajikistan), but also about the adjacent territories of neighboring states with the same arid climate and similar landscapes (south of European Russia and southern Siberia, northern regions of Afghanistan and Iran, northwestern China, northern Mongolia). The analysis involved the territory of Azerbaijan, with its well-represented arid landscapes, even though this country is located "on the other side of the Caspian Sea" and is usually referred to as the Caucasus region.

**Objects of the study**

The study is focused on arid steppe, semi-desert and desert regions of Central Asia, together with the adjacent territories of neighboring countries, with their valley-river, lacustrine-boggy objects and other water bodies, where it is potentially possible to find tugay vegetation with a characteristic fauna mainly distinguished by a variety of bird species.

The closest attention is paid to the largest Central Asian rivers, which are united in the same ecoregion – the Central Asian riparian woodlands. This ecoregion, whose contours are line-ar for natural reasons, is part of a much larger Deserts & Xeric Shrublands biome. First of all, this is about such rivers as the Amu Darya and the Syr Darya, the Murghab and the Tejen, the Ili and the Zeravshan, the Vakhsh and the Panj. It is along their course that the main analogs of the Tigrovaya Balka can be located (in the figure, this ecoregion is indicated in purple, source: https://wiki2.wiki/wiki/Central_Asian_riparian_woodlands).

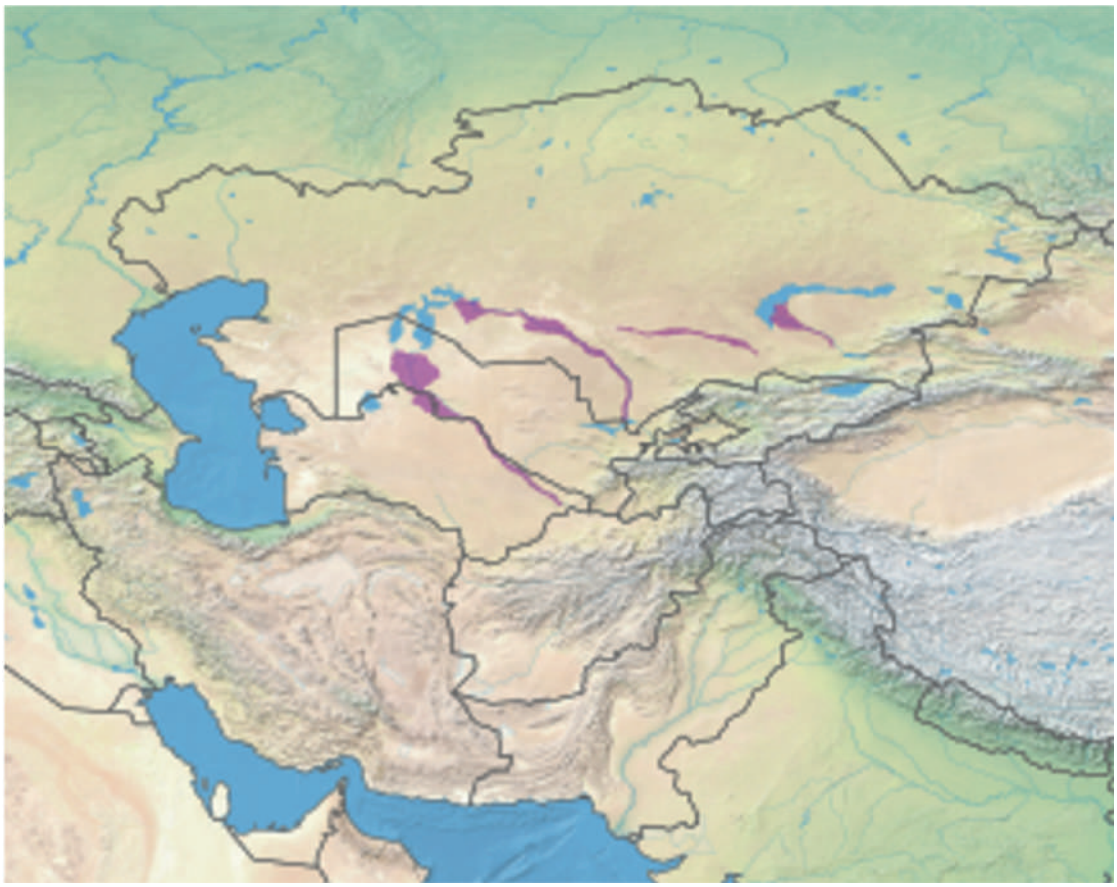


**Fig. 38. Boundaries and composition of the Central Asian riparian woodlands ecoregion**

An important reference in identifying such analogs can be the fact that the largest and most un-changed ones have already a certain conservation status. Most often these are reserves, key im-portant bird areas (IBM), wetland sites of international importance (RAMSAR) (http://datazone.birdlife.org/site/factsheet/8000).

### Main areas of comparative analysis

The search for possible analogs was carried out taking into account the fact that the discussed reserve is close to the inscription on the UNESCO World Heritage List under criterion x (biodiversity/rare species), and for two separate, although largely interrelated, reasons: A) the de-velopment of Central Asian riparian woodlands, and B) the presence of populations of several globally rare species, including, the Bactrian deer.

Therewith, the search for analogs was carried out in three areas: among the properties inscribed on the main World Heritage List, among the applicants (Tentative Lists), and among oth-er valuable natural sites beyond the mentioned World Heritage Lists, which are either already under the state protection (existing protected natural areas), or those proposed for such protec-tion (prospective protected natural areas).

### A) Central Asian riparian woodlands

At present, untouched riparian woodlands are preserved only in the form of separate, limited in area massifs in the floodplains of large rivers of Central Asia. They represent, in essence, only the remnants of the once widespread dense floodplain forests. About 10,800 hectares of such wood-lands have been preserved in the Republic of

Uzbekistan, 7,600 hectares in the Republic of Kyr-gyzstan, 5,600 hectares in the Republic of Turkmenistan, 5,400 hectares in the Islamic Republic of Afghanistan (on the border with Tajikistan).

In Kazakhstan, thanks to the vast Ili River delta, which has long had a conservation sta-tus, riparian woodlands occupy more significant areas, about several tens of thousands of hec-tares.

Thus, it turns out that the largest area of natural riparian woodlands in Central Asia of 24 thousand hectares is located in the Tigrovaya Balka Nature Reserve.

In this vast massif-oasis, surrounded by arid and in many ways already highly developed territories, the main tree and shrub species are blue poplar (Populus pruinosa Schrenk), oleaster (Elaeagnus angustifolia L) and multiramose tamarisk (Tamarix ramosissima Ledeb.). They mainly grow on the floodplain and above-floodplain river terraces of the reserve.

**Existing Natural World Heritage Sites**

The existing World Natural Heritage sites located in the countries of Central Asia and some ad-jacent regions were analyzed. The emphasis was on identifying riverine valley landscapes and lacustrine-boggy complexes in these arid zones.

As a result, several desert-steppe territories were identified, all with large water bodies, which can, hypothetically, compete with the Tigrovaya Balka Nature Reserve in Tajikistan, namely:

**Saryarka – Steppe and Lakes of Northern Kazakhstan (criteria ix, x)**

This area belongs to the Kazakh steppe ecoregion, a steppe biome. It includes a few large (Tengiz, Korgaldzhin) and many small fresh and salty, flowing and closed lakes, surrounded by steppes of different types, meadows and swamps, halophytic communities, reedbeds and bushes. Conifers, singly or in groups (a manifestation of the forest-steppe), are located not on the shores of lakes, but rather on the adjacent, more elevated watershed areas. For example, this is the unique Naurzum forest, which is located on ridge-hilly aeolian sands. On the slopes of the hills, there are small-leaved separated forest stands. In some places (along the eastern and northern shores of Sultankelda and the northern shores of Lake Zhamankul), one can find introduced spe-cies of oleaster (Elaeagnus angustifolia), which also presents in Tigrovaya Balka.

**Uvs Lake Basin (Russia/Mongolia) (criteria ix, x)**

One of the clusters of this World Heritage Site is an area of the northeastern shore of the large salty and closed Lake Uvs together with the mouth delta of the Oruku-Shynaa River at its con-fluence with the said lake. It includes inshore areas of semi-deserts and dry steppes, salt marshes, swamp grassland, reedbeds, shrubs, and small forests. There is no full forest cover. This cluster belongs to the Great Lakes Desert Steppe ecoregion, a desert biome.

**Landscapes of Dauria (Russia/Mongolia) (criteria ix, x)**

This area belongs to the ecoregion of Mongolian-Manchurian grasslands, steppe biome. A com-plex of large and small lakes, mostly saline and closed, is surrounded by real and meadow steppes, characterized by a very specific species composition, which

differs, for example, from the steppes of Northern Kazakhstan (the so-called Daurian steppes). In dry depressions and around lakes, there are saline and meadow-saline soils with characteristic halophytic plants. In shallow waters, there are dense reedbeds. In the floodplains of local Uldza, Borzya, and Imalka Rivers, there are grass meadows with some willow thickets. However, there are no large forest areas along the floodplains and lakeshores.

However, it is clear that these natural areas demonstrate the types of landscapes, which, with some formal similarity (arid climate, the development of steppes and deserts, the presence of fairly large water bodies), contrast very strongly with the nature of Tigrovaya Balka. There-fore, they cannot be recognized as analogs of this reserve in terms of the riparian woodlands de-velopment. At the same time, it should be noted that all listed protected natural areas, and Tigrovaya Balka itself, are the exceptional vital habitats for migratory birds, among which there are many rare and endangered species.

Several high-mountainous regions with the status of World Natural Heritage Sites, which are also located in the Central Asian region, do not offer any significant analogs too, namely:

**Pamir National Park (Tajikistan)**

**Western Tien Shan (Kazakhstan/ Uzbekistan/Kyrgyzstan, several branches)**

**Xinjiang Tien Shan (China, several branches)**

**Golden Mountains of Altai (Russia, several branches)**

All of them represent a fundamentally different biome, namely Montane Grasslands & Scrublands, and, although there are some areas of arid landscapes with rivers and riverine thick-ets, no forests similar to the tugays of the Tigrovaya Balka grow at such heights, on such a divid-ed relief, and in such climatic conditions.

## Promising World Natural Heritage Sites

In the search for analogs among promising World Natural Heritage sites, the Tentative Lists were analyzed, and only from those Asian countries whose territories coincide with the area of distri-bution of riparian woodlands.

As a result, 3 protected natural areas with massifs of tugay vegetation were identified. They are the **Amu Darya** and **Syunt-Khasardag Nature Reserves** in Turkmenistan and Dashti-Djum in Tajikistan (see the table below). However, none of these protected natural areas can be identified as a full-fledged analog of Tigrovaya Balka. Indeed, they have more modest areas with riparian woodlands (several thousand hectares), and the species composition, although it is similar at the level of genera (the same combination of poplar, oleaster, and tamarisk), significant-ly differs at the level of species). None of the said areas possesses such a wide distribution of well-preserved riparian woodlands of the blue poplar, which is so characteristic to Tigrovaya Balka.

Riparian woodlands of the Amu Darya Nature Reserve in Turkmenistan are the closest ones to those of Tigrovaya Balka in terms of species composition, with two poplar species. i.e. blue poplar (Populus pruinosa) and Euphrates poplar (Pópulus euphrática). One can also find here oleaster, willow, and tamarisk. However, riparian woodlands of the Amu Darya Nature Reserve occupy a much smaller area (only 7-8 thousand hectares) and are preserved much poorer, since many threats come from the adjacent old-developed and densely populated territories.

In general, the World Heritage Tentative Lists from the countries of Central Asia include such protected areas, which include fundamentally different types of landscapes, for example, high mountains, rocky areas, salt marshes, or areas of cold continental deserts.

For example, from three neighboring countries of Central Asia (Kazakhstan, Turkmeni-stan, and Uzbekistan) a serial property called Cold Winter Deserts of Turan is being promoted to the UNESCO List. These areas of cold deserts lie somewhat to the north, not in the subtropical, but in the temperate zone, where the tree cover is practically absent due to the very harsh climatic conditions (low temperatures combined with excessive dryness). Therefore no valley-river oases like Central Asian riparian woodlands can be found here.

**Possible analogs from among other protected natural areas of Central Asia (without the World Heritage status)**

In the course of this analysis, several other protected natural areas were identified (see the table below), where there are also massifs of tugay vegetation. These are properties in Kazakhstan, Uzbekistan, north of Afghanistan, as well as in Armenia. However, no single full analog of Tigrovaya Balka was found here, except for just one case – the **Ile-Balkhash Nature Reserve** – which area of riparian woodlands does not exceed several thousand hectares.

As for the species composition of tugays, no complete coincidence with those of Tigrovaya Balka was found anywhere. There is no such a clear predominance of the poplar in the forest cover, with the exception of just one case in the **Lower Amu Darya Nature Reserve**, where these species of poplar are also well represented in the stand.

**Imam Sahib and Darqad Nature Reserves** are quite large floodplain protected areas located in the north of Afghanistan, on the left bank of the Panj. They are the closest to Tigrovaya Balka in geographic terms and grow in very similar natural landscape conditions. Pre-viously, riparian woodlands also vastly covered this region. However, with a high degree of probability, it can now be assumed that they have already lost their environmental significance since the territories have fallen into the zone of military operations. In all the other protected are-as considered above, the protection of riparian woodlands is also far from ideal, as the proximity of settlements creates a number of threats everywhere.

The **Garayaz Nature Reserve** in Armenia, where, along the valley of the Kura River, fragments of the former Caucasian riparian woodlands are still preserved, has a very specific spe-cies composition, very far from the investigated reserve in the south-west of Tajikistan.

It's also worth noting the **Volga-Akhtuba Floodplain**, valuable natural property of the arid south of the European part of Russia. It is a huge in length (over 400 km in length, 5-10 km in width) oasis strip surrounded by dry steppes and semi- deserts, lying between Volgograd and Astrakhan and going directly to the Volga delta. It has the status of a regional natural park, and a biosphere reserve, a key bird area (IBA), and is also a candidate for the inscription on the List of Wetlands of International Importance. It is a complex mosaic of dense riverine thickets, flooded meadows, lakes and marshes, canals, and yeriks, hayfields and pastures, melons and vegetable gardens, small settlements. Relict floodplain oak forests, which have developed because of the proximity of groundwater and a special fertile microclimate, are of particular importance. How-ever, these are not riparian woodlands, but another kind of gallery forests, with their specific species composition. Oak trees here are mixed with the maple, the elm, the Asiatic poplar, and the sea buckthorn.

**Table 3**

**Specially protected natural areas of arid regions of Central Asia, including massifs of riparian woodlands (including Asiatic poplar tugays)**

| Property name/ conservation status/ WH criteria | Location and general description | Biome/ ecoregion (under RESOLVE Ecoregions 2017) | Total area of the property / area of riparian wood-lands | Predominant tree and shrub species of riparian wood-lands | Protection, integrity, threats |
|---|---|---|---|---|---|
| **Analogs – existing World Natural Heritage properties (World Heritage List, as of 01.01.2022)** | | | | | |
| NOT DETECTED | | | | | |
| **Analogs – promising World Natural Heritage properties (Tentative lists, as of 01.01.2022)** | | | | | |
| **Tigrovaya Balka Nature Reserve IBA x** | South-West of Tajikistan, the confluence of the Vakhsh and Panj Rivers: a wide flood-plain strip with oxbows, lakes, and wetlands | The border of two bi-omes: 1) Temperate Gras-slands, Savannas & Scrublands (Gissaĸo-Alai Open Wood-lands ecore-gion)<br><br>2) Deserts & Xeric Shrublands ( Badghyz and Karabil semi-desert region) | 50 ths. ha/ 24.1 ths. ha | Blue poplar (*Populus pru-inosa*), oleast-er (*Elaeagnus angustifolia*), multiramose tamarisk (*Tam-arix ramosissima* Ledeb.) | Little changed, moderate de-velopment of adjacent ter-ritories |
| **Amu Darya Nature Reserve IBA x** | North-East of Turkmenistan, three areas in the middle reaches of the Amu Darya, north-west from Turk-menabad, in-cluding the riv-er water area, riverine ripari-an thickets, ad-jacent parts of the Kyzylkum desert | Deserts & Xeric Shrub-lands/ Central Asian ripar-ian wood-lands | 49 ths. ha/7.6 ths. ha | Blue poplar (*Populus pru-inosa*), *Euphra-tes poplar Pópu-lus euphrática*), Turkmen oleast-er (*Elaeagnus turcomanica*), Junggar willow (*Salix songarica*), tamarisk (*Támarix* spp.), salt tree (*Hali-modend-ron*) | Mosaic of lit-tle, moderate-ly and strong-ly changed areas of tu-gay vege-tation, the proximity of densely pop-ulated old-de-veloped ar-eas creates a number of threats |

| | | | | | |
|---|---|---|---|---|---|
| **Syunt-Khasardag Nature Reserve IBA**<br><br>**x** | South-West of Turkmenistan, foothills of Kopetdag, basin of the Sumbar River, including desert, mountain-steppe and riparian landscapes | Montane Grasslands & Shrublands / Kopetdag woodlands and forest steppe | 26.5 ths. ha /several hundred ha | Tamarisk (*Tamarix meyeri. T. laxa, T. florida*), desert thorn (*Lycium turcomanicum*, Euphrates poplar (*Populus euphratica*), white willow (*Salix alba*), Oriental oleaster (*Elaeagnus orientalis*) | Small scattered massifs of tugay, medium state of preservation. Violations of the reserve regime (grazing, vegetable gardens, etc.) |
| **Dashti-Djum Nature Reserve**<br><br>**IBA**<br><br>**vii, x** | South-West of Tajikistan, a mountain range with access to the right bank of the Panj River | Temperate Grasslands, Savannas & Shrublands/ Gissaro-Alai Open Woodlands | 19.7 ths. ha/ several ths. ha | Oleaster (*Elaeagnus angustifolia*), willow (*Salix* spp), tamarisk (*Tamarix* spp) | Strongly changed and scattered areas of riparian woodlands |
| **Possible analogs from among other protected natural areas (beyond the World Heritage Lists)** | | | | | |
| **Ile-Balkhash Nature Reserve IBA, RAMSAR** | East of Kazakhstan, southern shore of the Lake Balkhash with the adjacent water area, the delta of the Ili River, which is one of the largest river deltas in Central Asia. Reedbeds, wet meadows, deltaic lakes and bogs, tugay, adjacent sandy deserts, salt marshes, saksaul thickets. | Deserts & Xeric Shrublands/ Central Asian riparian woodlands | 415 ths. ha / more than 10 ths. ha | Swamp poplar (*Populus diversifolia*), oleaster (*Elaeágnus angustifólia*), several types of willows (*Salix trianda*, etc.), tamarisk (*Támarix* spp.) | In general, good preservation. Grazing load, poaching and the threat of fires in some areas.<br>A program for the restoration of Central Asian riparian woodlands is being implemented in connection with the plans for the introduction of the Bactrian deer and tiger. |

| | | | | | |
|---|---|---|---|---|---|
| **Zeravshan Nature Reserve (National Park), IBA** | East o Uzbekistan. A narrow strip of Central Asian riparian woodlands along the valley of the Zeravshan River from the eastern suburbs of Samarkand to the border with Tajikistan. | Temperate Grasslands, Savannas & Shrublands/ Alai-Western Tian Shan steppe | 2.3 ths. ha / no more than 1 ths. ha | Junggar willow (*Salix songarica*), oleaster (*Elaeágnus angustifólia*), common sea buckthorn (*Hippóphaë rhamnóides*), white popler (*Pópulus álba*), tamarisk (*Támarix* spp.) | The proximity of a large city poses a number of threats. The felling of riparian woodlands in recent years, numerous violations of the protection regime |
| **Lower Amu Darya Biosphere Reserve (on the basis of the former Badai Tugai Nature Reserve)** | West of Uzbekistan, the right bank of the Amu Darya, to the north-east from Dashoguz and to the north from the border with Turkmenistan | Deserts & Xeric Shrublands/ Central Asian riparian woodlands | 68.7 ths. ha /about 4 ths. ha | Swamp poplar (*Populus diversifolia*), blue poplar (*Populus pruinosa*), oleaster (*Elaeágnus angustifólia*), Junggar willow (*Salix songarica*), tamarisk (*Támarix* spp.). | The property is located in a historically densely populated region, which poses many threats. |
| **Darqad Wildlife Reserve IBA** | North of Afghanistan, a swampy floodplain on the left bank of the Panj River, east of the Gissar Range. | Deserts & Xeric Shrublands/Paropamisus xeric woodlands | about 20 ths. ha/ several ths. of ha | Oleaster (*Elaeagnus angustifolia*), willow (*Salix* spp.), tamarisk (*Támarix* spp.) | Strongly changed riparian woodlands, a zone of military operations. |
| **Imam Sahib Wildlife Reserve** | North of Afghanistan, a swampy floodplain on the left bank of the Panj River, east of the Tigrovaya Balka Nature Reserve. | Deserts & Xeric Shrublands / Badghyz and Karabil semi-desert | about 20 ths. ha/ several ths. of ha | Oleaster (*Elaeagnus angustifolia*), willow (*Salix* spp.), tamarisk (*Támarix* spp.) | Strongly changed riparian woodlands, a zone of military operations. |

| | | | | | |
|---|---|---|---|---|---|
| **Garayaz Nature Reserve** | The middle course of the Kura River, north-west of Azerbaijan, on the border with Georgia | Deserts & Xeric Scrub-lands/ Azerbaijan shrub desert and steppe | 9.6 ths. ha/5-6 ths. ha | Southern willow (*Salix australior*), white poplar (*Populus alba*), black poplar (*Populus nigra*), white mulberry (*Mórus álba*), elm tree (*Ulmus* spp.), tamarisk (Támarix spp.) | Moderate state of preservation. The proximity of the developed lands creates a number of threats. |

Thus, against the background of all the studied analogs, riparian woodlands of the Tigrovaya Balka Nature Reserve are distinguished by a) a significant area occupied by them, b) a sufficiently high degree of preservation, c) the specificity of their species composition (clear dominance of the poplar).

Indeed, riparian woodlands of Tigrovaya Balka are concentrated not only along the floodplain and along the canals of the local rivers, but cover a much larger area, including many oxbow lakes, floodplain lakes, wetlands, and this is an important specificity of the forests along the Vakhsh and Panj valleys. It can be seen from the above that some other tugay massifs of Central Asia, studied as potential analogs, are represented in the form of rather narrow riverine forest belts, occupying a very limited area, literally several thousand hectares (for example, in the Zeravshan Nature Reserve in Uzbekistan, or the Garayaz Nature Reserve in Armenia).

Further, riparian woodlands of Tigrovaya Balka are still slightly changed, which is largely due to the inaccessibility of this remote border area, in contrast, for example, to the reserves in the north of Afghanistan, where the environmental regime is not observed for socio-political rea-sons, or the Zeravshan Nature Reserve, which, being in fact a recreation area in Samarkand, has been recently transformed into a national park.

Finally, the species composition of riverine thickets plays an important role. In general, riparian woodlands in arid regions of Central Asia may have a different species composition, for example, with a predominance of willows (for example, Junggar willow – Salix songarica), or other types of poplar (for example, Swamp poplar – Populus diversifolia). However, such proper-ties cannot be considered fully analogs of Tigrovaya Balka. Obviously, only floodplain riparian communities of arid zones formed by the blue poplar can be considered as full analogs (the blue poplar is a clear dominant in Tigrovaya Balka, about 80% of tugay massifs are formed by the blue poplar). No riverine riparian woodlands with similar species composition, comparable both in the area occupied and in the degree of preservation, have been found anywhere else.

### B) Bactrian deer

The second aspect of the outstanding universal value of the Tigrovaya Balka Nature Reserve is that it is still the vastest area in the whole Central Asia for the aboriginal habitation of the Bactrian deer (Cervus elaphus bactrianus), endemic of Central Asia, a subspecies of the red deer listed as vulnerable on the International Red Book (IUCN, 2011). Besides, the Bactrian deer is included in the lists of the Convention on Migratory Species (CMS) (Bonn Convention).


**Fig. 39. Dispersal of the Bactrian deer in Central Asia**

The areas of modern habitation of the Bactrian deer include aboriginal populations, groupings created by reintroduction of the deer into natural habitats within the historical range, and artificial groupings created by introduction. The first group includes populations found in the following territories in the Amu Darya basin:

1. Upper reaches: Tigrovaya Balka Nature Reserve, tugay forests on the right bank of the Panj River in Farkhor and Hamadoni districts (Tajikistan), Jazguzar (Turkmenistan), Maymuntugay (Uzbekistan) – territories bordering with Afghanistan;
2. Middle reaches of the Amu Darya: Kyzylkum Nature Reserve (Uzbekistan), Amu Darya Nature Reserve (Turkmenistan), and areas of tugay forest with no conservation status (seven in total) in Turkmenistan; these groupings appear to be related.

Another group of populations is the result of directed human activity:

1. Reintroduced population in the lower reaches of the Amu Darya – Baday-Tugay Nature Reserve and adjacent small areas of tugay forests (Uzbekistan).

Outside the Amu Darya Valley, reintroduced populations of the Bactrian deer inhabit the following territories:

1. the Zarafshan River valley – upper reaches (reintroduced in the 1970s) (Tajikistan / Uzbekistan); middle reaches - Zarafshan Nature Reserve in Uzbekistan (reintroduced in 2005, 2007);
2. the Ili River valley, Karachingil (reintroduced in the 1980s) (Kazakhstan);
3. the Syr Darya River valley in its middle reaches (Kazakhstan) – two groups were reintroduced in 2009 and 2010.

Artificial restoration of the Bactrian deer population has recently begun in the Ramit Nature Reserve (Tajikistan). Data on the natural population of the deer in Afghanistan are currently not available.

In fact, after the previous significant decline, the world population of the Bactrian deer has stabilized in 2002, and there is an upward trend in all populations. According to the data of regular monitoring of most part of the Bactrian deer populations carried out within the WWF projects from 2002 to 2010, the following trends were observed in the populations: Kazakhstan – 200 - approx. 400, upward trend; Tajikistan – 60 - 210, stable/growing (according to monitoring observations for 2019, there were more than 300 heads, see paragraph 6.c); Turkmenistan – 90 - 120, stable/insignificant growth; Uzbekistan – 330 - approx. 900, growth/overpopulation in Baday-Tugay, currently the threat of degradation of the ecosystem and the population itself (18).

Thus, the total number of the Bactrian deer throughout the entire range has reached about 1600 individuals (Flint et al., 1989; Baidavletov et al., 2003; Abdusalyamov, 2003; Pereladova et al., 2006, 2007; Lim, Marmazinskaya, 2007; Chikin et al., 2008; Marmazinskaya, 2008, 2009; WWF Review Report // the 1at Meeting of the Participants in the Signing of a Memorandum of Understanding on the Preservation and Restoration of the Bactrian Deer, November 20, 2011, Bergen, Norway).

Summarizing the above data, one can conclude that the largest aboriginal population of the Bactrian deer lives precisely within the boundaries of the nominated territory. In addition, it is necessary to note such an important fact that of all existing aboriginal populations, only three are protected at the highest state level (nature reserve, Ia category under the IUCN), i.e. in the Tigrovaya Balka (Tajikistan), Kyzylkum (Uzbekistan) and Amu Darya reserves (Turkmenistan). Among them, it is the population of the Tigrovaya Balka Nature Reserve that is the most numerous and steadily growing.

## OVERALL SUMMARY

Riparian woodlands, which occupy about half of the area of the Tigrovaya Balka Nature Reserve (24.1 out of 50 thousand hectares), are the only place in all of Central Asia where forests of this type have survived on such significant areas and in such a good and almost unchanged condition.

In general, riparian woodlands are an intrazonal, from a biogeographic point of view, ecosystem that has an extremely limited distribution in the continental arid regions of Asia. Therefore, if the goal is to identify possible analogs of the forests of Tigrovaya Balka, then only the said area may be viewed as appropriate. Moreover, the focus should be on the valleys of large rivers, where, due to the specific microclimate and good watering, tugay vegetation is formed. No same landscapes can be found in the rest of Eurasia, as well as on other continents. Therefore, it makes

little sense to compare tugays of the south of Tajikistan with other forms of riverine forests, such as ravine forests in the forest-steppe and steppe regions of Eurasia, gallery forests in the savannas of Africa, South Asia, and South America, etc.

The conducted virtual study of Central Asia, as well as some adjacent arid regions, showed that out of a dozen quite large massifs of riparian woodlands identified here, lying along the canals of large rivers, and already having a high conservation status (reserves, biosphere reserves, Ramsar lands, key bird areas), dense riverine thickets of Tigrovaya Balka occupy a special place. First of all, these woodlands are distinguished by their significant size and rather high (although not ideal) degree of preservation, as well as by the specific species composition. The share of blue poplar (Populus pruinose) and other types of Asiatic poplars is about 80%. At the same time, there are other variations of tugay vegetation, where the main tree species is, for example, the willow, the oleaster, or some other kind of poplar that does not belong to the Asiatic poplar group.

It is also important to note that riparian woodlands of Tigrovaya Balka, especially against the background of the adjacent desert areas, stand out for their very rich biodiversity, including a number of rare and endangered species from the International Red Book.

In the course of the comparative analysis, it has been found that, firstly, no analogs, even remote ones, to the Tigrovaya Balka Nature Reserve exist among the already available World Natural Heritage sites.

Secondly, there are several, albeit partial, analogs among the promising World Natural Heritage sites (Tentative List). The closest, in terms of species composition, are Asiatic poplar forests of the Amu Darya Nature Reserve in Turkmenistan, however, these massifs are significantly inferior both in terms of their area and in the degree of preservation.

Thirdly, several analogs have also been identified among other protected natural areas of Central Asia (outside the main and preliminary World Heritage Lists) with riparian woodlands. However, no complete similarities were noted. First of all, it's worth mentioning the Ile-Balkhash Nature Reserve in Kazakhstan (very significant areas of tugay forests, although without blue poplar in their species composition), and the Lower Amu Darya Nature Reserve in Uzbekistan (the area of tugays is small, but the species composition is closer, the blue poplar is present in the stand).

Further, in addition to Asiatic poplar tugay ecosystems, the unique objects protected in the territory of the reserve include animals from the IUCN Red List of Threatened Species, such as the Bactrian deer (*Cervus elaphus bactrianus*), the gazelle (*Gazella subgutturosa*), the Persian leopard (*Panthera pardus ciscaucasica*) (stops), and the striped hyena (*Hyaena hyaena*).

Tigrovaya Balka is also of outstanding importance from this point of view. Its contribution to the conservation of the above species, and especially the most iconic object of the animal world – the Bactrian deer, is very clear. Tigrovaya Balka, with its very large deer population (over 300 individuals), successfully complements the scope of Central Asian protected natural areas, where this rare species can still be found.

It's worth noting that since the distribution of the Bactrian deer is tied to Central Asian riparian woodlands, the preservation of these dense riverine thickets is the main prerequisite for the growth of the population of not only this rare artiodactyl but also of all other significant inhabitants of these areas. That is, the above two aspects of the global value of Tigrovaya Balka (Central Asian riparian woodlands – the Bactrian deer) turn out to be inextricably linked with each other, and the former determines the latter to a decisive extent.

In this way, the Tigrovaya Balka Nature Reserve should be recognized as a unique

natural area with no obvious analogs in the world. No analogs can be found either among the existing World Heritage Sites or among the sites inscribed on the Tentative Lists by various Central Asian countries, as well as among other high-profile protected areas of this region. The Tigrovaya Balka Nature Reserve fully complies with criterion x of the World Heritage in two aspects of the "outstanding universal value", i.e. in terms of preserving the most valuable plant community, which has an extremely limited distribution in the world, and in terms of protecting populations of several globally rare animal species inscribed on the International Red Book.

## 3.3 Proposed Statement of Outstanding Universal Value

**a) Brief synthesis**

The nominated territory is located in the interfluve area of the Vakhsh, Panj and Kafirnigan rivers, at the border of Afghanistan, where the largest river in Central Asia – the Amu Darya – takes its origin. The territory covers a vast area of tugay ecosystems, along the banks of the Vakhsh River, the territory of the hilly sandy Kashka-Kum desert, the Buritau eminence, as well as the low mountains of the southern spurs of the Aruktau range – the Hodja-Kaziyon mountains. The area of the Tigrovaya Balka Nature Reserve is 49,786 hectares and the area of its buffer zone is 17,672 hectares.

The reserve is a unique desert-tugay reservation of dry Central Asian type subtropics, where a natural Asiatic poplar tugay-floodplain ecosystem gene pool tugay vegetation complex is preserved. The complex is composed of water-resistant and thermophilic summer-green salt-tolerant trees and shrubs, such as the Asiatic poplar or blue poplar, the dzhida or oleaster, the multiramose tamarix, and rare and endangered animals inhabiting it, such as the Bactrian deer, whose population in the reserve exceeds 300 heads, the goitered gazelle, the striped hyena, the gray monitor, the Tajik black-and-gold pheasant, and many waterfowl birds. Tugay forests occupy an area of 24.1 thousand hectares in the reserve and this is the only place in the world where the Asiatic poplar tugai ecosystem has been preserved in its original form on a vast territory.

**b) Justification for Criteria**

*Criterion (ix):*

The natural complex of Tigrovaya Balka is an outstanding example of continuous ecological and biological processes taking place in the evolution and development of desert-tugay biocenoses and their characteristic plant and animal communities. The reserve has an amazing variety of landscapes with coexisting jungles, sandy and saline semi-deserts, piedmont semi-savannas, and various wetlands, dynamically adapting to changes in the hydrological regime of the territory.

*Criterion (x):*

The Tigrovaya Balka Nature Reserve is the last large reserve on the planet that preserves the natural communities of Asiatic poplar tugay flora and fauna that have not been significantly suffered from anthropogenic impact. The reserve serves as a genetic reservation for rare and endangered plant and animal species inhabiting its territory,

making a significant contribution to the preservation of the region's biodiversity.
In the Tigrovaya Balka Nature Reserve, the largest in Central Asia forest area of the Asiatic poplar or the blue poplar (*Populus pruinosa* Schrenk) is preserved, which in the community with the dzhida or the oleaster (*Elaesgnus angustifolia* L), the multiramose tamarix (*Tamarix ramosissima* Ledeb.), and others, occupies the floodplain and above-floodplain river terraces of the reserve.
In addition to the relict ecosystems, the unique objects preserved in the reserve include animals from the Red List of the IUCN, such as the Bactrian deer (*Cervus elaphus bactrianus*), the goitered gazelle (*Gazella subgutturosa*), the Persian leopard *(Panthera pardus ciscaucasica)*, and the striped hyena (*Hyaena hyaena*).

**c) Statement of Integrity**

The Tigrovaya Balka Nature Reserve is an integral natural complex, the main components of which are inseparably associated with each other by the common origin, historical fate, and dynamics of natural development, and includes the elements necessary to confirm its Outstanding Universal Value. The reserve presents ecosystems of tugai floodplain forests, sandy and saline semi-deserts, foothill low-grass semi-savannas and wetlands, with the entire spectrum of flora and fauna representatives characteristic of them.
By its size (49,786 hectares) the nominated property is sufficient to support the sustainable functioning of tugay ecosystems and fully represent characteristics and processes that reflect their significance. The buffer zone of the reserve (17,672 hectares) provides additional guarantees of the integrity of the nominated property.
Biophysical processes and properties of the natural landscape of the Tigrovaya Balka Nature Reserve are indirectly affected by economic activities (irrigated agriculture and cattle grazing) conducted in adjacent territories, but so far they have not been significantly disturbed.
In recent years, both plant communities of the nominated property and the inhabitants, primarily the IUCN Red List species – the Bactrian deer, the goitered gazelle, and the striped hyena – have demonstrated recovery dynamics.

**e) Requirements for protection and management**

The nominated territory has had the status of a state nature reserve since 1938, the highest nature protection status of the Republic of Tajikistan, corresponding to IUCN category Ia.
The Tigrovaya Balka Nature Reserve is a structural subdivision of the State Committee for Environmental Protection under the Government of the Republic of Tajikistan and operates in accordance with the Law of the Republic of Tajikistan «On Specially Protected Natural Territories» of 27.11.2014.
The protection of the territory and the observance of the protected regime is carried out by a special inspection service, consisting of 30 rangers and 5 senior rangers. The protection of the territory is carried out by the methods of daily rounds of the forest guard (by the forces of rangers) and night raid patrols.
Operational protection and preservation of attributes that express the Outstanding Universal Value of the Tigrovaya Balka property is carried out on the spot by the management of the reserve on the basis of medium-term management plans. Thus, the «Management Plan of the state reserve Tigrovaya Balka and the adjacent territory for the period 2022-2026» defines specific measures for protection, scientific research, monitoring of the state of conservation,

environmental education and interaction with the local population, the timing of their implementation, performers, sources of funding and expected results.

The nature protection institution Tigrovaya Balka Nature Reserve has the necessary material and human resources to ensure the preservation and further natural development of a unique complex of ecosystems.

The existing economic burden on the ecosystems of the reserve is associated with the development of agriculture and animal husbandry in the adjacent territories.

Compliance with the reserve regime, infrastructure, and staffing make it possible to self-renew the ecosystems of the reserve and restore the number of background species of plants and animals.

There is no doubt that the inscription of the Tigrovaya Balka Nature Reserve on the World Heritage List will significantly increase attention to the territory, contribute to its successful protection and conservation.

**Fig. 40. The Khalka-Kul' Lake** ***(photo by A. Butorin)***

**Tigrovaya Balka** *(photo by U. Akramov)*

# 4
# STATE OF CONSERVATION AND FACTORS AFFECTING THE PROPERTY

**Tigrovaya Balka Nature Reserve (*photo by F. Rakhimov*)**

## 4.a Present state of conservation

The Tigrovaya Balka Nature Reserve, created in 1938, is the largest reserve where the desert-tugay complex of the dry subtropical zone is preserved under natural conditions. Currently, its ecosystems are stable.

There is no industrial production on the territory of the reserve.

There are no exploration and mining works.

No agricultural activities and cattle grazing are carried out.

There is no resident population within the boundaries of the nominated territory.

However, there is a problem of preserving the protected area surrounded by the anthropogenic landscape. Agriculture and cattle grazing are the main forms of economic activity in the areas adjacent to the reserve. At the same time, agriculture is often directly related to melioration measures and water use systems, which in general affects not only the ecological environmental state of lands, but also water resources. Irrigated agriculture is a source of pollution and negatively affects the state of the territory surrounding the

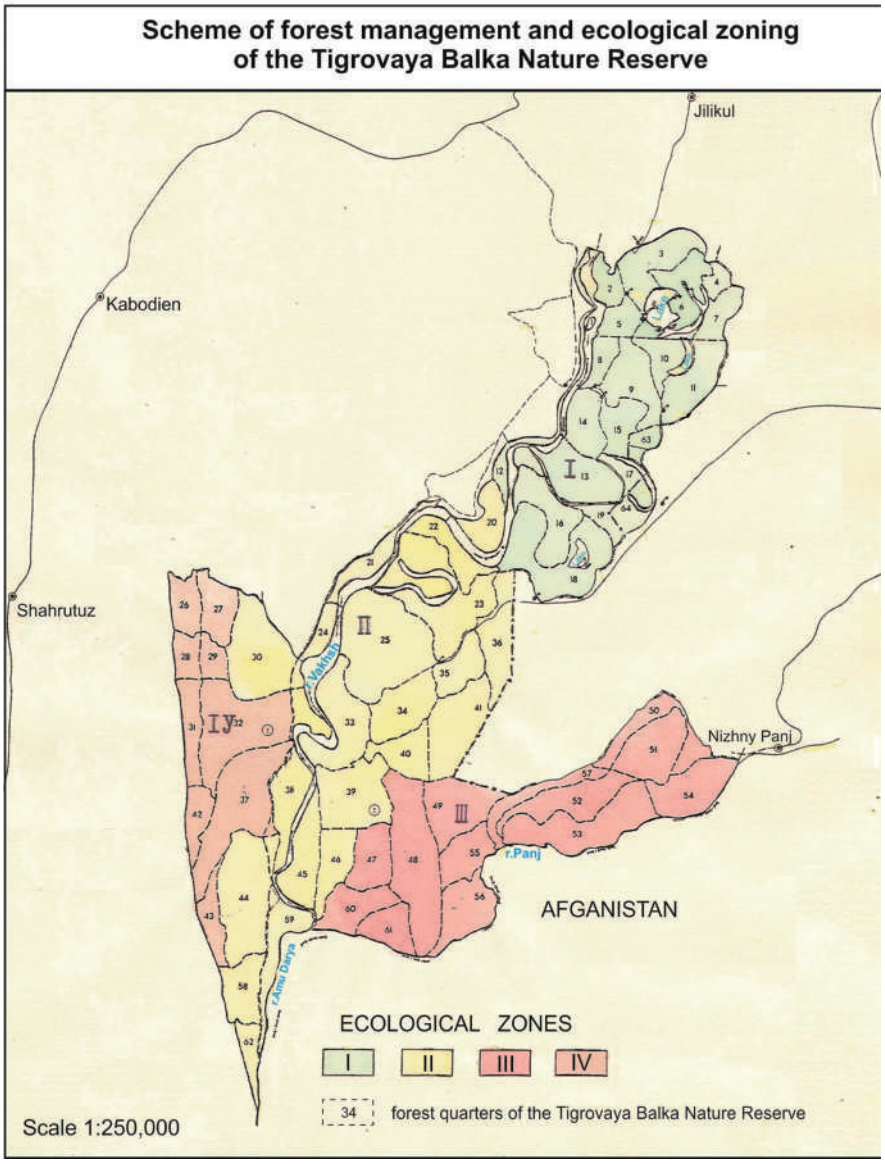



**Fig. 41. Scheme of forest management and ecological zoning of the Tigrovaya Balka Nature Reserve**

reserve, indirectly affecting the ecosystems of Tigrovaya Balka.

Based on the results of comprehensive ecological studies, it makes sense to divide the territory of the Tigrovaya Balka Nature Reserve into four environmental zones, differ markedly in terms of the sum of environmental characteristics and anthropogenic impact.

**1. The northern part** includes the right and left banks of the Vakhsh River with low and high floodplains and the hydrological regime on the left bank artificially maintained with wastewater from irrigated fields. This is the most changed part of the reserve both in terms of territory and in the number and configuration of water bodies caused by the migration of the Vakhsh and wastewaters.

The largest massifs of Asiatic poplar tugay and swamp-lake complex are located here. They are represented most diversely by various types of terrestrial flora and fauna as compared to other zones. Here, anthropogenic impact took place in the past and is still preserved at a great scale. People often come here on vacation. Until the end of the 1960s, a nutria farm, a gravel pit operated here. Besides, there was fishing, cattle grazing, and also a significant transport traffic was noted.

This part of the reserve includes 22 quarters (out of 65) and occupies 24.5% of the reserve's territory (Fig. 41).

**Fig. 42. Swamp-lake complex of the left bank of the Vakhsh** ***(photo by A. Butorin)***

**2. The southern part** of the reserve includes 21 quarters, which is 39.76% of its territory. The ecosystems of this part of the reserve have been changed to a lesser extent by anthropogenic activity. However, hayfields are carried out here, leading to a decrease in the projective cover, while the peculiarities of the Buritau water barrier system have led, in general, to the emergence of secondary salinization processes of the soil cover. On this territory, there are massifs of tugay forests on the high floodplain and ecosystems of clayey and sandy desert complexes on the second above-floodplain terrace. On the west, this part is adjoined by the lower Hodja-Kazien slopes, which are used mainly as winter pastures for free-range animal husbandry. It is here where the only and very small Tajik population of goitered gazelle inhabits. There are many wild boars, as well as desert species of reptiles, in particular, those included in the Red List, e.g. the gray monitor.

**Fig. 43. Tugai forest on a high floodplain** ***(photo by A. Butorin)***

**3. The Panj part** of the reserve includes tugays along the Panj River and the main part of the Buritau massif. There are still a few strongly and moderately mineralized oxbow lakes on the high floodplain. Tugay massifs are located in the border zone. This part includes 13 quarters or 21.85% of the reserve area. Like the mountainous part, it is poorly studied, although it is of great interest, primarily due to the fundamental difference in the water regimes of the main aquatic objects. For example, if the Vakhsh River is regulated by a cascade of reservoirs, the Panj River is not regulated at all. Therefore, the successions of tugays in its floodplain retain their natural character.

Comparison of the functioning and study of the mutual influence of these two water systems at the point of their confluence – at the head of the Amu Darya River – are very promising both in terms of science and application.

**4. The mountainous part** occupies 13.85% of the reserve area and includes only 9 quarters least affected by human activity. This is the highest dividing part of the two rivers – the Vakhsh and the Kafirnigan – within the reserve. The border of the reserve runs along the dividing line. Mountain slopes adjacent to a narrow strip of tugays along the right bank of the Vakhsh, represent a conjugate series of ecosystems: from dry steppes and fragmentary pistachio forests to rock debris and clay deserts. Numerous rocky outcrops make the environment even more diverse. This part of the reserve is poorly studied but it is very convenient for studying the natural functioning of winter pastures, identifying the formation and movement of surface and underground runoff on the local mountain slopes. Small areas along the ridge and slopes near the rocks allow the local population of urial to be preserved here. Besides, it is possible to restore the once-inhabited population of the markhor. Inaccessible extremely steep southwestern slopes of mountain ranges are especially important for ungulates.

**Fig. 44. Ecosystems of dry steppes on the slopes of the Khodja-Kazien ridge** ***(photo by A. Butorin)***

The physical and geographical peculiarities of the location of the reserve make it less vulnerable. A sufficiently large area of the reserve (49.786 hectares) and the highest conservation status (1a category under the IUCN's system for classification of Specially Protected Natural Areas) guarantee the safety of the main habitats of endemic, rare, and endangered species of plants and animals.

Tugay forests occupy 47.3% of the total area of the reserve; sandy and saline semi-deserts, foothills and low mountains – 52.7%, including freshwater reservoirs and wetlands – 21.4%. One of the most typical types of woody vegetation in the reserve is the Asiatic poplar, which reproduces both with seeds and by cloning. Seeds can germinate with good soil moisture, both during floods (such environmental conditions existed in the past), and heavy precipitation. The ability of the Asiatic poplar for cloning significantly increases the stability of populations, and hence their ability to restore the Asiatic poplar ecosystem. This can be traced especially well during the restoration of Asiatic poplar forests after fires.

Assessment of the current state of groundwaters as a leading ecological factor for floodplain communities refutes pessimistic forecasts about the possible transformation of the reserve's ecosystems into solonchak soils and the extinction of tugay-type vegetation.

## 4.b Factors affecting the property

### (i) Development Pressures (e.g., encroachment, adaptation, agriculture, mining)

The economic pressure on the existing ecosystems of the reserve is associated with the development of agriculture and animal husbandry in adjacent territories. Outside the reserve, the foothill ecosystems are mostly ploughed up and converted into agricultural lands. Ecosystems of low mountains are also under anthropogenic impact and are used as winter pastures, the areas and water level of which decrease in the summer months.

The territory of the Tigrovaya Balka Nature Reserve is almost completely surrounded by fields located on higher terraces. Tugays appeared to be affected not only by the Vakhsh River, which previously formed the regime of floodplain terraces, but also by the numerous irrigation facilities of the surrounding agricultural farms, which complicated the dynamics of both surface and underground runoff. One of the central goals of the reserve is solving the problem of the formation of a secondary water regime on the territory of the reserve under the influence of the anthropogenic factor, which negatively affects the entire natural complex.

The unregulated discharge of wastewater from agricultural lands and the associated release of pesticides into the reservoirs of the reserve represent a certain problem. Currently, the influence of these substances on the inhabitants of the tugai complex is decreasing. Nevertheless, the contamination of reservoirs with pesticides to a certain extent leads to a deterioration of the ecological situation in them and affects the fish feed base.

The solution of the problem of runoff is one of the central goals of the target comprehensive program of the Tigrovaya Balka Nature Reserve. The problem can be solved only with the simultaneous solution of environmental problems of the entire region in which the reserve is located.

In connection with the regulation of the Vakhsh river runoff by a number of hydroelectric power plants, the water level in the river has dropped. There has appeared a problem of dehydration of

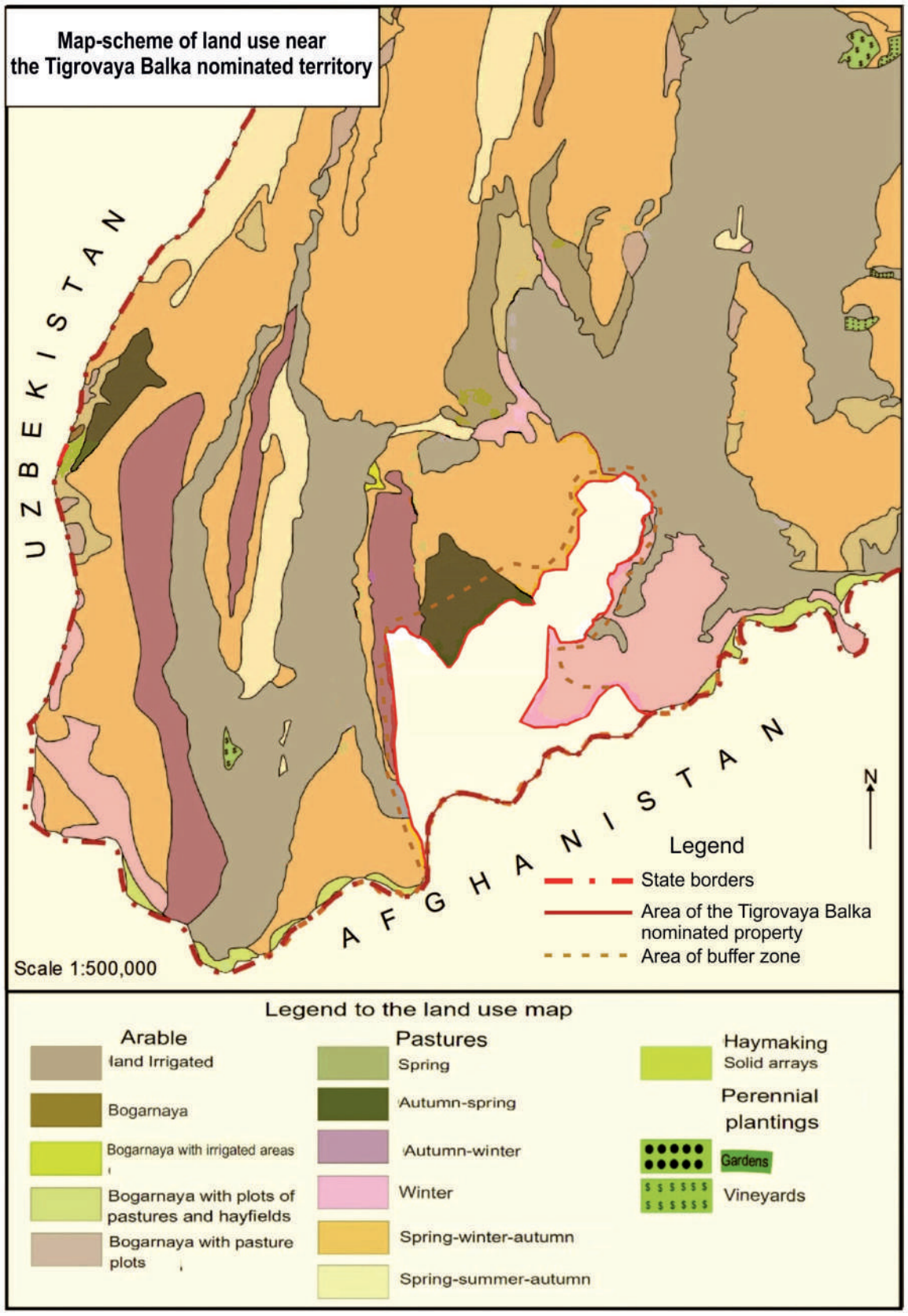



**Fig. 45. Land use near the Tigrovaya Balka nominated property**

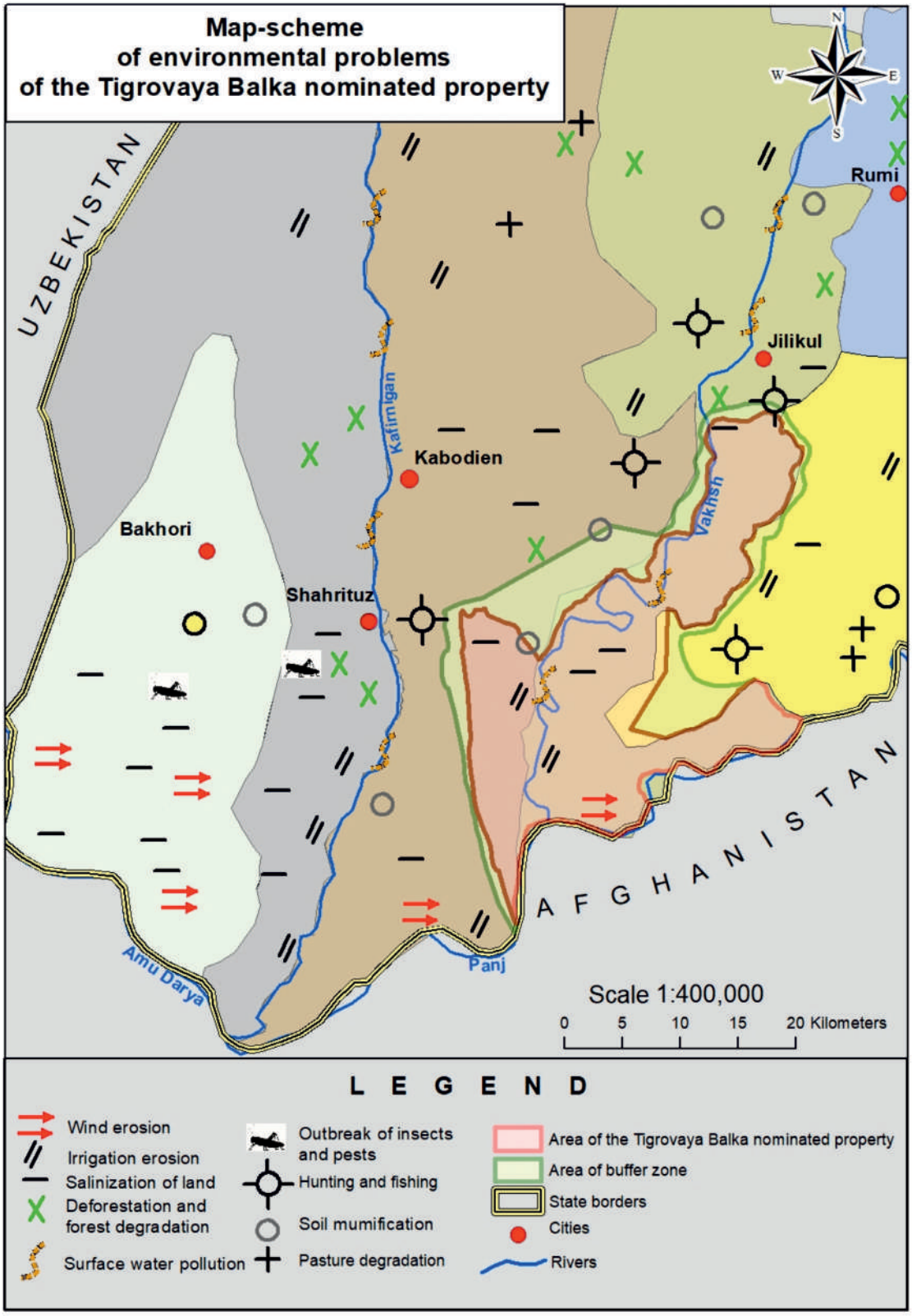



**Fig. 46. Environmental problems of the Tigrovaya Balka nominated property**

large areas due to the lack of floods. The Vakhsh floods played another positive role. They covered vast areas with a layer of water during the period of the most intense evaporation (July-August), thus preventing salinization of the territory, and during the flood decline, the water carried out excess salts with surface and groundwaters.

Another problem is the rise in the level of groundwater in the areas of the reserve adjacent to the developed irrigated areas and those under the development. Intensive irrigation, leading to an increase in the level of groundwater, occurs in May-September, that is, a period of high evaporation, which entails an increase in the salinity of the reserve's soils.

Amid the cessation of floods and the development of adjacent territories the ecosystems of the reserve are dynamically adapting to changes in the hydrological regime of the territory, which is of undoubted interest for scientific research.

## (ii) Environmental pressures (e.g., pollution, climate change, desertification)

**Global and regional climate change factor**

In the context of the ongoing global climate change and an increase in aridity of the Pamir-Alai territory as a whole, in the coming years, there is a high probability of decrease in the number of springs, change in channel processes and drying-up of seasonal rivers. In the future, natural ecosystems may somewhat change their boundaries. It is assumed that the moisture supply of the territory will decrease due to a decrease in surface runoff. Strengthening and increase in frequency of extreme weather events, including mudflows and heavy rains in the spring season, and soil drought in the late summer-autumn season, are also expected. In these conditions, the negative consequences will be amplified by the fact that the rules and regulations that determine the existing reserve regime are not adapted to the ongoing natural and climatic changes.

Processes that threaten ecosystems and their resources are associated with an intensification of the complex process of desertification, a deterioration in growing conditions due to a change in the temperature regime and a deterioration in the redistribution of moisture by the vegetation cover, as well as with an increase in soil degradation:

- gradual change in vegetation towards more adapted to moisture deficit; a decrease in populations of rare plants and habitats of species with narrow parameters of suitable conditions as a result of possible destruction of their habitats due to extreme natural phenomena in addition to the anthropogenic factor;
- replacement of productive semi-savannas, meadow, and meadow-steppe communities with desertified ones;
- simplification of the structure of communities and a decrease in floristic diversity, as a result of the deterioration of the life state and the number of plant populations from the group of summer-green mesophytes;
- decrease in the conservation and anti-erosion function of the grass cover and the loss of the soil's ability to restore fertility; increased erosion;
- possible spread of diseases and damage to plants caused by the lack of moisture and weakening;
- reduction of areas and possible disappearance of small areas of meadows and sazes;

- general weakening of the stability of forest stands (and the state of a number of species), including stands of vegetative origin;
- acceleration of displacement of native species by aggressive introduced species of a wide ecological amplitude, tolerant to aridization;
- intensification of stress effects of extreme weather events (dust storms, wind, mudflows, avalanches, etc.) on flora and vegetation;
- undesirable change in the ratio of open and wooded areas, a decrease in the biological productivity of trees and shrubs;
- reduction of biodiversity and simplification of communities due to a decrease in the number of mesophilic and hygrophilic hardy-shrub species and grasses;
- appearance of aggressive and weed plant species that have not been previously typical for the given territory.

## (iii) Natural disasters and risk preparedness (earthquakes, floods, fires, etc.)

Fires that occur both in tugay forests and in reed thickets pose a serious danger to the Tigrovaya Balka Nature Reserve. Most of the fires are caused by careless handling, mainly during the hottest summer months. Reed thickets, oleasters, willows, Asiatic poplars are exposed to the greatest fire hazard. Due to the poor technological infrastructure of forestry and lack of fire-fighting equipment, the damage from forest fires can be significant, although the number of fires is usually small.

There is a fairly extensive network of earth roads in the reserve. Almost any district or quarter of the protected area can be accessed by road at any time of the year. The roads of the reserve are primarily intended for fire prevention. Fire-fighting, the so-called mineralized strips, have a total length of 90 km and are ploughed every year during the fire-hazardous season. There are 4 fire-prevention observation towers on the territory of the reserve.

## (iv) Responsible visitation at World Heritage sites

At present, the reserve is regularly visited by students of local schools, students and teachers of the faculties of sciences of the universities of the Republic.

Botanists, zoologists, soil scientists, and other specialists of the Academy of Sciences and Agricultural Academy of the Republic carry out monitoring observations and research work at the permanent stations of the reserve. The reserve is visited by numerous biologists and other specialists from foreign countries.

The reserve is primarily focused on receiving visitors for the purpose of education and scientific research. The development of tourist routes is underway. In general, visitors create no negative impact on the natural complexes of the reserve.

## (v) Number of inhabitants within the property and the buffer zone

There is no permanently residing population on the territory of the reserve. The reserve employs more than 50 people who visit it only during working hours.

Estimated population located within:
Area of nominated property – no permanently residing population
Buffer zone  up to 1000 permanent residents
Total  up to 1000 permanent residents
Year 2021

**Tsentral'ny lodge (left bank of the Vakhsh River) of the Tigrovaya Balka Nature Reserve** ***(photo by A. Butorin)***

# 5
# PROTECTION AND MANAGEMENT OF THE PROPERTY

**Bactrian deer (*Cervus elaphus bactrianus* Lydekker) (camera trap)**

## 5.a Ownership

The Tigrovaya Balka Nature Reserve is a state-funded nature protection institution.
According to the Decree of the Government of the Republic of Tatarstan No. 189 of April 24, 2008, the Tigrovaya Balka Nature Reserve is a structural subdivision of the State Institution for Specially Protected Natural Areas of the Committee for Environmental Protection under the Government of the Republic of Tajikistan.

Organization: The Committee on Environmental Protection under the Government of the Republic of Tajikistan
Address: 5/1 Shamsi str., Dushanbe city, Tajikistan
Tel: (99237) 236-40-59
Fax: (99237) 236-13-53
E-mail: info@tajnature.tj
Web address: www.tajnature.tj

## 5.b Protective designation

State nature reserve (1a category as per IUCN).
The legal status is determined by state legislative acts, i.e. Law of the Republic of Tajikistan No. 1159 "On Specially Protected Natural Areas" of November 27, 2014 (Appendix B1);
Decree of the Council of People's Commissars of the Tajik SSR No. 1165 "On the establishment of the Tigrovaya Balka Nature Reserve" of November 4, 1938 (Appendix B2).

## 5.c Means of implementing protective measures

According to the Regulations on the Tigrovaya Balka State Natural Reserve (Appendix B3), the following is prohibited on the territory of the reserve:

- activities that threaten the existence of ecosystems and protected historical and cultural properties;
- geological exploration and development of mineral resources;
- felling of trees, shrubs, unsystematic use of flora and fauna; activities of enterprises that pose a special environmental hazard;
- activities that change the hydrological regime;
- construction of main roads, pipelines, power lines, and other communications not related to the activities of the reserve;
- placement of living organisms for acclimatization.

The regulation may prohibit or restrict other types of activities that entail a decrease in the natural, scientific, aesthetic, and cultural value of the reserve.
Measures are taken to preserve and restore ecosystems on the territory of the reserve. A special inspection service protects the area and ensures observation of the reserve regime. The inspection service of 30 gamekeepers and 5 senior gamekeepers is part of the reserve staff and is headed by its director. The director of the reserve is the chief state inspector for nature protection within his territory.
The protection of the territory of the reserve is carried out in the following ways:
- daily rounds of forest gamekeepers;
- night raid patrol.

Forests are protected from fires by the fire-fighting service, which has fire-chemical stations, machinery, and equipment as per the established standard.
The territory of the reserve is divided into three technical areas for effective protection.

**Fig. 47. Bely Dom central lodge of the Palvontugay district (right bank of the Vakhsh River) of the Tigrovaya Balka Nature Reserve** ***(photo by A. Butorin)***

## 5d. Existing plans related to municipality and region in which the proposed property is located (e.g., regional or local plan, conservation plan, tourism development plan)

State comprehensive program for fostering environmental culture and education of the population of the Republic of Tajikistan for 2021-2025;

The Ministry of Science and Education of the Republic of Tajikistan has adopted a state program to improve environmental awareness, including training programs in the reserve;

The Committee on Tourism under the Government of the Republic of Tajikistan is developing a program for the promotion of ecotourism until 2030, which provides for the inclusion of the reserve museum and the Korolevskaya Dacha lodge in the list of tourist sites;

The National Academy of Sciences of Tajikistan plans to intensify scientific research in the Tigrovaya Balka Nature Reserve.

## 5e. Property management plan or other management system

The medium-term Management Plan for the Tigrovaya Balka Nature Reserve and the adjacent territories for the period 2022-2026 determines specific activities, terms of their implementation, executors, sources of funds, and expected results.

The plan outlines the work of the reserve in two main directions for solving a number of management problems.

Section I - activities within the boundaries of the reserve.

Management problems to be solved:

1. Improving the infrastructure of the reserve and its material and technical base.
2. Maintaining and improving the ecological condition of the reserve by implementing measures aimed at preserving biodiversity and restoring the environment.
3. Carrying out arrangements to improve the state of natural ecosystems and implementing fire-fighting measures.
4. Organizing and conducting scientific research in the Tigrovaya Balka Nature Reserve.
5. Implementing environmental monitoring of the state of natural ecosystems of the reserve and adjacent territories (buffer zones).
6. Executing advanced training of scientific personnel and specialists in environmental protection.
7. Promoting awareness of the population, developing informative excursion visits to specially prepared educational routes.

Section II – cooperation with the administration and the population of the territory adjacent to the reserve.

Management problems to be solved:

1. Improving the efficiency of the use of land resources.
2. Developing alternative energy sources.
3. Improving forest resources and biodiversity in the areas adjacent to the reserve.
4. Ensuring access to clean drinking water.

The key section of the management plan, i.e. the Action Plan, is provided in Appendix B4.

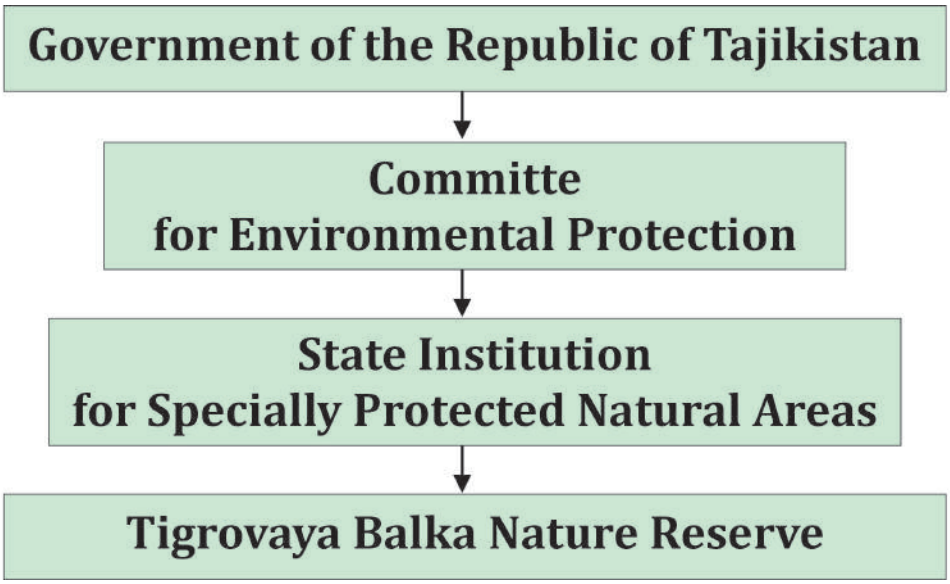



**Fig. 48. Proposed property management scheme**

## 5f. Sources and levels of finance

The Tigrovaya Balka Nature Reserve is funded from the state budget (Committee for Environmental Protection under the Government of the Republic of Tajikistan). It has bank accounts, an official seal, and letterhead.

Revenues in 2021:
$ 46,309 from the state budget
$ 9,780 income from tourists
grants from third parties - small grants from WWF
Total: $ 56,089

Expenses in 2021:
Salary - 67.7% of the annual budget, or $ 37,987
Conservation activities - 7.4% of the annual budget, or $ 4,151
Transport, repair, and maintenance of buildings, communication services - 6.7% of the annual budget, or $ 3,743
Business trips, medical care, utility bills, etc. - 18.2% of the annual budget, or $ 10,208.

It is planned to increase the budgetary funding to $ 115,000 in 2022.

## 5g. Sources of expertise and training in conservation and management techniques

7 employees of the reserve have university degree, 5 – secondary degree, 25 employees have more than 10 years of experience in the environmental industry.

Over the past 3 years, 5 advanced training courses have been held for the gamekeepers of the reserve and employees of the scientific department. The training courses were organized by the State Institution for Specially Protected Natural Areas of the Committee for Environment Protection, the Center for Biodiversity and Biosafety of the Committee for Environment Protection, the Arzit and Kuhiston non-governmental organizations, and the WWF. The reserve staff constantly take part in training seminars, conferences and working meetings.

## 5h. Visitor facilities and infrastructure


**Fig. 49. The central entrance to the Tigrovaya Balka Nature Reserve *(photo by A. Butorin)***

**Fig. 50. The building of the museum and the visitor center of the Tigrovaya Balka Nature Reserve** ***(photo by A. Butorin)***

The reserve is located in an easily accessible area. Its office can be approached by the asphalt road from Jilikul. From Kumsangir, the asphalt road leads to Korolevskaya Dacha.

The reserve has an office, a museum, an information center, 4 lodges for visitors, and 5 lodges for gamekeepers.

**Fig. 51. Korolevskaya Dacha lodge** ***(photo by A. Butorin)***

Visitors may stay in the wooden building of the Korolevskaya Dacha lodge which can simultaneously accommodate up to 40 people. The stone building of the Palvontugay lodge can simultaneously accommodate 20 visitors. The wooden building of the Tarzan lodge can accommodate 16 visitors and the modern 2-storey brick building of the Daryakul lodge - up to 50 people.

**Fig. 52-53. Daryakul and Korolevskaya Dacha guest houses** ***(photo by A. Butorin)***

The entrances to the reserve are fitted with information boards. A guide translator from English is constantly working at the museum of the reserve.

The reserve has a complex ecological observation path called Tigrovaya Balka:

1. Museum. The history of the reserve, its directors for the entire period of its existence and their contribution, as well as scientists who have worked in the reserve and their contribution. It is planned to install an information board with a map of the reserve, a list of the most specific species of animals and plants, portraits of directors and scientists who have worked in the reserve.
2. Botanists' station and a former industrial farm. The history of cooperation of the Academy of Sciences of the Republic of Tajikistan and the reserve, the most interesting research and significant expeditions, animals and plants specific for this area, and soil types.
3. Transition from tugay vegetation and bulrushes to solonchak soils (salt marshes). Characteristics of solonetz and solonchak soils. Typical vegetation for these soils.
4. Unprotected lands, lands of the State Land Fund adjacent to the reserve, are planned to be included in it. The junction of two deserts: clayey Kara-Dum and sandy Kashka-Kum. The uniqueness of their flora and fauna.
5. Khalka-Kul' lake (Korolevsky lodge). History of the lodge. A story about the lakes of the reserve and their history. Information about floods on the Vakhsh river; their impact on the flora and fauna of the reserve.
6. Ala-Kul' lake as one associated with Vakhsh. A detailed story about tugay vegetation, turangovniki (Populus pruinosa) and dzhidovniki (Elaeagnus angustifolia).
7. Relict loose, drift sands. A story about the uniqueness of the fauna and flora of sandy ecosystems, their history. Here, one may found more details about the archaeological sites on the territory of the reserve (ancient human sites, etc.)

At each stopping point, it is planned to install information boards and notices with quotes from prominent scientists, philosophers and writers about nature, as well as basic information about the reserve.

## 5i. Policies and programmes related to the presentation and promotion of the property

The Kuhiston Foundation NGO has been theoretically and practically engaged in the promotion of environmental knowledge about the Tigrovaya Balka Nature Reserve from 1995 to the present. Since 1997, Kuhiston, with small grants from WWF, has been conducting training and round tables on environmental education for all social strata in the territories adjacent to the Tigrovaya Balka reserve. Specialized ecological camps are organized for children living near the reserve. Local environmental NGOs have been created to promote knowledge about protected areas and, in particular, about the Tigrovaya Balka Nature Reserve.

Also, with the support of the OSCE, the Kuhiston Foundation organized environmental camps and international youth environmental forums on specially protected natural areas of the Republic of Tajikistan directly in the reserve.

Since 2000, the Institute of Zoology and Parasitology under the Academy of Sciences of the Republic of Tajikistan has been broadcasting popular radio and TV shows about specially protected natural areas.

The Institute of Zoology and Parasitology under the Academy of Sciences of the Republic of Tajikistan, the Institute of Botany, Physiology, and Genetics under

the Academy of Sciences of the Republic of Tajikistan, the National University of the Republic of Tajikistan, the Tajik State Pedagogical University named after Sadriddin Aini, the Tajik State University named after Nosiri Khusrav, the Russian-Tajik Slavonic University, the scientific institutes of the Ministry of Healthcare of the Republic of Tajikistan, the scientific center of the Committee for Environmental Protection under the Government of the Republic of Tajikistan, as well as more than 12 non-governmental organizations carry out research and conservation activities on the basis of the reserve.

In recent years, 12 candidate and 3 doctoral dissertations have been defended on the basis of the reserve. Currently, 3 graduate students and 2 candidates of science conduct scientific research in the reserve.

The reserve administration constantly cooperates with local regional and district khukumats, local communities, environmental NGOs, the State Committee for Land Management, Geodesy and Cartography.

## 5j. Staffing levels and expertise (professional, technical, maintenance)

The reserve staff consists of 56 permanent employees:

- 1 director, a university degree in agronomy
- 2 deputy directors, a university degree in engineering
- 2 researchers, university and secondary degrees in biology
- 1 accountant, university degree
- 1 economist, university degree
- 5 senior gamekeepers, 4 with university degrees and 1 with secondary degree
- 30 gamekeepers, secondary degrees
- 14 workers

For the summer period, 15 temporary workers are hired. Volunteers are also involved.

Job responsibilities:

The director of the reserve is responsible for general management of the reserve's activities, recruiting personnel, improving employees' qualifications, re-certification, distribution of gamekeepers' districts, and legal, administrative, and economic issues.

The senior forester acts as a deputy director of the reserve for the protection of flora and fauna, natural and historical properties, registration of the number of animals and the implementation of biotechnical measures. He is also responsible for the fire-fighting and sanitary condition of the reserve, directly supervises and controls the work of the Fire-Chemical Station, and ensures the work of engineers and gamekeepers.

The engineer of forest safety and protection is directly in charge of forest safety and protection issues, supervises the work of senior and subordinated gamekeepers.

Gamekeepers are directly involved in the protection of districts entrusted to them, bear personal responsibility for the state of districts, the performance of planned work in their districts, and must also constantly improve their knowledge and skills.

**Tigrovaya Balka Nature Reserve** *(photo by M. Salimov)*

# 6
# MONITORING

**Tigrovaya Balka Nature Reserve** *(photo by F. Rakhimov)*

## 6a. Key indicators for measuring state of conservation

| Indicator | Periodicity | Location of Records |
|---|---|---|
| Population of waterfowls | Annually | Institute of Zoology and Parasitology of the National Academy of Sciences of Tajikistan |
| Population of the Bactrian deer | Annually | Institute of Zoology and Parasitology of the National Academy of Sciences of Tajikistan |
| Population of the goitered gazelle | Annually | Institute of Zoology and Parasitology of the National Academy of Sciences of Tajikistan |
| Status of the populations of wild animals | Annually | Institute of Forestry under the Forestry Agency of the Republic of Tajikistan |
| Population of rodents | Every 5 years | Plague Control Station of the Ministry of Health of the Republic of Tajikistan |
| Condition of fish stocks | Annually | Institute of Zoology and Parasitology of the National Academy of Sciences of Tajikistan |
| Condition of edificators of ecosystems of the tugay complex | Annually | Institute of Botany and Plant Physiology of the National Academy of Sciences of Tajikistan |
| Groundwater level | Annually | Agency for Irrigation and Melioration under the Government of the Republic of Tajikistan |
| Mineralization of ground and surface waters | Annually | Ministry of Melioration and Water Resources of the Republic of Tajikistan |

Every year, the staff of the reserve conducts wildlife in the reserve. Census materials in the form of reports are submitted to the Committee for Environmental Protection under the Government of the Republic of Tajikistan. The Institute of Zoology and Parasitology annually monitors the population of the Bactrian deer wintering here.

On the territory of the reserve, forest inventory is carried out every 10-15 years, during which a plan for scientifically based measures is drawn up for a certain period. The territory of the reserve is divided into quarters. Several quarters are combined into gamekeepers' districts, which are the main production units of the reserve. During regular inspections of the territory, the staff of the reserve, under the guidance of the gamekeeper, carry out various biotechnical activities, e.g. register wild animals and birds, carry out phenological observations, regulate the water regime through a network of hydraulic structures, conduct fire-prevention and other activities.

Monitoring research observations of edificators and background species of animals in various ecosystems of the reserve, as well as activities to increase the number of rare and endangered species of animals and plants are carried out by researchers of the reserve and the Institutes of the Academy of Sciences of the Republic of Tajikistan.

Thus, the state of the ecosystem of the tugay complex is determined by the proximity of groundwater on floodplain terraces, and, as a result, the state of its edificators, i.e. the Asiatic poplar or blue poplar (Populus pruinosa), oleaster (Elaeagnus angustifolia) and multiramouse tamarix (Tamarix ramosissima).

Reeds (Phragmites communis), erianthus (Erianthus ravennae), and sugar cane (Saccharum spontaneum) determine the condition of the thickets of giant grasses.

The main background, defining the ephemeral vegetation of the semi-desert landscape, is the bluegrass and the sedge

from Poa bulbosa and Carex pachystilis families.
The ecosystem of low-grass piedmont semi-savannas and shiblyak is dominated by ephemeretum, mainly the barley from Hordeum spontaneum and H. bulbosum families. The upper layer of the ecosystem was previously occupied by shiblyak or arid open woodland of pistachio (Pistacia vera) and almonds (Amygdalus spinosissima). Currently, the pistachio woodland occupies very small areas.
Monitoring observations of the groundwater level, edificators of plant communities, and background species of wildlife ecosystems allow monitoring the state of the reserve.

## 6b. Administrative arrangements for monitoring property

Institute of Zoology and Parasitology of the National Academy of Sciences of Tajikistan
Address: Tajikistan, Rudak district, Guliston Jamoat

Institute of Forestry under the Forestry Agency of the Republic of Tajikistan
Address: Tajikistan, Dushanbe, Balami str., 9/1
Tel: +992 37 231-39-11

Institute of Botany and Plant Physiology of the National Academy of Sciences
Address: Tajikistan, Dushanbe, Karamova str., 27

Agency for Irrigation and Melioration under the Government of the Republic of Tajikistan
Address: 734034, 5/1 Shamsi str., Dushanbe city, Tajikistan
Tel: (99237) 235-72-51

## 6c. Results of previous reporting exercises

- Amirov Z. abstract of the Candidate of Sciences. diss., 2017
- N. Mirzoev, Ichthyofauna of the lower reaches of the Vakhsh River/thesis on the candidate of biological sciences – Dushanbe, 2019 – p. 177
- R.Sh. Muratov, Meeting with the striped hyena (Hyaena hyaena L.) in the Tigrovaya Balka Nature Reserve/ Ecological features of biological diversity: Materials of the International scientific conference – Kulyab, 2021 – p. 103-105
- R.Sh. Muratov, A.M. Tsoi, Kh.M. Talbonov/Results of monitoring of wild animals with camera traps in the Tigrovaya Balka Nature Reserve, 2016
- F.I. Rakhimov, Spatial and temporal characteristics of ornithologic fauna and its protection in the Tigrovaya Balka Nature Reserve/Thesis of the candidate of biological sciences – Dushanbe, 2021 – p. 176

**Monitoring the state of tugay vegetation**

A number of researchers point out that in the lack of floods and the development of nearby territories will intensify two processes in the reserve: desertification and salinization, which, ultimately, will lead to the replacement of tugay vegetation by solonchak and desert one, that is, to the destruction of the existing biogeocenoses. However, the analysis of monitoring observations refutes this assumption. For example, it is the fact that the northern part of the reserve (according to the ecological zoning scheme, item 4.a) has not experienced a direct effect of flood waters

for five decades, since the Vakhsh floods did not affect this territory. Nevertheless, one can find here well-developed stands of Asiatic poplar (the gray poplar or *Populus pruinosa* Schank), dzhida (the oleaster or *Elaeagnus angustifolia*), tamarix (*Tamarix* sp.), and other associations of tugay vegetation.

The analysis of the processes of desertification and salinization on the territory of the reserve makes one doubt that they will lead to the extinction of tugay vegetation. For example, in the southeastern part of the reserve, a process of desertification is actually observed, which, however, is caused by the withdrawal of the Vakhsh to the west rather than by the lack of floods. Drying of the Asiatic poplar and the dzhida is observed here, followed by the loss of trees. Herbaceous plants such as sedge (*Carex pachystilis* J. Gay) and bluegrass (*Poa bulbosa* L.) that are typical of low-grass semi-savannas (semi-deserts) appear between drying trees. However, along the new oxbow lakes, in the dried-up channels of the former Vakhsh creeks, along the river, there is an intensive renewal of tugay vegetation according to the following succession pattern: sugar cane (Saccharum spontaneum 1.) – dzhida (*E. angustifolia* L.) with erianthus (*Erianthus ravennae* (L ) P. Beauv) – Asiatic poplar (*P. pruinosa* Schrenk) with imperata (*Emperata cylindrica* (L.) R.V.). Such "successions" are clearly visible on the terrain from above, for example, during a helicopter flight.

In this way, this is not the case of tugay vegetation loss but with a simple change of landscapes, in which the homeostat of the system is preserved due to the redistribution of areas occupied by this or that type of vegetation. Salinity analysis, a striking example of which is the process in the northeastern part of the Jilikul area, which happened due to the mismanaged and uncontrolled collection of wastewater from the fields, shows that here the possibilities for self-recovery are not at their limit.

**Fig. 54. Asiatic poplar forest on the shore of the old lake *(photo by A. Butorin)***

## Monitoring of the Bactrian deer population

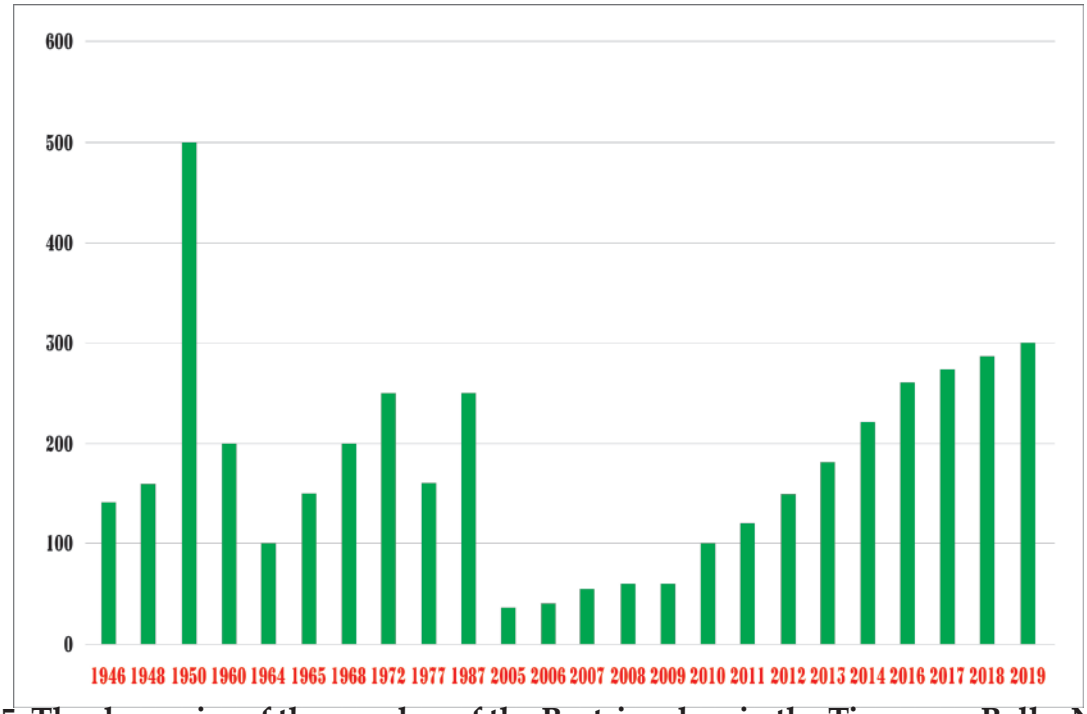



**Fig. 55. The dynamics of the number of the Bactrian deer in the Tigrovaya Balka Nature Reserve in the period 1946 - 2019. (1946-1950 – according to V.I.Chernyshev, 1958; 1960 - 1973 – according to G.N.Sapozhnikov, 1976; 1977 - 1987 – according to A.I. Sokov, 1993; 2005 - 2019. – according to R. Muratov)**

**Fig. 56. Bactrian deer (*Cervus elaphus bactrianus* Lydekker) Camera Trap**

As follows from the diagram, the most stable population of the Bactrian deer in the reserve was preserved in the period 1968-1987. During the civil war 1992-2000, the population in the reserve was on the verge of complete extinction. A steady rise in the number of deers has been observed since 2009-2011. By 2019, it has reached 300 heads. At the moment, it is being resettled in other natural reserves.

**Monitoring of the goitered gazelle population**

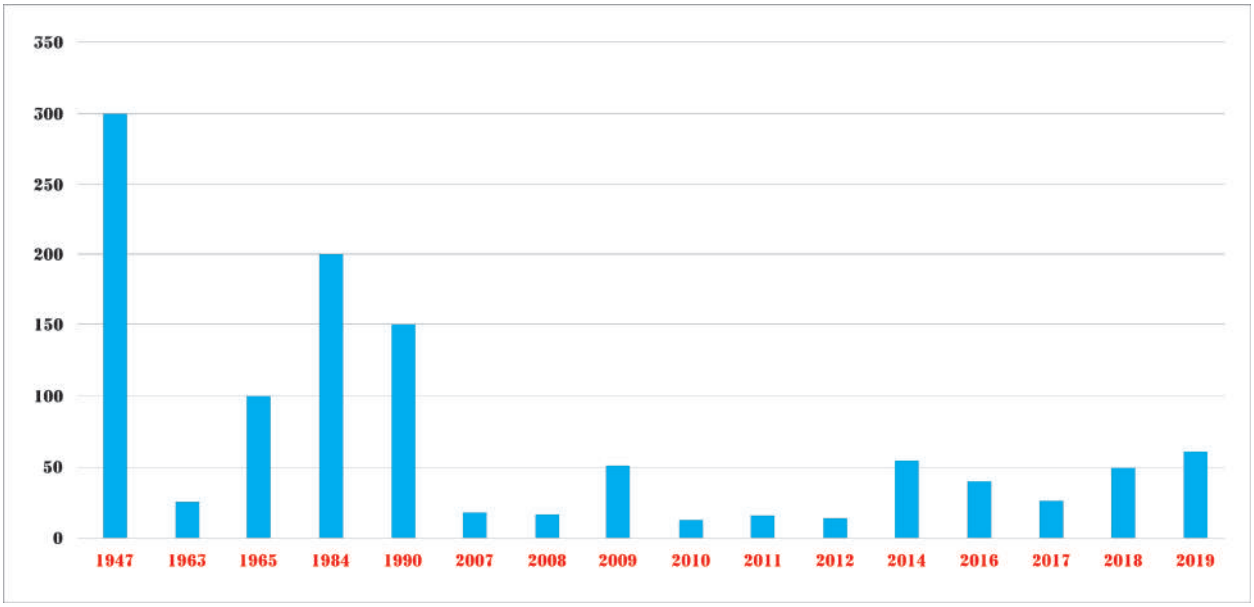



**Fig. 57. Dynamics of the number of the goitered gazelle in Tajikistan in the period 1947-2019**

Note: 1947 – low mountains of Southwestern Tajikistan (Yakovlev et al., 1979); 1963 – Panj Karatau Range (Sapozhnikov, 1976); 1965 – Tigrovaya Balka Nature Reserve (Sapozhnikov et al., 1984); 1984 – low mountains of Southwestern Tajikistan (Kovalev, 1987); 1990 – low mountains of Southwestern and Northern Tajikistan (Sokov, 1990); 2007 – Tigrovaya Balka Nature Reserve (Amirov et al., 2011); 2008 - Northern Tajikistan (Amirov et al., 2011); 2009 - 2019 – Tigrovaya Balka Nature Reserve; Panj Karatau Range (Amirov, 2009-2017, Muratov, 2018-2019).

Due to the limited habitats, the number of goitered gazelles in the reserve remains at a low level of 40-45 heads.

**Tigrovaya Balka Nature Reserve** *(photo by M. Salimov)*

# 7
# DOCUMENTATION

# 7a. Photographs and audiovisual image inventory and authorization form

## Photographs and audiovisual image inventory and authorization form

| Id. No | Format (slide/ print/ video) | Caption | Date of Photo (mo/ yr) | Photographer/Director of the video | Copyright owner (if different than photographer/director of video) | Contact details of copyright owner (Name, address, tel/fax, and e-mail) | Non exclusive cession of rights |
|---|---|---|---|---|---|---|---|
| 1. | photo | Bactrian deer (*Cervus elaphus bactrianus* Lydekker) | 08.2021 | N. Marmazinskya | N. Marmazinskya | | yes |
| 2. | photo | Goitered gazelle, the Kashka-Kum stow of the Tigrovaya Balka Nature Reserve | 08.2012 | R. Muratov | R. Muratov | eco-forest98@mail.ru | yes |
| 3. | photo | *Clamydotis undulata* | 02.2016 | R. Muratov | R. Muratov | eco-forest98@mail.ru | yes |
| 4. | photo | Common redshank (*Tringa totanus*) | 01.2013 | F. Rakhimov | F. Rakhimov | faridunrahimow@yandex.ru | yes |
| 5. | photo | Pallid scops owl (Otus brucei) | 03.2021 | F. Rakhimov | F. Rakhimov | faridunrahimow@yandex.ru | yes |
| 6. | photo | Wetlands near the Brick Lake cordon | 11.2015 | F. Rakhimov | F. Rakhimov | faridunrahimow@yandex.ru | yes |
| 7. | photo | The Vakhsh Rivers in the Palvontugay area of the Tigrovaya Balka Nature Reserve | 11.2015 | N. Mizoev | N. Mizoev | mir.nur78@mail.ru | yes |
| 8. | photo | Tigrovaya Balka Nature Reserve | 11.2015 | F. Rakhimov | F. Rakhimov | faridunrahimow@yandex.ru | yes |
| 9. | photo | Tigrovaya Balka Nature Reserve | 11.2015 | F. Rakhimov | F. Rakhimov | faridunrahimow@yandex.ru | yes |
| 10. | photo | *Tenuidactylus bogdanovi* | 08.2021 | A. Bragin | A. Bragin | | yes |
| 11. | photo | Barred wolf snake (*Lycodon striatus*) | 08.2021 | A. Bragin | A. Bragin | | yes |
| 12. | photo | *Varanus griseus* | 08.2021 | A. Bragin | A. Bragin | | yes |
| 13. | photo | *Teratoscincus scincus* | 08.2021 | A. Bragin | A. Bragin | | yes |
| 14. | photo | Bactrian deer | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 15. | photo | Canyon-shaped valley of the temporary stream flowing into the Vakhsh River | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 16. | photo | The Vakhsh River in the central part of the Tigrovaya Balka Nature Reserve | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 17. | photo | Asiatic poplar tamarix tugay | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 18. | photo | Asiatic poplar licorice tugay | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 19. | photo | Asiatic poplar oleaster reed tugay | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 20. | photo | The border between tugay and meadow vegetation on the floodplain and semi-savanna on the over-floodplain terrace | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 21. | photo | Tugai forest on a high floodplain | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 22. | photo | The old Khalka-Kul' Lake framed by Asiatic poplar tugay vegetation | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 23. | photo | Low-grass semi-savanna in the foothills of Hodja-Kaziyon | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 24. | photo | Asiatic poplar tugay forest in the floodplain of the Vakhsh River | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 25. | photo | Watering point at a temporary channel of the Vakhsh River | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 26. | photo | Tsentral'ny lodge (left bank of the Vakhsh River) of the Tigrovaya Balka Nature Reserve | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 27. | photo | Bely Dom central lodge of the Palvontugay district (right bank of the Vakhsh River) | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 28. | photo | The central entrance to the Tigrovaya Balka Nature Reserve | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 29. | photo | The building of the museum and the visitor center of the Tigrovaya Balka Nature Reserve | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |
| 30. | photo | Daryakul and Korolevskaya Dacha guest houses | 09.2021 | A. Butorin | A. Butorin | butorin@ nhpfund.ru | yes |

## 7b. Texts relating to protective designation, copies of property management plans or documented management systems and extracts of other plans relevant to the property

Law of the Republic of Tajikistan No. 1159 "On Specially Protected Natural Areas" of November 27, 2014 (Appendix B1);
Decree of the Council of People's Commissars of the Tajik SSR No. 1165 "On the establishment of the Tigrovaya Balka Nature Reserve" of November 4, 1938 (Appendix B2);
Regulation on nature reserves of the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR (Appendix B3);
The medium-term Management Plan for the Tigrovaya Balka Nature Reserve and the adjacent territories for the period 2022-2026c(Appendix B4).

## 7c. Form and date of most recent records or inventory of property

Report on the impact of the Rogun HPP on the ecosystems of the reserve, 2014
UNECE Third Environmental Performance Review of Tajikistan. New York, Geneva, 2017
Report on the Convention on Biological Diversity. Dushanbe, 2021
Report on the Ramsar Convention on Wetlands. Dushanbe, 2021
Report on the United Nations Framework Convention on Climate Change. Dushanbe, 2019

## 7d. Address where inventory, records and archives are held

Organization: The Committee on Environmental Protection under the Government of the Republic of Tajikistan
Address: 5/1 Shamsi str., Dushanbe city, Tajikistan
Tel: (99237) 236-40-59
Fax: (99237) 236-13-53
E-mail: info@tajnature.tj
Web address: www.tajnature.tj

Institute of Zoology and Parasitology of the National Academy of Sciences of Tajikistan
Address: Tajikistan, Rudak district, Guliston Jamoat

Institute of Forestry under the Forestry Agency of the Republic of Tajikistan
Address: Tajikistan, Dushanbe, Balami str., 9/1
Tel: +992 37 231-39-11

Institute of Botany and Plant Physiology of the National Academy of Sciences
Address: Tajikistan, Dushanbe, Karamova str., 27

Agency for Irrigation and Melioration under the Government of the Republic of Tajikistan
Address: 734034, 5/1 Shamsi str., Dushanbe city, Tajikistan
Tel: (99237) 235-72-51

## 7e. Bibliography

1. I.A. Abdusalyamov, Tigrovaya Balka Nature Reserve/Reserves of the Soviet Union. – M.: Kolos, 1969, p. 432-437
2. I.A. Abdusalyamov, Fauna of the Tajik SSR/Birds – Dushanbe: Donish, 1971. – V.19 – Part 1 – p. 398
3. I.A. Abdusalyamov, Fauna of the Tajik SSR/Birds – Dushanbe: Donish, 1971. – V.19 – Part 2 – p. 396
4. I.A. Abdusalyamov, Fauna of the Tajik SSR/Birds – Dushanbe: Donish, 1971. – V.19 – Part 3 – p. 273
5. I.A. Abdusalyamov, The experience of creating new populations of the Bactrian deer in Tajikistan/Collection: Breeding and creation of new populations of rare valuable species of animals – Ashgabat, 1982
6. I.A. Abdusalyamov, The main ecosystems of Tajikistan/ D.N. Pachajanov, S.T. Blagoveshchenskaya, O.B. Pereladova, Conservation of biodiversity in Central Asia – Tajikistan. Dushanbe, 1997, p. 8-25
7. G. Avzalov, K. Kasirov, Kh. Akhmadov, 60th anniversary of the Tigrovaya Balka Nature Reserve – Tajikles State Forest Enterprise. Dushanbe, 1998, p. 44
8. Amirov Z. abstract of the Candidate of Sciences. diss., 2017
9. A.G. Bannikov, I.A. Abdusalyamov, A.I. Sokov, Bactrian deer in Tajikistan – Proroda, 1977, No. 8
10. M.A. Gulyaeva, Experience in domestication and semi-free keeping of the tugay deer in the Tigrovaya Balka Nature Reserve – Works of the Institute of Zoology and Parasitology of the Academy of Sciences of the Tajik SSR, 1962 a, V. 22
11. A. Davlyatov, Vegetation cover of the Tigrovaya Balka Nature Reserve/Abstract of the thesis of the candidate of biological sciences – Tashkent, 1979, p. 22
12. G.S. Davydov, Fauna of the Tajik SSR/Mammals. Rodents – Dushanbe: Donish, 1974 – V. 20 – Part 3 – p. 314
13. G.S. Davydov, Fauna of the Tajik SSR/Mammals. Lagomorphs, ground squirrels, marmots – Dushanbe: Donish, 1974 – V. 20 – Part 1 – p. 258
14. V.S. Zamyatyev, Desert life – Moscow, Mysl, 1976
15. Tigrovaya Balka Nature Reserve (collection of articles) – Works of the Research Institute for Soil Science. Dushanbe: Donish, 1991
16. V.I. Zapryagaeva, Forest resources of the Pamir-Alai. – Leningrad: Nauka, 1976, p. 34-36
17. Red Book of the Republic of Tajikistan. Second edition. Plants and animals of the world (Birds)/R.Sh. Muratov et. al// – Dushanbe: Ganch Nashriyot, 2015 – p. 150-193
18. N.V. Marmazinskaya, Guidelines for restoration and reintroduction of the Bactrian deer in natural habitats – World Wildlife Fund (WWF) Russia, Moscow: Skorost' sveta, 2012 – p. 100
19. N. Mirzoev, Ichthyofauna of the lower reaches of the Vakhsh River/thesis on the candidate of biological sciences – Dushanbe, 2019 – p. 177
20. Sh. Kh. Muratov, Dynamics of the number of birds of prey in South-West Tajikistan/VII All-Union ornithological conference: Abstract of the report – Kiev, Naukova Dumka, 1977, Part 1 – p. 88
21. R.Sh. Muratov, A.M. Tsoi, Kh.M. Talbonov/Results of monitoring of wild animals with camera traps in the Tigrovaya Balka Nature Reserve, 2016
22. R.Sh. Muratov, Meeting with the striped hyena (Hyaena hyaena L.) in the Tigrovaya Balka Nature Reserve/Ecological features of biological diversity: Materials of the International scientific conference – Kulyab, 2021 – p. 103-105

23. R.Sh. Muratov, Diurnal migration of birds in the Pamir-Alai territory/Abstract of the thesis of the candidate of biological sciences – Novosibirsk, 1989 – p. 24
24. P.N. Ovchinnikov, Main features of vegetation and regional flora of Tajikista/Flora of the Tajik SSR. Volume 1. - M., L., Publishing House of the Academy of Sciences of the USSR, 1957
25. R.L. Potapov, In Tigrovaya Balka. Zoologist's notes – M., Geografizdat, 1962
26. F.I. Rakhimov, Spatial and temporal characteristics of ornithologic fauna and its protection in the Tigrovaya Balka Nature Reserve/Thesis of the candidate of biological sciences – Dushanbe, 2021 – p. 176
27. Birds of Central Asia (5 volumes)/Edited by A.K. Rustamov, A.F. Bucket – Almaty, 2007, V. 1, p. 574
28. S.A. Said-Aliev, Amphibians and reptiles of Tajikistan – Dushanbe: Donish, 1979 – p. 146
29. A.S. Saidov, Rodents of Southwestern Tajikistan – Dushanbe: Donish, 2010, V. 20 – Part 7 – p. 352
30. G.N. Sapozhnikov, Nature reserves of Tajikistan – Dushanbe: Donish, 1973
31. G.N. Sapozhnikov, About the number of some species of animals in the tugay part of the Tigrovaya Balka Nature Reserve. Journal of the Academy of Sciences of the Tajik SSR, Department of Biological Sciences, No. 4 (29, 1967)
32. G.N. Sapozhnikov, Let's create reserves in Tajikistan/Game and game husbandry, No. 9
33. Tajikistan: (Nature and natural resources)/[Kh. M. Saidmuradov, A. P. Nedzvetsky, G. P. Vinnichenko et. al]; Edited by Kh. M. Saidmuradov, K. V. Stanyukovich – Dushanbe: Donish, 1982 – p. 601

*Tulipa korolkovii (photo by M. Salimov)*

# 8
# CONTACT INFORMATION OF RESPONSIBLE AUTHORITIES

## 8a. Preparer

1. Muzafar Salimov – Head in charge of the Special Protected Natural Areas and Natural Parks Sector of the Committee for Environmental Protection (CEP) under the Government of the Republic of Tajikistan (head of the working group)
Tel. +992 938887007
E-mail: muzafar1961@rambler.ru;

2. Rustam Muratov – Senior researcher, Institute of Zoology and Parasitology of the National Academy of Sciences (NAS) of the Republic of Tajikistan
Tel: +992 901005341
E- mail: eco-forest98@mail.ru

3. Ubaidullo Akramov – Director, Center for Biodiversity and Biosafety of the CEP under the Government of the Republic of Tajikistan
Tel. +992 918332938
E- mail: ubaid_ubaid@mail.ru

4. Najmiddin Najmiddinov – Deputy Director, State Institution for Specially Protected Natural Areas of the CEP under the Government of the Republic of Tajikistan
Tel. +992 888880894.
E-mail: najmiddin.9090@mail.ru

5. Alexander Schwartz – Researcher, Institute of Seismology of the National Academy of Sciences of the Republic of Tajikistan
Tel: +992 919139223
E- mail: ashvartz@yahoo.com

6. Faridun Rakhimov – Researcher, National Academy of Sciences of Tajikistan
Tel. +992 933018375
E- mail: faridunrahimow@yandex.ru

Name: Alexey Butorin (international expert)
Title: Researcher, the Institute of Geography of the Russian Academy of Sciences / President, the Natural Heritage Protection Fund
Address: Vyborgskaya str., 8-3, 125212
City, country: Moscow, Russian Federation
Telephone: +7 910 414 53 15
Fax: +7 499 159 83 20
E-mail: a.a.butorin@igras.ru

## 8b. Official Local Institution/Agency

Organization: The Committee on Environmental Protection under the Government of the Republic of Tajikistan
Chairman of the Committee: Sheralizoda B. A.
Address: 5/1 Shamsi str., Dushanbe city, Tajikistan
Tel: (99237) 236-40-59
Fax: (99237) 236-13-53
E-mail: info@tajnature.tj
Web address: www.tajnature.tj

Organization: Tigrovaya Balka Nature Reserve
Director of the Reserve: H. Asadullozoda
Address: Tigrovaya Balka Nature Reserve, Dusti District, Khatlon Region, Tajikistan
E-mail: Sulaymon.dusti@mail.ru

## 8c. Other Local Institutions

Ministry of Foreign Affairs of the Republic of Tajikistan
Address: 33 Sheroz str., 734001 Dushanbe city, Tajikistan
Tel: (992 37) 2210551, (992 37) 2277556 (general department), (992 37) 2211808 (reception)
Fax: (992 37) 221-02-59
E-mail: info@mfa.tj

Ministry of Culture of the Republic of Tajikistan
Address: 34 Rudaki str., 734025, Dushanbe city, Tajikistan
Tel: (992 37) 221-03-05, 221-53-70
E-mail: info@vfarhang.tj
Website: http://vfarhang.tj.

Ministry of Science and Education of the Republic of Tajikistan
Address: 13a Nisor Muhammad str., Dushanbe city, Tajikistan
Tel: (+992 2214605),
E-mail: mort@maorif.tj

Committee for Environmental Protection under the Government of the Republic of Tajikistan
Address: 5/1 Shamsi str., 734025 Dushanbe city, Tajikistan
Tel: (+992 2364059)
Tel: +992 (37) 227 8576
E-mail: info@tajnature.tj
E-mail: king_tj@mail.ru

National Academy of Sciences of Tajikistan
Address: 33 Prospekt Rudaki str., 734025 Dushanbe city, Tajikistan
Tel: +(992 37) 221 50 83
Fax: +(992 37) 221 49 11

National Library of the Republic of Tajikistan
Address: 5 Tehran str., Dushanbe city, Tajikistan
Tel: + 992-37-221-05-94
Fax: + 992-37-221-02-35
E-mail: info@kmt.tj

Central Asia Regional Ecology Center, office in Tajikistan
Address: 5/1 Shamsi str., 734025 Dushanbe city, Tajikistan
Tel/Fax: (+992) 372 36 25 09
E-mail: tajikistan@carececo.org

### 8d. Official Web address

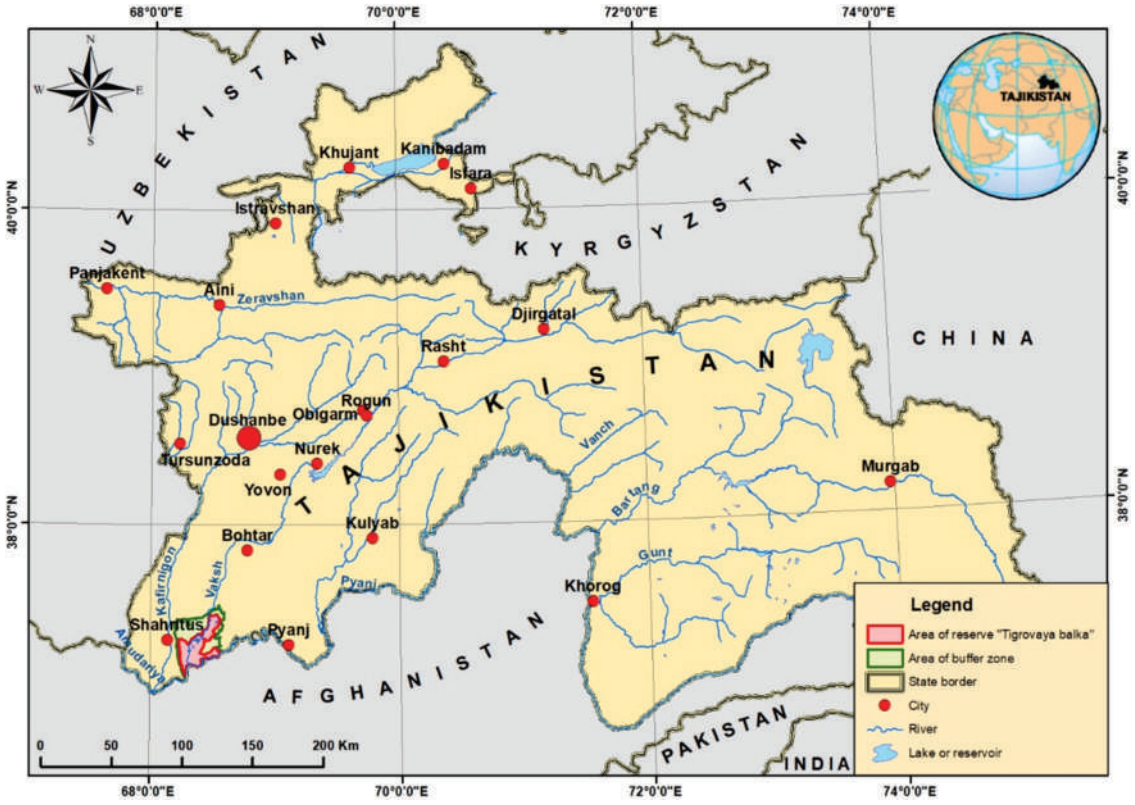
http://www.tajnature.tj
Contact name: N. Nadzhmiddinov
E-mail: najmiddin.9090@mail.ru

## 9. Signature on behalf of the State Party

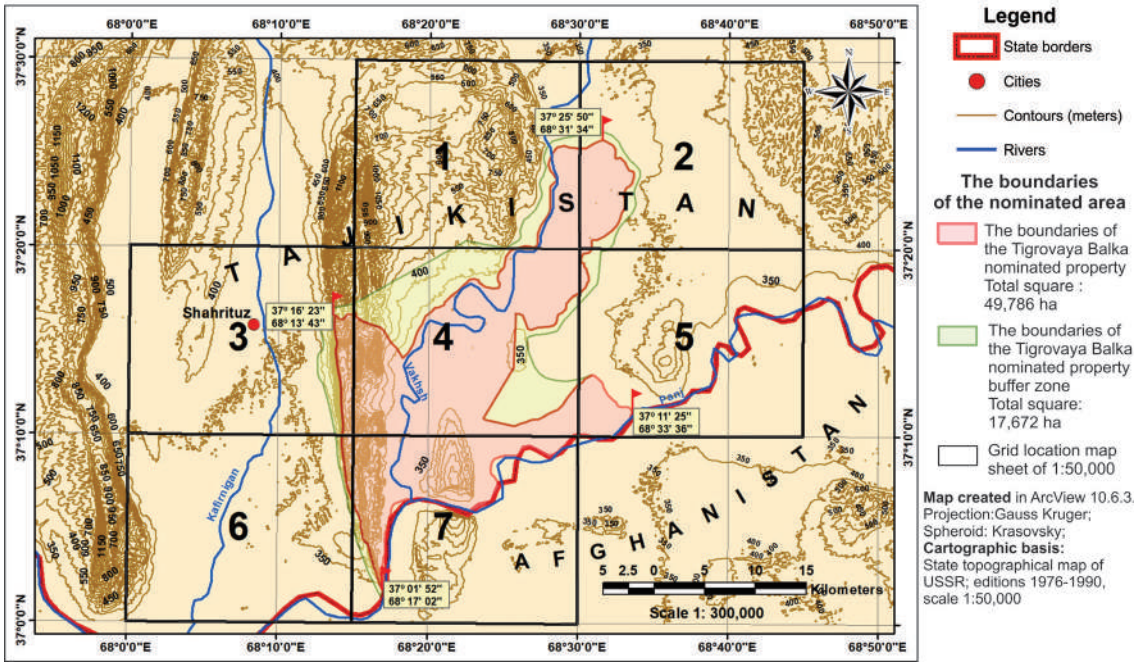
# ANNEX

# ANNEX A

## Maps and diagrams




**Location of the Tigrovaya Balka nominated property on the map of the Republic of Tajikistan**




**Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone**

## Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone

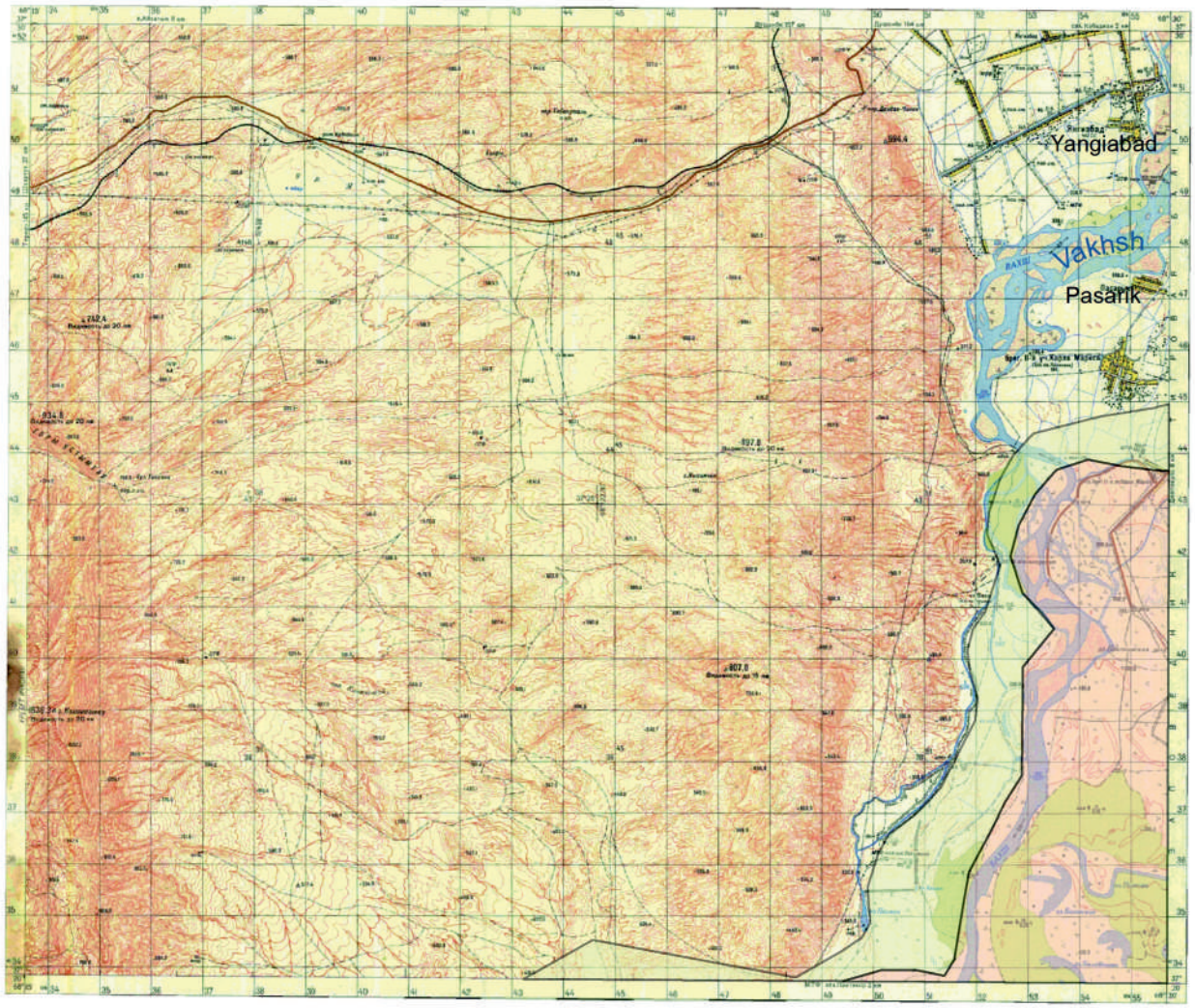
**Land map (J-42-089-4)**

N

**Scale 1:50,000**

0 3 6 9 Kilometers

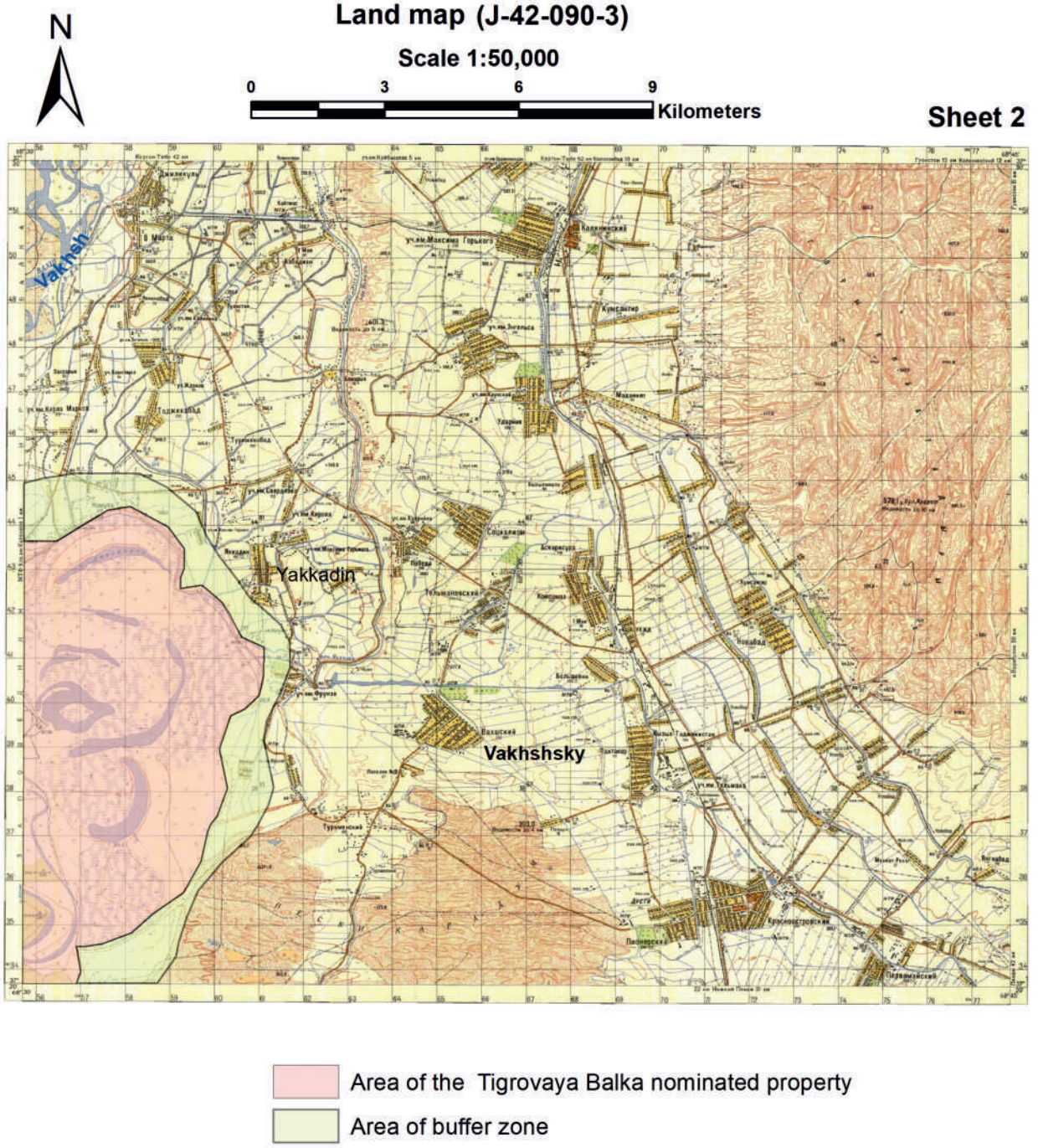
**Sheet 1**



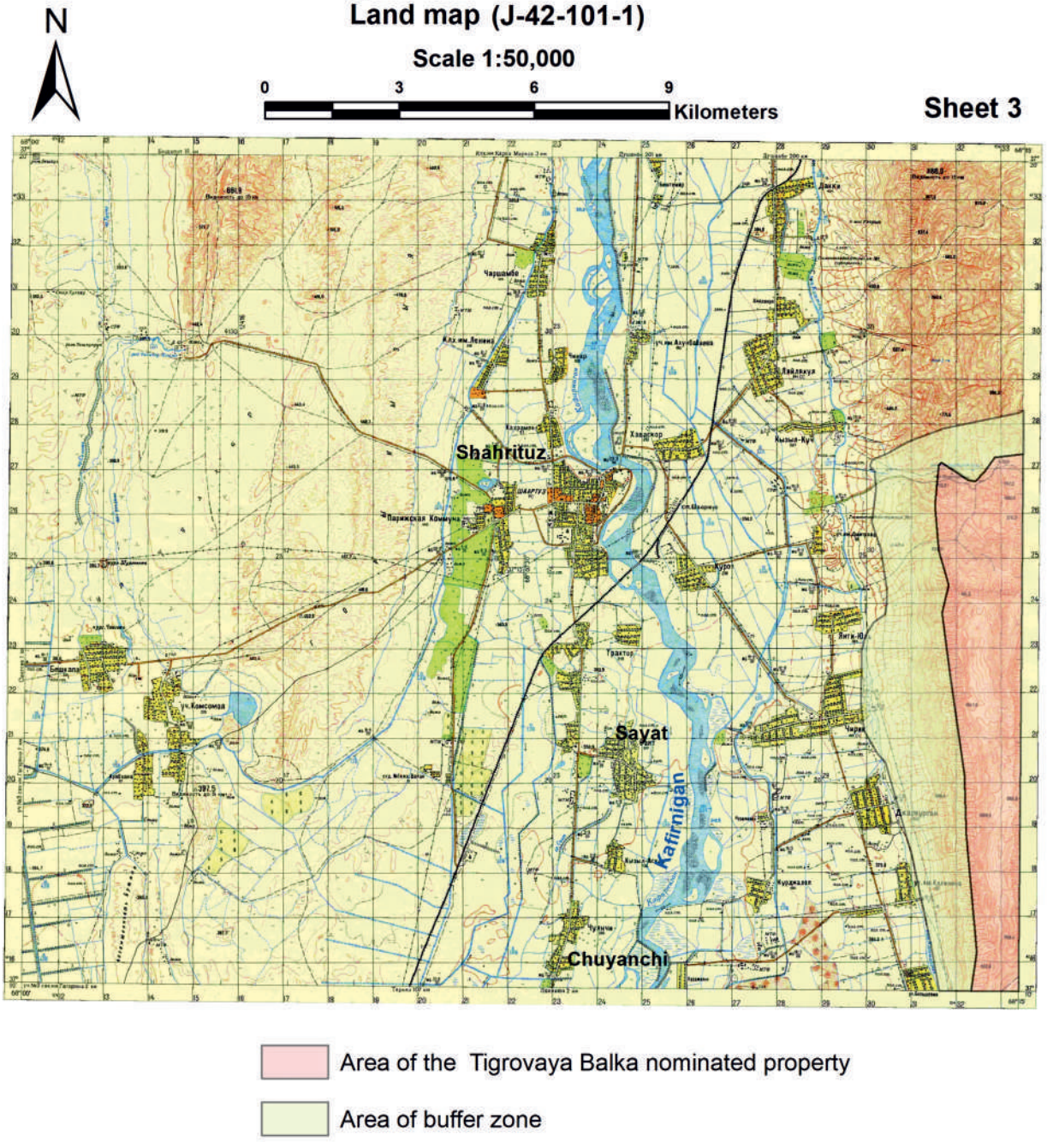

Area of the Tigrovaya Balka nominated property

Area of buffer zone

## Topographic map of the Tigrovaya Balka nominated property showing boundaries and buffer zone



## Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone



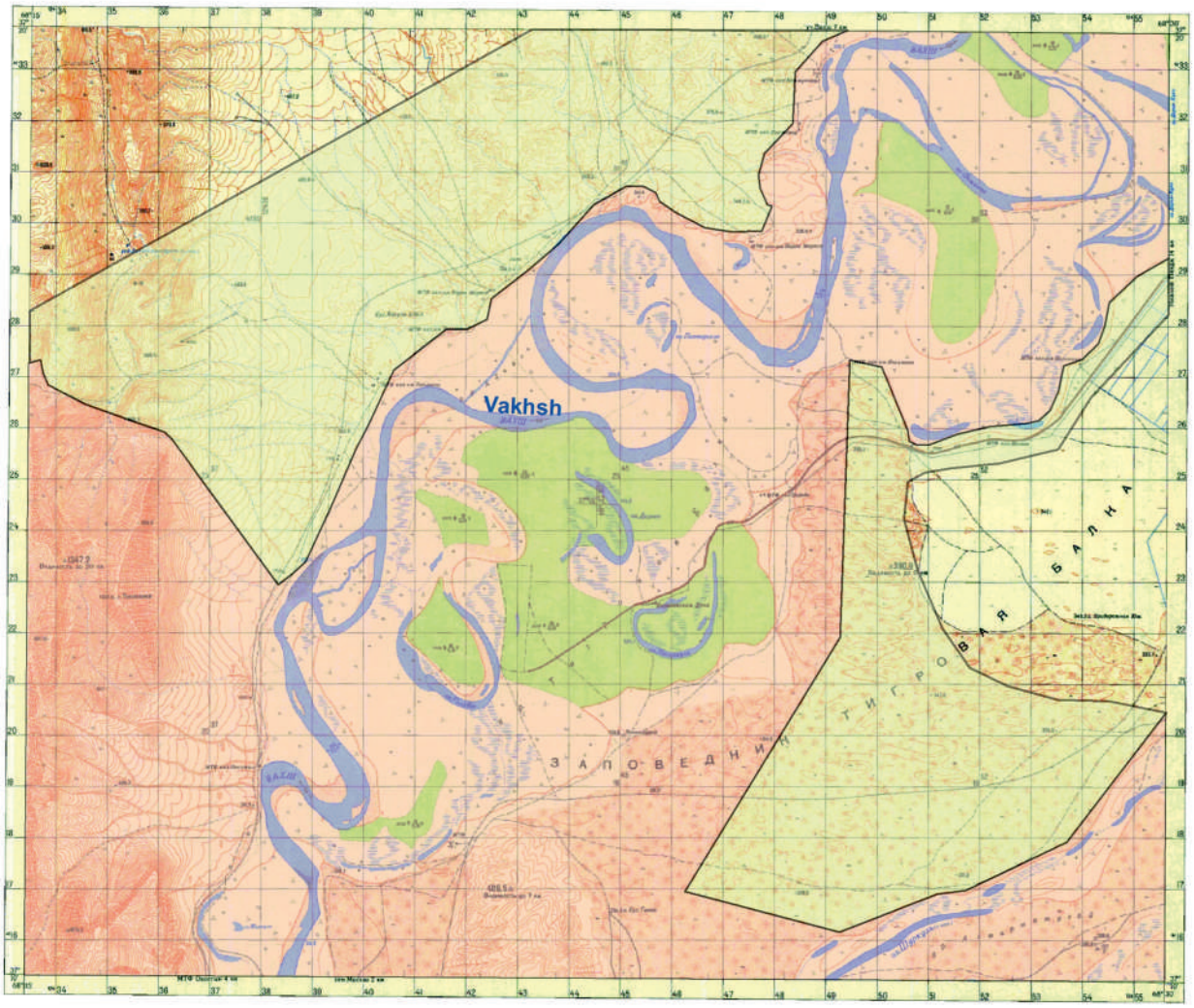
## Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone

Land map (J-42-101-2)

Scale 1:50,000

0 3 6 9 Kilometers

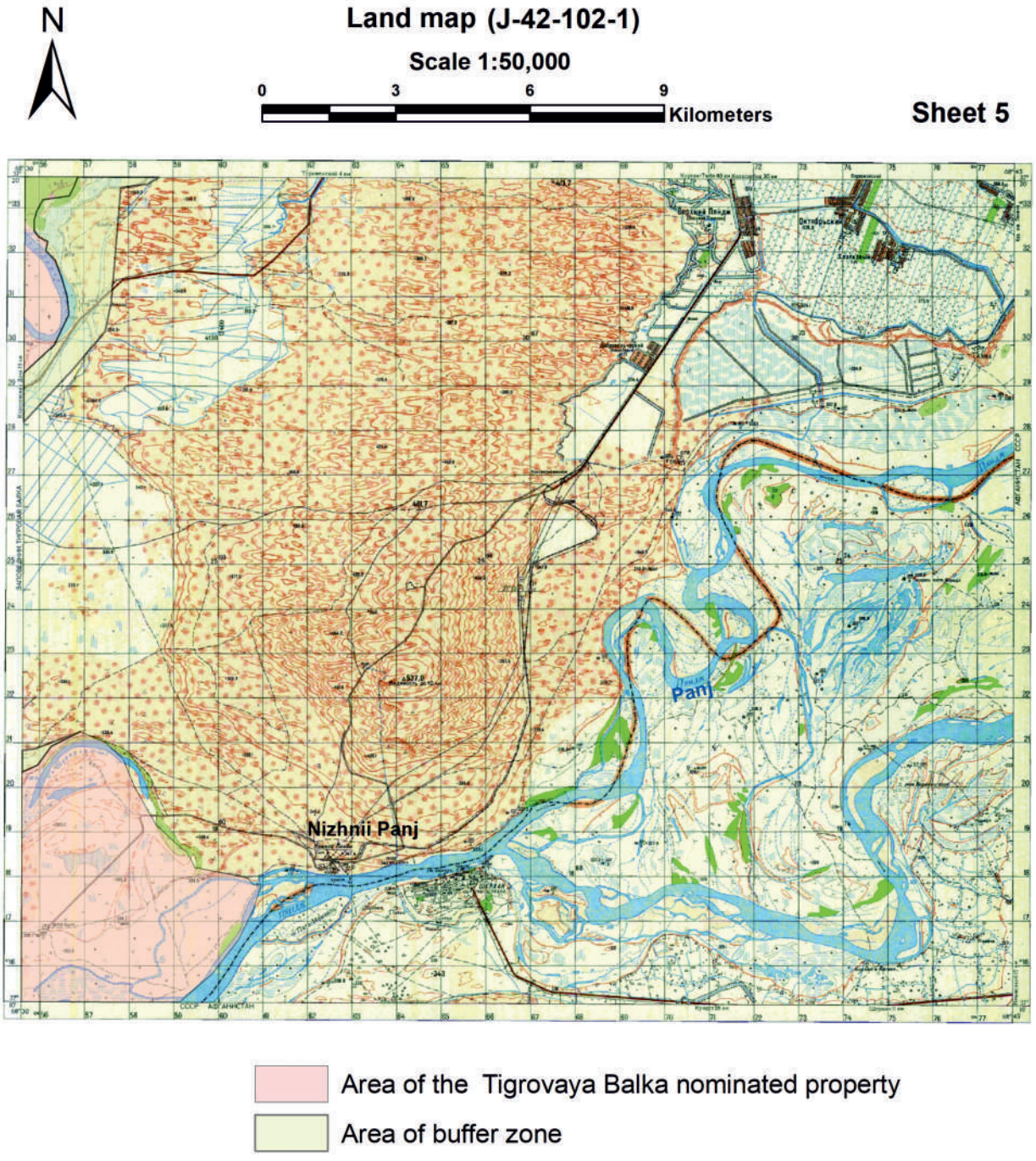
Sheet 4




Area of the Tigrovaya Balka nominated property

Area of buffer zone

## Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone



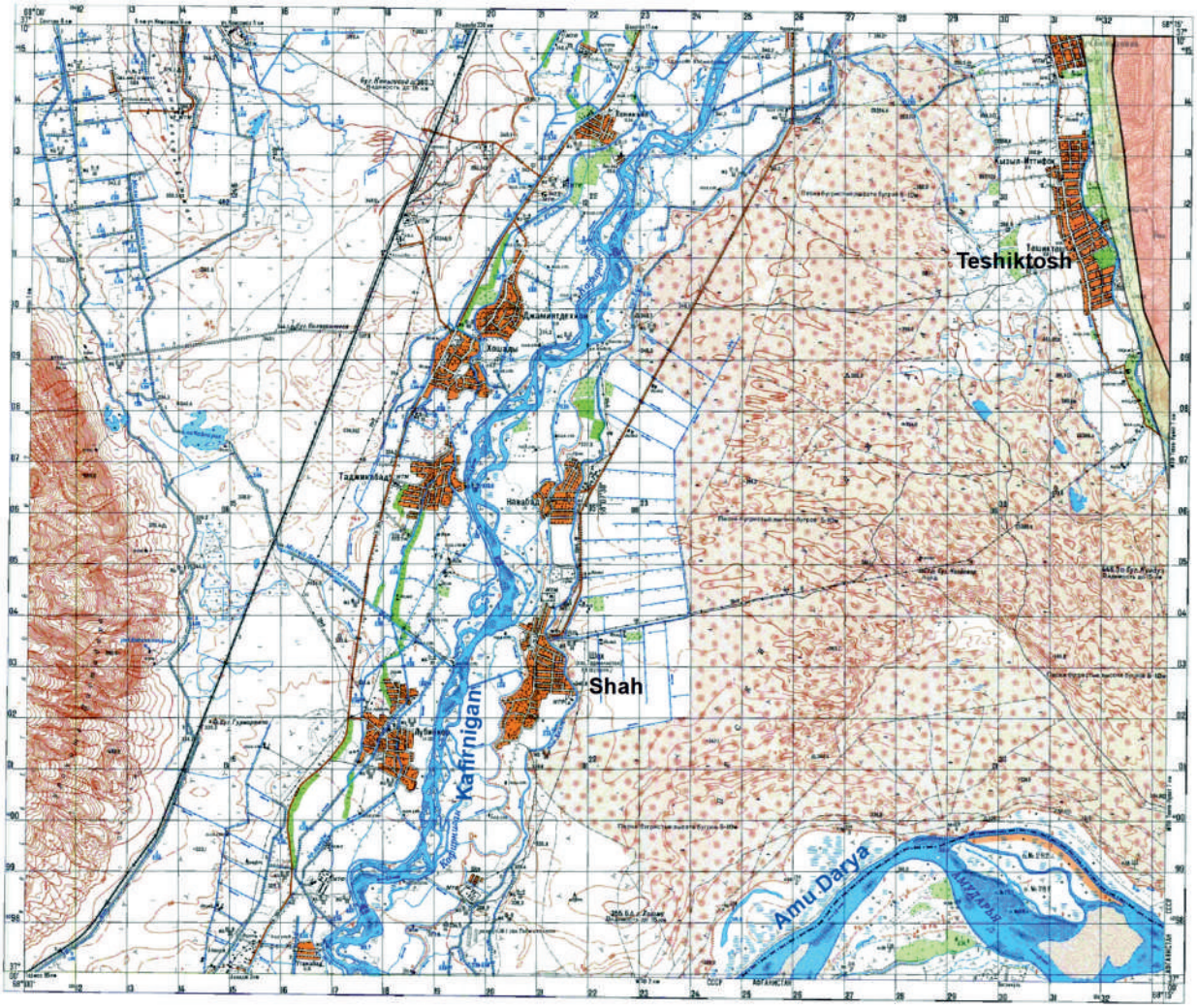
## Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone

Land map (J-42-101-3)

Scale 1:50,000

0 3 6 9 Kilometers

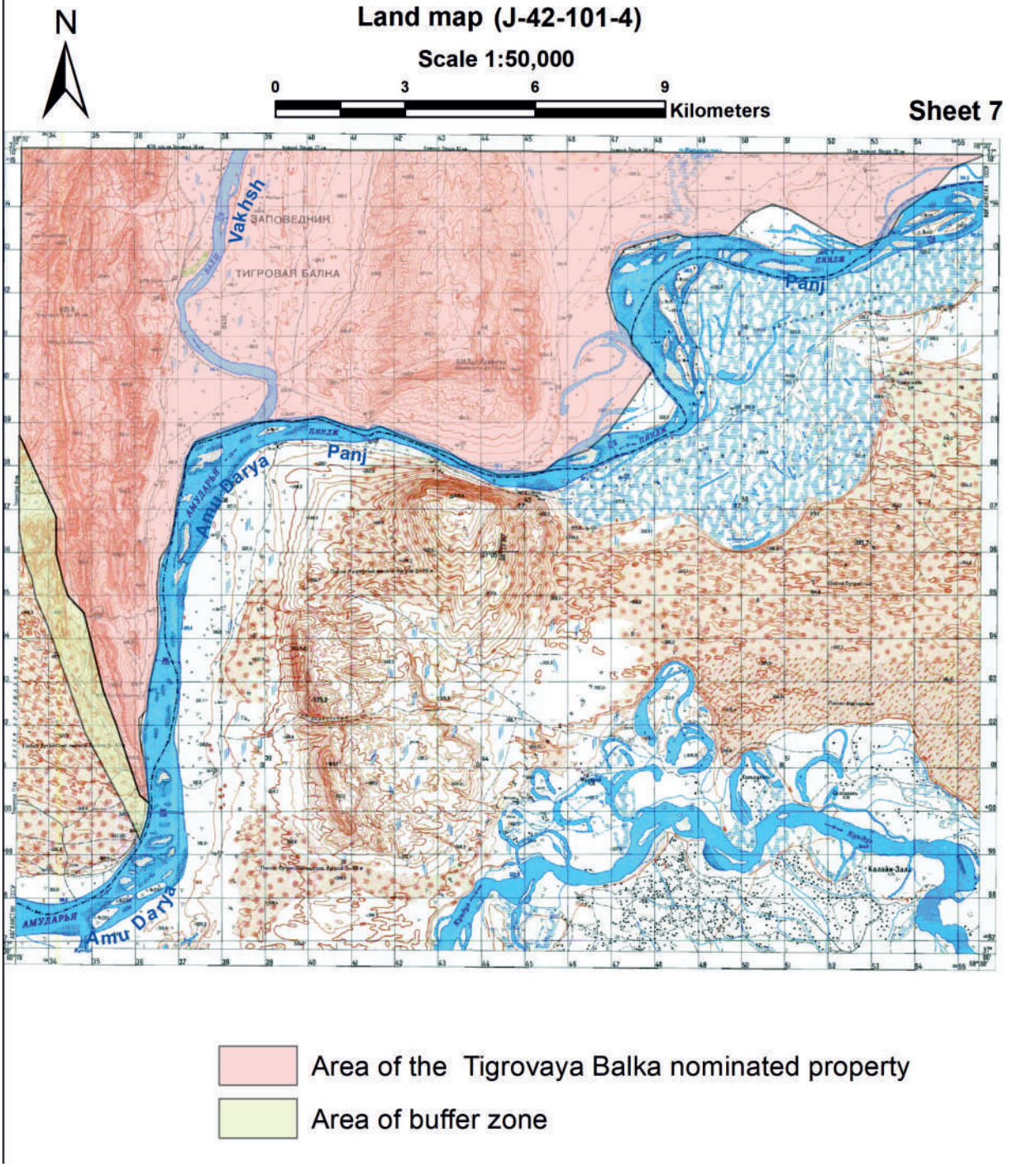
Sheet 6




Area of the Tigrovaya Balka nominated property

Area of buffer zone

## Topographic map of the Tigrovaya Balka nominated property, showing boundaries and buffer zone



**ANNEX B1**

Extract from

# THE LAW OF THE REPUBLIC OF TAJIKISTAN ON SPECIALLY PROTECTED NATURAL AREAS

(Akhbori Majlisi Oli of the Republic of Tajikistan, 2011, No. 12, p. 852; the Law of the RT of 27.11.2014, No. 1159)

This Law determines legal, organizational and economic basis of specially protected natural areas, sets their tasks, the mode of activities and zoning.

## CHAPTER 1. GENERAL PROVISIONS

Article 1. Basic concepts

In this Law the following basic concepts are used:

– specially protected natural areas - land areas, waters and airspace over them where the natural complexes and objects having special nature protection, scientific, cultural, esthetic, recreational and health-improving value, withdrawn in the procedure established by the legislation of the Republic of Tajikistan from economic use, fully or partially, for which the mode of special protection is set, are located;

– nature reserve – the territory of the earth or the water space withdrawn completely from economic activity, intended for preserving and studying of typical and unique natural complexes, gene pool of plants and animals, carrying out monitoring of dynamics of natural processes and the phenomena;

– natural park - the territory which includes the natural complexes having special ecological, historical and esthetic value, held for use in the nature protection, recreational, scientific and cultural purposes;

– biosphere wildlife reserve – the site of terrestrial and water ecosystems or their combination included in Worldwide network of biosphere wildlife reserves, intended for protection of natural and cultural values and sustainable land use, including lands of agricultural purpose, forest fund, specially protected natural areas and rural settlements;

– natural wildlife area – the territory allocated for certain period for the purpose of protection and recovery of separate components of the nature and natural complexes;

– nature sanctuary – unique, irreplaceable and valuable object of natural origin in the ecological, scientific, esthetical, cultural relation;

– recreational zone – the land area, water space or their combination having esthetical, ecological or cultural value, used for the purpose of recreation and health improvement of the population;

– protective (buffer) zone – the zone created around especially protected natural territories for the purpose of reduction of adverse external effects

– State Cadastre of specially protected natural areas – the code of data on the legal

status, geographical location, quantity and quality characteristics of the protected natural areas of natural, ecological, economic, scientific, educational and other value and their users;

– nature records – the scientific document in which the main results of observations of natural processes and the phenomena, the analysis of the obtained data, and also the revealed patterns of observed natural processes, the phenomena, the reasons causing them and forecasts of their further development are fixed;

– ecological tourism - the tourism including travel to places with rather untouched nature with the purpose to gain impression about natural and cultural and ethnographic features of this area and not breaking at the same time integrity of ecosystems and creating economic conditions under which conservation and natural resources become profitable to local population.

– dendrological parks and botanical gardens – organizations which task includes creation of collection of trees and bushes for the purpose of preserving biodiversity and enrichment of flora, introduction and acclimatization of new types of plants, and also in the scientific, educational and cultural and educational purposes.

Article 2. The legislation of the Republic of Tajikistan on specially protected natural areas

The legislation of the Republic of Tajikistan on specially protected natural areas is based on the Constitution of the Republic of Tajikistan and consists of this Law, other regulatory legal acts of the Republic of Tajikistan, and also the international regulatory legal acts recognized by Tajikistan.

Article 3. Categories of specially protected natural areas

1. Depending on the purposes of creation, features of the mode of protection and use the following categories of especially protected natural territories are established:
   - national natural parks;
   - state natural parks;
   - natural wildlife areas;
   - state zoological parks;
   - state nature sanctuaries;
   - ecology-ethnographic zones;
   - dendrological parks and botanical gardens;
2. Other categories of specially protected natural areas may be established in accordance with the legislation of the Republic of Tajikistan.
3. Taking into account the ecological value, specially protected natural areas can be of international, republican and local importance.

Article 4. State ownership of specially protected natural areas

1. Specially protected natural areas are the exclusive property of the state, and the state guarantees their effective use in the interests of the people.
2. Actions directly or indirectly, violating the right of state ownership of specially protected natural areas are prohibited.

## CHAPTER 2. MANAGEMENT OF SPECIALLY PROTECTED NATURAL AREAS

Article 5. Management of specially protected natural areas

1. The Government of the Republic of Tajikistan, the authorized state body in the field of specially protected natural areas (hereinafter referred to as the "authorized state body"), local government bodies, ministries, departments and organizations in charge manage specially protected natural areas. Control of the state and compliance with the regime of specially protected natural areas is carried out by the authorized state body.
2. Activities for the implementation of state control and management of specially protected natural areas in the border areas are regulated by the legislation of the Republic of Tajikistan. Specific measures in these territories are carried out with the permission of the authorized state body for the protection of the state border.

Article 6. Competence of the Government of the Republic of Tajikistan concerning specially protected natural areas

The competence of the Government of the Republic of Tajikistan concerning specially protected natural areas includes:

– pursuing a unified state policy in the field of specially protected natural areas;

– coordination of the activities of state bodies for the protection and management of specially protected natural areas;

– making decisions on the organization and liquidation of specially protected natural areas of republican and international importance;

– approving state programs and adopting normative legal acts concerning specially protected natural areas;

– determining the authorized state body in charge for specially protected natural areas;

– implementing international cooperation in the field of specially protected natural areas;

– exercising other powers determined by the legislation of the Republic of Tajikistan.

Article 7. Powers of the authorized state body

The powers of the authorized state body include:

– implementing a unified state policy concerning specially protected natural areas;

– organizing monitoring of specially protected natural areas;

– implementing state control;

– developing programs and regulatory legal acts for specially protected natural areas;

– filing claims for compensation for damage caused to specially protected natural areas as a result of non-compliance with environmental legislation;

– exercising other powers determined by the legislation of the Republic of Tajikistan.

Article 8. Powers of local government bodies concerning specially protected natural areas

The powers of local government bodies concerning specially protected natural areas include:

– providing assistance in implementing state programs in the field of specially protected natural areas;

– determining the main measures for the protection and use of specially protected natural areas, approving local environmental programs;

– coordinating and controlling the activities of local authorities on environmental protection, providing assistance in voluntary fundraising to implement measures for the preservation and restoration of specially protected natural areas;

– exercising other powers determined by the legislation of the Republic of Tajikistan.

Article 9. Participation of public organizations and citizens in the organization, protection and use of specially protected natural areas

Public organizations and citizens take part in the implementation of measures for the organization, protection and use of specially protected natural areas in accordance with the legislation of the Republic of Tajikistan.

Article 10. State Cadastre of specially protected natural areas

1. The State Cadastre of specially protected natural areas is maintained to evaluate the state of the natural fund, determine the prospects for their development, and ensure their protection, conduct scientific research, state control over the conservation of the gene pool, and comply with the relevant regime, as well as take into account these areas when planning socio-economic development and placement productive power in the region.
2. The State Cadastre of specially protected natural areas is maintained according to a unified system developed by the authorized state body with the participation of other interested departments. The procedure for maintaining the State Cadastre of specially protected natural areas is established by the Government of the Republic of Tajikistan.

Article 11. Planning of measures to protect and use specially protected natural areas

1. Measures to protect and use specially protected natural areas are provided for in the concepts, strategies and programs of socio-economic development. The planning of measures to protect and use specially protected natural areas is carried out taking into account the scientifically grounded combination of economic and environmental interests of society.

Current and long-term planning of measures to protect and use specially protected natural areas is carried out as part of concepts, strategies and programs of socio-economic development on the basis of the state environmental program and the general scheme for the development and distribution of productive power, sectors of the economy, taking into account the natural resource potential of the Republic and its individual regions.

Specially protected natural areas are taken into account when developing programs for the socio-economic development of regions, land management schemes and district planning.

The planning of measures to protect and use specially protected natural areas is carried out by the ministries, departments and organizations that are in charge of these areas.

Article 12. Material and technical support and financing of measures to protect and use specially protected natural areas

1. The Government of the Republic of Tajikistan, ministries and departments, local government bodies, and organizations, regardless of the form of ownership and subordination, take the necessary measures for the material and technical support

of activities aimed at protection and use of specially protected areas.

2. Measures to protect and use specially protected natural areas are financed from the following sources:

– republican and local budgets;

– republican and local funds for environmental protection;

– funds of enterprises, institutions and other organizations, regardless of their form of ownership;

– voluntary investments of individuals and legal entities;

– other types of financing not prohibited by the legislation of the Republic of Tajikistan.

## CHAPTER 3. ORGANIZATION OF SPECIALLY PROTECTED NATURAL AREAS

Article 13. The procedure for the creation of specially protected natural areas

Specially protected natural areas are created by decisions of the Government of the Republic of Tajikistan and local government bodies at the suggestion of the authorized state body in accordance with this Law and other regulatory legal acts of the Republic of Tajikistan.

Article 14. Protective (buffer) zones

1. If it is necessary to prevent or mitigate harmful effects on the natural complexes of specially protected natural areas, protective (buffer) zones with limited economic activity may be established around these areas.
2. In the protective (buffer) zones, the types of economic activities and nature management that have a negative impact on specially protected natural areas are prohibited.
3. The sizes of protective (buffer) zones and their regime are established by the authorized state body.

Article 15. Ecological corridors

1. Ecological corridors are formed to ensure spatial communication between specially protected and other protected natural areas of the ecological network to preserve the property of the state natural reserve fund, biological diversity, protect natural migration routes of animals and the propagation of plants that live and grow in these protected natural areas.
2. On the sections of ecological corridors, a regulated regime of land use is established, which ensures the safety of wild animals in places of their temporary habitat and movement during the migration period, as well as the safety of places where wild plants grow.
3. The boundaries, area and regime of protection of ecological corridors are determined by local government bodies together with the authorized government body.

Article 16. Lands of specially protected natural areas

The lands of specially protected natural areas belong to the category of lands of the state forest fund and those used for environmental, health-improving, recreational, historical and cultural purposes. On the lands of specially protected natural areas, activities that contradict their designated purpose are prohibited.

Article 17. Procedure for reserving land for the creation of specially protected natural areas

1. The reservation of land plots for the purpose of organizing specially protected natural areas is made by the decision of heads of cities and districts based on the joint proposal of the authorized state body and the authorized scientific institution.
2. When land is reserved to organize specially protected natural areas and their protective (buffer) zones, losses of land users are reimbursed in accordance with the legislation of the Republic of Tajikistan.
3. In case of seizure of lands of the state forest fund, state land reserves for the creation of specially protected natural areas, no losses are reimbursed to nature protection institutions and other organizations who own these lands.

Article 18. Access of citizens to specially protected natural areas

1. Specially protected natural areas, with the exception of those with a strict protection regime, are generally accessible and are used by citizens for recreational, health-improving, cultural purposes and for ecological tourism.
2. The historically established residence of the local population with a low density in specially protected natural areas, except for those with a strict protection regime, is allowed, provided that the ecological balance of this area is preserved.
3. Ecological tourism is carried out at a specified time along the predetermined routes in accordance with the rules for accessing specially protected natural areas determined by the authorized state body. The authorized state body or organizations in charge of specially protected natural areas may prohibit ecological tourism in certain zones of specially protected natural areas to protect rare and endangered species of animals and plants and their habitat (growth).
4. Individuals and legal entities engaged in ecological tourism must enter into agreements with bodies or organizations in charge of specially protected natural areas to ensure compliance with their regime and rules for ecological tourism, agree on routes and other conditions.
5. Visits to specially protected natural areas for the purpose of ecological tourism may be carried out on a paid basis. The size and procedure for payment for ecological tourism in specially protected natural areas is established by the Government of the Republic of Tajikistan. Funds received from ecological tourism in specially protected natural areas are used to preserve, ensure the goals, objectives and regime of these areas.

Article 19. Procedure for reorganization, suspension of functioning and liquidation of specially protected natural areas

1. Reorganization, suspension of functioning and liquidation of specially protected natural areas is carried out by decisions of the Government of the Republic of Tajikistan and local government bodies in accordance with the proposal of the authorized state body and under this Law and other regulatory legal acts of the Republic of Tajikistan.
2. Reorganization of specially protected natural areas is carried out when it is necessary to change their type and category.
3. Suspension of functioning or liquidation of specially protected natural areas is carried out in the following cases:
   – expiration of their term of operation;

– is irreparable damage has been caused to the specially protected natural area by natural disasters and man-made actions;

– seizure of lands of specially protected natural areas for other state and public needs.

## CHAPTER 4. STATE NATURE RESERVES

Article 20. Objectives of state nature reserves

The following objectives are assigned to state nature reserves:

– preserving biological diversity by maintaining the entire natural complex of the reserve in its natural state;

– biological monitoring;

– conducting scientific research;

– participating in the state ecological expertise of projects and layouts of economic and other objects, the implementation of which may have a negative impact on the natural complexes of reserves and their buffer zones;

– providing assistance in training scientific personnel and specialists in the field of environmental protection;

– disseminating environmental knowledge.

Article 21. Procedure for the formation of state natural reserves

1. The decision on the formation of state natural reserves, as well as on the change of their areas, is taken by the Government of the Republic of Tajikistan at the suggestion of the authorized state body and in agreement with local government bodies.

The organization of state nature reserves does not require the consent of individuals and legal entities carrying out economic activities and nature management in this area.

Seizure of land for the organization of state natural reserves is carried out in the manner prescribed by the legislation of the Republic of Tajikistan.

Article 22. Management of state natural reserves

1. The management of state natural reserves is carried out by the authorized state body in accordance with this Law.
2. Plans for the management of state natural reserves are approved by the authorized state body and brought to the attention of the relevant state bodies, public organizations and citizens. Interested individuals and legal entities may be involved in the development of management plans in the manner prescribed by the legislation of the Republic of Tajikistan. (Law of the RT No. 1159 of 27.11.2014).

Article 23. Regime of state natural reserves

1. On the territory of state natural reserves, economic and other activities that violate the development of natural processes, threaten the state of natural complexes and objects, and are not related to the fulfillment of the objectives assigned to the reserve are prohibited.

On the territory of state nature reserves and their protective (buffer) zones, the acclimatization of plants and animals unusual for these territories is prohibited.

The following is allowed in state nature reserves:

–carrying out measures to preserve, restore and prevent changes in natural complexes as a result of anthropogenic impact, as well as to implement research assigned to the reserve;

– carrying out fire-prevention and sanitary measures, as well as other types of limited economic activity and environmental management necessary to fulfill the objectives assigned to the state reserve.

4. Staying on the territory of state natural reserves of citizens, except for employees of the reserve and persons exercising state control, is allowed only with the permission of the administration of the reserves.

5. The construction of new economic facilities and the implementation of other activities in the territories adjacent to the state natural reserves that pose a threat to the reserve regime, leading to an increase in background concentrations of pollutants or a change in the hydrological regime within reserves, are carried out only in agreement with the authorized state body.

Article 24. Scientific and research activities in state natural reserves

1. Scientific and research activities in state nature reserves are carried out in the form of stationary round-the-clock long-term comprehensive research aimed at studying natural complexes and long-term monitoring of the dynamics of natural processes to evaluate and predict the ecological situation, develop scientific foundations for environmental protection, preserve the diversity of the biosphere, restore and rational use of natural resources. Keeping the «Nature records» is mandatory for all state nature reserves.
2. Specific features, regime and scientific profile of state natural reserves are established in their regulations, approved by the authorized state body.
3. Academic councils may be set up in state nature reserves. The composition of the academic council and the regulations on it are approved by the authorized state body.
4. Scientific data banks of state natural reserves are subject to permanent storage. State nature reserves are granted the right to publish scientific papers.

Article 25. Use of objects of the state natural reserve

Land, water, mineral resources, flora and fauna of state natural reserves are transferred to the reserves for unlimited use completely and free of charge. Leasing of lands and other natural resources of reserves is prohibited.

## CHAPTER 12. PROCEDURE FOR PROTECTION OF SPECIALLY PROTECTED NATURAL AREAS

Article 48. Procedure for the protection of specially protected natural areas

1. Protection of specially protected natural areas is carried out by the bodies in charge for those areas in the manner prescribed by the legislation of the Republic of Tajikistan.

Workers of the service for the protection of specially protected natural areas are included in the staff of state nature reserves and national parks.

The directors of state nature reserves and state natural parks are the chief state inspectors for the protection of these areas.

Article 49. Rights of state inspectors for the protection of nature reserves and state natural parks

1. Employees of nature reserves and state natural parks, who are state inspectors for the protection of these areas, have the right to enjoy all the rights and benefits of state inspectors for environmental protection and forest protection.

2. Decisions made by state inspectors for the protection of nature reserves and state natural parks within their powers are binding on individuals and legal entities and can be appealed in court.
3. State inspectors for the protection of nature reserves and state natural parks in the performance of their official duties have the right to store, bear and use special means and service weapons in accordance with the established procedure.
4. State inspectors for the protection of nature reserves and state natural parks are subject to compulsory insurance and have the right to compensation for damage in case of injury suffered in the course of duty.

Article 50. Public control in the field of specially protected natural areas

Public control in the field of specially protected natural areas is carried out by public organizations on their own initiative in agreement with the authorized state body.

## CHAPTER 13. FINAL PROVISIONS

Article 51. International cooperation concerning specially protected natural areas

1. International cooperation concerning specially protected natural areas is carried out on the basis of the legislation of the Republic of Tajikistan and international legal acts recognized by the Republic of Tajikistan.
2. In the event that the norms of the legislation of the Republic of Tajikistan on specially protected natural areas contradict international legal acts recognized by the Republic of Tajikistan, the norms of international legal acts shall apply.

Article 52. Responsibility for violation of this Law

Individuals and legal entities are held accountable for violation of this Law in the manner prescribed by the legislation of the Republic of Tajikistan.

Article 53. On recognizing as invalid the Law of the Republic of Tajikistan "On Specially Protected Natural Areas and Properties"

Recognize as invalid the Law of the Republic of Tajikistan of December 13, 1996 "On Specially Protected Natural Areas and Properties" (Akhbori Majlisi Oli of the Republic of Tajikistan, 1996, No. 23, p. 353; 1998, No. 10, p. 125; 2002 ., No. 4, part 1, p. 272).

Article 54. Procedure for the entry into force of this Law

This Law enters into force after its official publication.

President
of the Republic of Tajikistan Emomali Rahmon

Dushanbe, December 26, 2011
No. 788

**ANNEX B2**

**CENTRAL STATE ARCHIVE OF THE REPUBLIC OF TAJIKISTAN**
**MAIN ARCHIVES ADMINISTRATION UNDER THE COUNCIL**
**OF MINISTERS OF THE TAJIK SSR**
**/Coat of Arms/**

38/1 N. Karabaev str., 734018, Dushanbe
Tel. 33-95-71, 33-95-81, 33-94-97.
Settlement account 12011, 14160 in the city department of the State Bank
Dushanbe

Ref. No. 8 of May 13, 1998
to No. 100/3 May 06, 1998

**ARCHIVE COPY**
**RESOLUTION OF THE**
**Council of People's Commissars of Tajik SSR**
**city of Stalinabad**
**No. 1165**
**of November 3, 1938**

On the organization of the republican game preserve in the Tigrovaya Balka stow of the Tajik SSR.

To preserve and study the Bactrian deer (hangul), goitered gazelle, urial (mouflon), and pheasant, which are species of animals valuable in terms of hunting and scientific research, as well as to preserve the original flora of floodplain forests of the lower course of the Vakhsh River, which suffer the destruction, the Council of People's Commissars of the Tajik SSR

**Resolves:**

**1. To organize the Tigrovaya Balka reserve with a total area of 500 sq. km. in the Tigrovaya Balka stow in Dzhilikul and Shaartuz districts including a part of plateau and mountains adjacent to the western slope of the Tigrovaya Balka stow to the western slope of the Khoja-Kaziyan mountains to ensure the natural living conditions for gazelles and urials.**
**2. To propose to the People's Commissariat of Agriculture of the Tajik SSR to allocate from the funds of the cattle-breeding department 14788 rubles for the 1st quarter of this year, and also to provide in budget of the People's Commissariat of Agriculture the fund to maintain the Tigrovaya Balka reserve in 1939.**
**3. To appoint the People's Commissariat of Agriculture of the Tajik SSR liable for the organization of the Tigrovya Balka reserve.**
**4. To instruct the People's Commissar of Agriculture to approve.**
**5. To oblige the Dzhilikul, Shaartuz, Mikoyanabad, Voroshilovobad, and Modotovabad regional executive committees to communicate the significance of the Tigrovaya Balka reserve through the regional press.**

**DEPUTY CHAIRMAN OF THE COUNCIL OF THE PEOPLE'S COMMISSARS OF THE TAJIK SSR: Karimov**
**MANAGEMENT OF COUNCIL AFFAIRS OF THE TAJIK SSR: Mardankulov**

**Grounds: fund 18, list 8., case 335, sheet 72**

| | | |
|---|---|---|
| **Director** | **/signature//signature/** | **M.S. Shakirova** |
| **Senior archivist** | **/signature//signature/** | **L.I. Ivanyuk** |

**Round seal /CENTRAL STATE ARCHIVE OF THE TAJIK SSSR/**
**Printing house of the Ministry of Education, ordered 1180 copies,**
**a run of 2000 copies, November 23, 1981**

**ANNEX B3**

**CENTRAL STATE ARCHIVE OF THE REPUBLIC OF TAJIKISTAN**
**MAIN ARCHIVES ADMINISTRATION UNDER THE COUNCIL OF MINISTERS OF THE TAJIK SSR**
**/Coat of Arms/**

38/1 N. Karabaev str., 734018, Dushanbe
Tel. 33-95-71, 33-95-81, 33-94-97.
Settlement account 12011, 14160 in the city department of the State Bank Dushanbe

Ref. No. 8 of May 13, 1998
to No. 100/3 of May 06, 1998

**ARCHIVE COPY**
**REGULATION**
**on nature reserves of the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR**

1. Nature reserves are land plots of special economic, scientific or cultural value, the natural wealth of which is used for scientific research in practical interests of the national economy and ensuring the complete preservation of nature in its original state.

The Government of the Tajik SSR decides on the organization and identification of the area of nature reserves.

2. The territory of nature reserves with all the natural properties located on it constitutes the state nature reserve fund, the use of which in the purposes other than those determined can be carried out only with the consent of the Government of the Tajik SSR.

3. Nature reserves are under the direct jurisdiction of the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR.

4. Nature reserve administration of the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR:

a) protects the territory of the reserve with all its natural resources and ensures the compliance with the respective regime adopted on the territory of the reserve;

b) keeps records of the forest fund of the reserve, protected animals and valuable plants;

c) draws up and submit for approval to the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR production, labor and capital construction schedules for the reserve and takes measures to fulfill the approved schedules;

d) prepares reports on research and production activities, as well as regular, annual accounting and statistical reports.

Printing house of the Ministry of Education, ordered 1180 copies, a run of 2000 copies, November 23, 1984

5. Research work is being carried out in reserves aimed at resolving theoretical and practical issues of biology, protection and reproduction of flora and fauna, as well as the rational use of the natural resources of Tajikistan.

6. The reserves are charged with the following objectives:

a) preserving and enriching flora and fauna of the reserve and adjacent areas;

b) carrying out research work according to plans approved by the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR;

c) preserving and restoring typical natural complexes of the reserve;

d) studying animals, birds, and plants that are important for the national economy, as well as their relationship with the habitat;

e) developing and testing scientifically grounded methods of quantitative accounting of hunting and commercial fauna, ways of its increase, enrichment and the most reasonable use;

f) identifying useful properties of wild animals and plants, methods of their reproduction and cultivation, as well as their use in the interests of the national economy;

g) birdbanding and marking of animals;

h) protecting and saving forests of the reserve, looking after them and implementing the necessary forestry and fire-fighting measures;

i) organizational and economic arranging of the reserve;

j) providing assistance to other institutions in carrying out research in the reserve, facilitating workers' excursions, as well as student practice and tourism.

7. Hunting, catching, destruction in any way of animals and birds, ruining nests and holes, fishing, collecting eggs and fluff, damaging trees and bushes is prohibited on the territory of reserves.

Those violating the regime of reserves are brought to justice in accordance with the established procedure.

8. The presence of unauthorized persons on the territory of reserves without the appropriate permission is prohibited, and the presence of unauthorized persons on the territory of reserves with a gun or fishing gear is treated as poaching activity.

9. Shooting animals and birds to regulate their population and conduct scientific research, destructing predators, as well as collecting fruits and berries, fishing, seed harvesting, harvesting hardy-shrub species, mining, felling, and haymaking on the territory of reserves are allowed only with the consent of the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR.

10. With the permission of the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR, land plots are allocated on the territory of reserves to meet the economic needs of the reserve.

11. Nature reserves are headed by directors appointed by the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR.

12. Scientific councils are organized in the reserves, the composition of which is approved by the Main Directorate of Forestry and Protective Afforestation under the Council of Ministers of the Tajik SSR.

13. Nature reserves carry out their activities in accordance with this regulation.

14. Reserves are liquidated in accordance with the resolutions of the Government of the Tajik SSR.

15. Nature reserves are included in the budget of the Republic.

16. Nature reserves have their original seals with the name of the respective reserve.

17. State nature reserves are protected based on the regulations approved by the Main Directorate for Nature Reserves under the Council of Ministers of the USSR, and enjoys all the rights of the state forest protection of the USSR, in accordance with the resolution of the Council of the Ministers of the USSR of March 22, 1950 No. 1181.

Grounds: fund 18, list 8., case 1605, sheets 180-183

| | | |
|---|---|---|
| Director | /signature/ | M.S. Shakirova |
| Senior archivist | /signature/ | L.I. Ivanyuk |

Round seal /CENTRAL STATE ARCHIVE OF THE TAJIK SSSR/

**APPENDIX B4**

**Committee for Environmental Protection under the Government of the Republic of Tajikistan**

# MANAGEMENT PLAN

## for the Tigrovaya Balka Nature Reserve and the adjacent territory for the period 2022-2026

**Committee for Environmental Protection under the Government of the Republic of Tajikistan**

Approved by
Head of the State Institution for Specially Protected Natural Areas of the Committee for Environmental Protection under the Government of the Republic of Tajikistan
_____ S. Kh. Kholzoda

# MANAGEMENT PLAN

## for the Tigrovaya Balka Nature Reserve and the adjacent territory for the period 2022-2026

**Dushanbe, 2021**
**Management plan structure**

## INTRODUCTION

This mid-term Management Plan for the Tigrovaya Balka Nature Reserve for 2022-2026, developed by the staff of the State Institution for Specially Protected Natural Areas (SI SPNA) of the Committee for Environmental Protection under the Government of the Republic of Tajikistan and the National Academy of Sciences of Tajikistan, with the participation of international experts from the IUCN, within the framework of the UNESCO project for the preparation of documents for the inscription of the Tigrovaya Balka Nature Reserve on World Heritage List. When developing the Plan, the «Instruction for the development of management plans for specially protected natural areas of Tajikistan», approved by the Head of the State Institution for Specially Protected Natural Areas on June 18, 2010, was used.

The Management Plan has been developed to ensure the improvement of public administration and planning of Tigrovaya Balka Nature Reserve in accordance with the Law of the Republic of Tajikistan "On Specially Protected Natural Areas and Properties" and the State Program on the Development of Specially Protected Natural Areas of the Republic of Tajikistan for the period 2021 – 2030. The international obligations of the Republic of Tajikistan on the conservation of biological diversity and other international documents have also been taken into account.

The Management Plan is designed to play an important role in informing the public about the activities of the Tigrovaya Balka Nature Reserve, as well as in promoting awareness among the population living in the reserve zone. The main objective is to foster a respectful attitude towards nature, form a sense of personal responsibility for the state of the environment.

The existing information on the resources of the Tigrovaya Balka Natural Reserve, the analysis of its activities, as well as the study and analysis of existing on-site problems served as the basis for drawing up the Management Plan. The specially conducted research, fund materials and developments served as the input data.

Interaction with the local population, regional and local government bodies, landowners and land users, scientific institutions, non-governmental environmental organizations was an important component of this work. For these purposes, the authors of the Plan conducted workshops with the of representatives of third-party interested organizations and the local population, at which the main directions and possibilities of further development of the Tigrovaya Balka Natural Reserve were identified. A consensus was reached on the issues under consideration.

| MANAGEMENT PLAN 2022-2026 (- year period): Main Management Objectives and Activities to Address Threats | | | | | |
|---|---|---|---|---|---|
| **Task/Activity** | **Activity** | **Term, years** | **Expected results** | **Sources of financing** | **Moni-toring** |
| **PART 1. ACTIVITIES ASSOCIATED WITH THE RESERVE** | | | | | |
| | ***Program on conservation of the unique ecosystems of the reserve and its components***<br>Program goal: Implementation by the reserve of the functions of regional nature conservation, academic and research, and propaganda center for the preservation of ecosystems of the region and their components.<br>Results Expected: reduction of violations of the reserve's protection regime, improvement of the efficiency and quality of inspection activities ; reduction of violations of environmental legislation in the region, and application of the principle of sustainable nature management in the territories adjacent to the reserve. | | | | |
| **Task 1** | **8.1. Strengthening the infrastructure of the reserve and material and technical base by maintaining and developing the administrative and technical capacity and resources.** | | | | |
| Activity 1.1 | Purchase of individual motor vehicles, solar panels, and other equipment for the security service, provision of the security service with uniforms, night vision googles, and communication facilities. | 2022-2026 | Reduction of the number of violations of the reserve's protection regime; improving the efficiency and quality of inspection activities; reduction of violations of environmental legislation | State budget and other possible sources | State Institution for Special Protected Natural Areas |
| Activity 1.2 | Purchase of camera traps, office and other equipment | 2022-2026 | Improvement of the management efficiency of the reserve and ensuring monitoring of key species | State budget and other possible sources | State Institution for Special Protected Natural Areas |
| Activity 1.3 | Barbed wire fencing of the protected area on the left-bank part of the reserve for about 40 km and the installation of border pillars with appropriate inscriptions. | 2024 | Increasing the degree of protection of the reserve (especially from grazing of domestic animals, felling) | Attraction of grantors, State budget | State Institution for Special Protected Natural Areas |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 1.4 | Major overhaul of two gamekeepers' loges and the house for scientists | 2023-2026 | Improvement of the effectiveness of the protection of the reserve, improving the conditions for scientific work | State budget, other possible sources of financing | State Institution for Special Protected Natural Areas, NGOs |
| Activity 1.5 | Purchase of 2 fire-protection pumps in the amount, 20 fire extinguishers/modern fire extinguishing equipment, and other fire-fighting equipment, as well as 2 duralumin boats | 2023-2026 | Strengthening of fire protection | State budget | State Institution for Special Protected Natural Areas |
| Activity 1.6 | Repair of dirt roads in the right-bank part of the reserve on the Polvantugay section with a total length of 60 km | 2022-2026 | Improving the protection regime of the reserve | State budget | |
| Activity 1.7 | Construction of 2 observation fire towers in fire hazardous areas and fitting them with communication means | 2022-2026 | Strengthening of fire protection | State budget, grantors | |
| **Task 2:** | **8.2. Maintenance and improvement of the ecological state of the reserve through the implementation of environmental protection measures and activities aimed at preserving biodiversity and restoring the environment** | | | | |
| Activity 2.1 | Improvement of the hydrological regime of the tugay ecosystems of the reserve by cleaning 1000 m of channels to deliver water to the lakes of the reserve annually | 2022-2026 | Scope of work performed by year-filling in the lakes with water | State budget and other non-governmental organizations | State Institution for Special Protected Natural Areas |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 2.2 | Restoration of forest saksaul plantations/ maintenance of plantings made in 2009-2011 in degraded desert ecosystems on an area of 120 hectares annually. | 2022-2026 | Scope of work performed by year- desert land, overgrown with saksaul | State budget and other non-governmental organizations, donors | State Institution for Special Protected Natural Areas |
| Activity 2.3 | Restoration of Asiatic poplar plantations in degraded areas of tugays, in the burnt-out areas | 2022-2026 | Scope of work performed by year- floodplain lands with Asiatic poplar regrowth | State budget and other non-governmental organizations, donors | State Institution for Special Protected Natural Areas |
| Activity 2.4 | Annual biotechnical measures in the buffer zone (on the lands to be withdrawn from Dusti, Kabodien districts in 2023) to improve the habitats of wild animals:<br>• sowing grain on 2.5 hectares and obtaining at least 4 tons of grain for laying out in winter,<br>• planting 3500 fruit trees,<br>• preparation of 38 tons of hay for wild ungulates,<br>• preparation of rich feed - 18 tons and laying out in winter,<br>• arrangement of 70 feeding grounds,<br>• laying out 60 salt licks. | 2022-2026 | Increase in the number of valuable and rare species of wild animals | State budget | State Institution for Special Protected Natural Areas |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 2.5 | Restoration of the population of rare and endangered species of fauna, such as the goitered gazelle, the Bactrian deer, the Tajik pheasant and the houbara bustard by strengthening protection and raising them in zoo nurseries in conditions close to their natural habitats, i.e. in the buffer zone of the reserve (on the lands to be withdrawn from Dusti, Kabodien, or Jai districts in 2022).<br>Organization of permanent monitoring of the state of rare and valuable species of animals. | 2023-2026 | Achievement of optimal numbers and improvement of the status of populations of rare and valuable animal species | State budget | State Institution for Special Protected Natural Areas |
| Activity 2.6 | Implementation of biotechnical measures to reduce the number of alien species in the lakes of the reserve, e.g. the snakehead | 2022-2026 | Decrease in the number of snakeheads | State budget | State Institution for Special Protected Natural Areas |
| Activity 2.7 | • Creation of mini-nurseries to grow rare plant species.<br>• Organization of permanent monitoring of the state of rare and valuable plant species. | 2022-2026 | Increase in the number of cultivated seedlings and planting stock for their subsequent introduction into the natural environment - enrichment and maintenance of the ecosystems of the reserve | Attraction of grantors, NGOs | State Institution for Special Protected Natural Areas |
| **Task 3;** | **8.3. Organizational measures to improve the state of natural ecosystems and fire-prevention measures.** | | | | |
| Activity 3.1. | Expanding the protected area of the reserve, including the buffer zone, for up to 60 thousand hectares. | 2023 | Obtaining a land certificate | Attraction of grantors, NGOs | State Institution for Special Protected Natural Areas |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 3.2 | Drawing up operational plans for extinguishing forest fires and approving them in the hukumats of the districts.<br>Carrying out the following fire-fighting measures annually:<br>• installation of fire-prevention (mineralized) strips 90 km long,<br>• reconstruction of 10 km of roads,<br>• cleaning 20 km of roadsides from dry reeds in the early-spring period,<br>• installation of 20 notices with environmental content. | 2022 - 2026 | Forest fire extinguishing plans<br><br>Preparedness for the fire season | State budget | State Institution for Special Protected Natural Areas, local bodies |
| Activity 3.3 | Fitting the fire and chemical station (FCS) with fire extinguishing means and ensuring the perfect operation of the FCS during the fire hazard season, the readiness of firefighting equipment, the availability of the necessary supply of fuel and lubricants, the presence of equipped fire shields in all gamekeepers' districts. | 2022 - 2026 | Preparedness of the FCS for the fire hazardous season | State budget | State Institution for Special Protected Natural Areas, local bodies |
| | Программа «Развитие научных исследований и экологического мониторинга»<br>Цель программы: Развитие научных основ сохранение и восстановление экосистем заповедника<br>Ожидаемые результаты: получение данных о компонентах экосистем; повышение мобильности, увеличение объема и улучшение качества работы; повышение объема информации о состоянии экосистем региона и их компонентах; улучшение возможности анализа данных; более полный и качественный сбор и анализ информации о состоянии и изменении экосистем заповедника для корректировки режима его сохранения. | | | | |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| **Task 4** | **8.4. Organization and conduction of scientific research in the Tigrovaya Balka Nature Reserve** | | | | |
| Activity 4.1 | Keeping gamekeepers' records and carrying out phenological observations of indicator species of animals and plants and a systematic (annual) evaluation of the state of the wildlife based on the annual animal registration data and an inventory of rare plant species | 2022 - 2026 | Dynamics of changes in the state of fauna and flora | State budget and other possible sources | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 4.2 | Conducting scientific research with the Institute of Zoology and Parasitology of the Academy of Sciences of the Republic of Tajikistan on the following topics:<br>• «Study of the state of artiodactyls (the gazelle, the Bactrian deer) in the reserve and the development of measures to bring their number to the optimum.»<br>• "Assessment of the state of the population of the Central Asian cobra, the blunt-nosed viper, and the carpet viper in the Tigrovaya Balka Nature Reserve.<br>• "Study of the state of populations of the Tajik subspecies of pheasant and houbara bustard in the Tigrovaya Balka Nature Reserve.<br>• "Study of the hydrological regime and hydrofauna of the floodplain lakes of the Tigrovaya Balka Nature Reserve."<br>• "Counting the number of waterfowl and near-water birds in Tigrovaya Balka Nature Reserve in winter." | 2022 - 2026 | Research reports and practical recommendations. Data on the state of ecosystems and their components | State budget and other possible sources | State Institution for Special Protected Natural Areas and of the NAST |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| | • "Counting the number of the Bactrian deer by the roar of males in autumn during the rutting season."<br>• "Monitoring the population of the alien species, i.e. the snakehead, in the lakes of the Tigrovaya Balka Nature Reserve and the development of recommendations for reducing its number.» | | | | |
| Activity 4.3 | Conducting scientific research with the Forest Research Institute on the following topics:<br>• "Study of the state and dynamics of changes in tugay forest complexes.»<br>• "Conducting a survey and determining the current sanitary state of forest plantations in the Tigrovaya Balka Nature Reserve."<br>• «Проведение обследования и определение современного санитарного состояния лесных насаждений заповедника «Тигровая балка». | 2022 - 2026 | Research reports and practical recommendations | State budget and other possible sources | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 4.4 | Conducting scientific research with the Institute of Botany of the Academy of Sciences of the Republic of Tajikistan on the following topics:<br>• Determination of indicator species and succession processes in various ecosystems of the reserve<br>• Determination of the species composition of phytocenoses of low-grass semi-savannas, meadows and herbaceous bogs<br>• Determination of the main pests for indicator species in phytocenoses | 2022 - 2026 | Research reports and practical recommendations | State budget and other possible sources | State Institution for Special Protected Natural Areas and of the NAST |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 4.5 | Implementation of scientific developments and prepared recommendations into the practice of environmental protection and scientific and educational activities | 2022 - 2026 | Research reports and practical recommendations | State budget and other possible sources | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 4.6 | Keeping the Nature Records of the Tigrovaya Balka Nature Reserve | 2022 - 2026 | Keeping the Nature Records of the Tigrovaya Balka Nature Reserve | State budget and other possible sources | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 4.7. | Learning modern research methods:<br>• Invitation of specialists, holding seminars, business trips to exchange work experience, participation in scientific conferences, meetings<br>• Invitation of foreign specialists | 2022 - 2026 | Improving the quality of work<br>Obtaining data on unexplored ecosystem components | State budget and other possible sources | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 4.8. | Purchase of scientific equipment, tools | 2022 - 2026 | Increased mobility, volume and quality of work | State budget and other possible sources | |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| **Task 5** | **8.5. Осуществление экологического мониторинга состояния природных экосистем заповедника и прилегающих территорий (буферная зона).** | | | | |
| Activity 5.1. | Development of monitoring guidelines for the reserve staff | 2022 - 2026 | Availability of prepared guidelines for monitoring | State budget | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 5.2 | Organization of an optimal network of permanent observation points and improvement of the primary data collection system (regularity, reliability). | 2022 - 2026 | The presence of a network of observation points – improvement of the quality and volume of information on the state of the region's ecosystems and their components | State budget | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 5.3 | Ensure the annual systematic observation of wild animals and the state of their habitat | 2022 - 2026 | Data on the state of wildlife populations | State budget | State Institution for Special Protected Natural Areas and of the NAST |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 5.4 | Monitoring the state of the hydrological regime of tugay complexes and the degree of mineralization of wastewater in the buffer zone of the reserve | 2022 - 2026 | Data on the state of the hydrological regime | State budget | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 5.5 | Continuous monitoring of the state of forest ecosystems and the presence of foci of insect pests and forest diseases | 2022 - 2026 | Data on the state of forest ecosystems and the presence of foci of pests and diseases of forest plantations | State budget | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 5.6 | Continuous monitoring by type of land use and the degree of direct negative impact on agroecosystems in the buffer zone of the reserve, and monitoring indirect impact on the protected area | 2022 - 2026 | Data on the state of land use in the buffer zone and the degree of its influence | State budget | State Institution for Special Protected Natural Areas and of the NAST |
| Activity 5.7 | Annual comprehensive monitoring of the reserve's ecosystems (forests, waters, wetlands, deserts, etc.) and agroecosystems of the buffer zone | 2022 - 2026 | Monitoring data for adjusting the territory management system | State budget | State Institution for Special Protected Natural Areas and of the NAST |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 5.8 | Comprehensive ecological and geochemical evaluation of the natural systems of the reserve and adjacent territories. | 2022 - 2026 | Availability of a comprehensive assessment of the state and forecast of the natural development of ecosystems | State budget | State Institution for Special Protected Natural Areas and of the NAST |
| **Task 6** | **8.6 Advanced training of scientific personnel and specialists in the field of environmental protection** | | | | |
| Activity 6.1 | Preparation of training programs for scientific, engineering and technical workers of the reserve on the following topics:<br>• "Rights and obligations of officials, engineers and gamekeepers of the reserve."<br>• "Environmental monitoring within the framework of the national environmental monitoring system", 6 hours.<br>• "Rules for conducting phenological observations of wild animals, taking into account their species characteristics", 8 hours.<br>• "Wildlife census in the reserve", 8 hours.<br>• "Keeping Nature Records", 2 hours.<br>• "Museum affairs and modern opportunities for their further development"<br>• Opportunities for the development of ecotourism in protected areas and the rules for working with ecotourists."<br>• "Ecosystem approach to the management of specially protected areas" | 2022-2026 | Availability of prepared programs to train researchers and engineers of the reserve | State budget and other possible sources | State Institution for Special Protected Natural Areas and NGOs |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| | • "Legislative and legal mechanisms regulating the nature protection activities for specially protected areas", 6 hours.<br>• "The Red Book - Indicator Species of Flora and Fauna for the Reserve", 6 hours.<br>• Sharing experience on nature reserve management with other reserves in Tajikistan, the CIS, and the Russian Federation. | | | | |
| Activity 6.2 | Annual classes and training seminars with scientific and engineering workers of the reserve on the basis of the Information Center at the reserve on the developed topics | 2022-2026 | Improving the quality of work. Indicator - Number of classes conducted and number of employees trained | State budget and other possible sources | State Institution for Special Protected Natural Areas and NGOs |
| | ***Program on the Environmental Education Development Program.***<br>Program goal: to increase the public significance of the Tigrovaya Balka Nature Reserve and ensure its support as an object of national treasure by the general population.<br>Expected results: increased public awareness, raising awareness of the local population about the reserve, forming a positive opinion, raising awareness of the population about the local nature, increasing environmental education of visitors, use of environmentally efficient farming methods by the local population, organization of ecological paths in buffer zones | | | | |
| **Task 7.** | **8.7. Promoting awareness among the population, environmental propaganda and the development of educational excursion visits to specially prepared eco-educational paths in the buffer zone of the reserve.** | | | | |
| Activity 7.1 | Conducting trainings and short-term courses for trainers to work with the population on the basic rules of attitude to wildlife and sustainable nature management in the buffer zone of the reserve | 2022-2026 | Improving the quality of work. Indicator - the number of events held and the number of trained trainers | State budget and other possible sources | |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 7.2 | Study of the possibilities for cognitive ecotourism, determination of excursion routes, determination of the procedure and rules for visiting excursions in the buffer zone of the reserve, development of tariffs for environmental excursions, coordination with the Committee for Environmental Protection under the Government of the Republic of Tajikistan | 2022 | Approved excursion routes, rules and tariffs for visiting ecological routes in the buffer zone | State budget and other possible sources | |
| Activity 7.3 | Preparation of ecological routes (ecological paths) on the ground (in the buffer zone of the reserve), provision of technical equipment, information materials | 2022-2026 | Availability of the approved excursion routes | State budget and other possible sources | |
| Activity 7.4 | Promoting awareness among the local population through interviews, training sessions and seminars on environmental protection, restoration of lost biodiversity and ecosystem approach in the use of natural resources. | 2022-2026 | Application of rational nature management in the territories adjacent to the reserve. Indicator - Number of events held and number of people trained | State budget and other possible sources | State Institution for Special Protected Natural Areas and NGOs |
| Activity 7.5 | Updating the existing website of the Tigrovaya Balka Nature Reserve. | 2022-2026 | Greater access to information, increased awareness | State budget | State Institution for Special Protected Natural Areas |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 7.6 | Preparation and publication of an illustrated booklet on ecological routes | 2022-2026 | Advertising brochures about ecological routes in the buffer zone of the reserve | State budget and other possible sources | State Institution for Special Protected Natural Areas, NGOs |
| Activity 7.7 | Popularization of the Tigrovaya Balka Nature Reserve through the media | 2022-2026 | Information about the reserve is regularly published in the media. Raising awareness of the local population | State budget and other possible sources | State Institution for Special Protected Natural Areas and NGOs |
| Activity 7.8 | Regularly informing the local population about the activities of the reserve through local authorities | 2022-2026 | Improving the environmental education of the population and tourists | State budget and other possible sources | State Institution for Special Protected Natural Areas and NGOs |
| Activity 7.9. | Reconstruction of the reserve museum, creation of new expositions and exhibits | 2023 | Increasing the number of visitors, attracting tourists | State budget and other possible sources | State Institution for Special Protected Natural Areas and NGOs |

| PART II. INTERACTION WITH THE ADMINISTRATION OF THE TERRITORY ADJACENT TO THE TIGROVAYA BALKA NATURE RESERVE | | | | | |
|---|---|---|---|---|---|
| **Task/Activity** | **Activity** | **Term, years** | **Expected results** | **Sources of financing** | **Monitoring** |
| **Task 8.** | **9. Improvement of management on the territory of the buffer zone of the Tigrovaya Balka Nature Reserve in Dusti, Kumsangir, Kabodien and Shaartuz districts** | | | | |
| **Management task 8.** | **9.8. Agriculture**<br>**The task is to improve the efficiency of the use of land resources** | | | | |
| Activity 8.1 | Conducting training seminars with farmers in Dusti, Kumsangir, Kabodien and Shaartuz districts on the following topics:<br>• "Learning the rules to use water-saving technologies in the cultivation of agricultural crops:<br>• "Norms and rules for the use of mineral fertilizers in the cultivation of agricultural crops in the context of the need to preserve protected biodiversity"<br>• "Permissible pressure of grazing of livestock on the territory of the buffer zone of the reserve and measures to increase the productivity of pastures"<br>• "Carrying out measures to increase the productivity of hayfields" | 2022-2026 | Sustainable land management in the buffer zone of the reserve without factors of negative impact on nature | Grantors, State budget, other sources of financing | Hukumats of districts, Associations of dehkan farms, NGOs |
| Activity 8.2. | Measures to regulate livestock grazing in the buffer zone of the reserve:<br>• Determination of the productivity of pastures (cadastral assessment) in the buffer zone of the reserve. Determination of the capacity of pastures and permissible pressure thereon by season | 2022-2026 | Improving the condition of pastures | State budget, other sources of financing (grantors) | Local executive authorities (Hukumats), Committee for Land Management, Ministry of Agriculture |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| | • On site determination and marking of pasture boundaries, installation of boundary pillars and identification of permanent and temporary users<br>• Control over the use of pastures and compliance with the norms of pressure thereon<br>• Designing measures to ensure an increase in the productivity of pastures and compliance with pasture rotation<br>• In connection with the possibility of irrigation of certain areas in the buffer zone, practice the creation of irrigated hayfields with the transfer of these areas for long-term lease to farms or individual entities | | | | |
| Activity 8.3. | Small grant programs for demonstration projects on the use of advanced soil and water saving technologies | 2022-2026 | Reducing the adverse impact on the reserve | Grants | NGOs, Hukumats, land users |
| Activity 8.4. | Organization of nurseries, gardens, greenhouses for growing productive crops | 2022-2026 | Improving the condition of land resources, reducing land degradation | Land users, grants, other sources of financing | WUA, Hukumats, land users |
| Activity 8.5. | Construction (acquisition) of small processing enterprises for processing agricultural products (fruits, vegetables), 3-4 in each district | 2022-2026 | Reducing the pressure on the reserve | State budget programs, grants | Hukumats, land users, NGOs |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 8.6. | Growing medicinal plants – demo plots – 4 in each district | 2022-2026 | Increase in incomes of the population and reducing the pressure on the reserve | Grants | Hukumats, land users |
| Activity 8.7. | Development of beekeeping, fish farms, seed production | 2022-2026 | Increase in incomes of the population and reducing the pressure on the reserve | State budget, other sources of financing | Hukumats, land users, academic institutions |
| Activity 8.8. | Carrying out anti-erosion measures (terracing, forest melioration, etc.) | 2022-2026 | Improving the condition of land resources | State budget, other sources of financing | Hukumats, State Committee on Land Resources, land users |
| Activity 8.9 | Leaching of saline soils | 2022-2026 | Improving the condition of land resources | State budget, grants, other sources of financing | Hukumats, Ministry of Agriculture, State Committee on Land Resources, CEP |
| Activity 8.10 | Development of a marketing network for agricultural products | 2022-2026 | Increase in income of the population and decrease in the degree of use of the natural resources of the reserve | State budget, grants, other sources of financing | Hukumats, Ministry of Agriculture |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| Activity 8.11 | Reconstruction of inerfarm and intrafarm irrigation systems | 2022-2026 | Improving the state of land resources, increasing agricultural productivity and reducing the pressure on the reserve | WUA, State budget, other sources of financing (projects, grants, credits, etc.) | Hukumats, WUA, land users, projects (CPM ) |
| Activity 8.12 | Introduction of cost-effective, energy-saving technologies for processing agricultural products (solar dryers, kitchens, etc.) | 2022-2026 | Reducing pressure on the resources of the reserve, increasing the income of the population around the reserve | ADF, State budget, other sources of financing (projects, grants, credits, etc.) | Hukumats, WUA, land users, projects ( CPM ), NGOs |
| Management task 8.2 | 9.8.2. Development of alternative energy sources | | | | |
| Activity 8.2.1. | • Installation of 2-4 solar panels on the territory of the buffer zone of the reserve in each farm of Dusti, Kabodien, Shaartuz districts<br>• Installation of mini-hydroelectric power plants on the territory of the buffer zone of the reserve in the Kumsangir region | 2022 - 2026<br>2022 - 2026 | Provision of the population with electricity | NGOs | State Institution for Special Protected Natural Areas and NGOs |

| Task/Activity | Activity | Term, years | Expected results | Sources of financing | Monitoring |
|---|---|---|---|---|---|
| | • Introduction of biogas plants in farms in 4 districts | 2022 - 2026 | | NGOs | |
| **Management task 8.3.** | **9.8.3. Improvement of forest resources and biodiversity in the areas adjacent to the reserve** | | | | |
| Activity 8.3.1. | Creation of forest belts | 2022 - 2026 | Increasing the area covered by forests | State budget, grantors | |
| Activity 8.3.2. | Establishment of nurseries for fast-growing, highly productive forest species (poplars) - development of a forest management system based on local community management | 2022 - 2026 | Reducing the incidence of tree felling in the reserve | State budget, other sources of financing | Land users, ADF, Hukumats, NGOs |
| Activity 8.3.3. | Carrying out forest melioration activities | 2022 - 2026 | Improving the condition of natural resources | State budget | Hukumats, Ministry of Agriculture, CEP |
| Activity 8.3.4. | Strengthening slopes with trees | 2022 - 2026 | Increasing the area covered by forests, reduction of land degradation resources | | Hukumats, WUA, CEP, other |
| **Management task 8.4.** | **9.8.4. Ensuring access to clean drinking water** | | | | |
| Activity 8.4.1 | Arrangement of 5-6 water pumps with drinking water for farms in the buffer zone of the reserve in the Kabodien region | 2022 - 2026 | Provision of the population with drinking water | State budget, grants, other sources of financing | MMWR, Ministry of Healthcare, CEP, Hukumats |

**Suggested measures to improve the use of water resources in the area adjacent to the Tigrovaya Balka Nature Reserve for the period 2022-2026**

| Management task | Activity | Estimated scope of work | Expected result (to be filled in for tasks only) | Term | Responsible body (Performers) | Alleged sources of financing | Monitoring |
|---|---|---|---|---|---|---|---|
| Ensuring the discharge of quality water from collectors | Cleaning collectors from silt and overgrowth | No less than 20-25% of their length | Increase the volume of water course | Once a year | SDWM - State Directorate for Water Management - (district water management authorities) WUA - Water Users Association | State budget, water users | Water Resources District Inspectorate |
| Monitoring of water supplied to users and dehkan farms | Conclusion of contracts between the SDWM and WUA or water Users | 1 contract per WUA or each water user (dehkan farm) | Compliance with the terms of the contract | Once a year | SDWM, WUA | State budget, water users, grantors | Water Resources District Inspectorate |
| Channel monitoring | Security works of water metering facilities (WMF) | 1 WMF per each WUA water outlet or dehkan farm | The reliability of the information received | During vegetation | SDWM of the Ministry of Water Resources | State budget, grantors | Water Resources District Inspectorate |
| Prevention of salinization of irrigated land | Compliance with the irrigation regime; preventing the rise of the groundwater level | Drains cleaning | Increasing crop yields | During vegetation | Water users | WUA, water users | Water Resources District Inspectorate |

| Management task | Activity | Estimated scope of work | Expected result (to be filled in for tasks only) | Term | Responsible body (Performers) | Alleged sources of financing | Monitoring |
|---|---|---|---|---|---|---|---|
| Rational use of water for irrigation | Compliance with irrigation techniques; training sessions for irrigators | All over the area | Reducing surface discharge and soil erosion | During vegetation | Scientific departments of the Ministry of Agriculture and Ministry of Water Resources | At the expense of projects, international organizations. grantors | Water Resources District Inspectorate |
| Creation of a water protection zone for main channels | Compliance with regulations and requirements for using water protection zones | Along the entire length of the channels | Avoiding water pollution | Once in 3 years | SDWM, local bodies | SDWM, local bodies, donors | Water Resources District Inspectorate |
| Water reuse | Avoiding pollution of water protection zones with industrial waste and polluted wastewater (approx. 300 km.) | Clean shores eco-campaign | Improvements in water quality | Once a year | WUA, water users | WUA, water users | Water Resources District Inspectorate |
| Improving the water quality of channels and rivers | Maintenance of the restored water supply system of the reserve | Clean shores eco-campaign | Improvements in water quality | Once a year | Local population, jamoats, CEP, WUA, IWRM, water users | State bodies, grantors, water users | Water Resources District Inspectorate |

| Management task | Activity | Estimated scope of work | Expected result (to be filled in for tasks only) | Term | Responsible body (Performers) | Alleged sources of financing | Monitoring |
|---|---|---|---|---|---|---|---|
| Preserving water supply to lakes | Maintenance of the restored water supply system of the reserve | Regular cleaning of the system of channels and drains from channels to the reserve | Optimization of the hydrogeological network on the territory of the reserve | 2022 -2026 | Nature reserve, director, gamekeepers | State budget, | Water Resources District Inspectorate |
| Ensuring water filling of lakes | Creation of a rapid response system to identify potential threats | Rapid response systems | Optimization of the hydrogeological network on the territory of the reserve | 2022-2026 | Nature reserve, director | State budget, support of the IO | Water Resources District Inspectorate |
| Ensuring water filling of lakes | Lake level monitoring | 8 monitoring points on representative lakes (RL) by lake (1 of 5) | Optimization of the hydroge-ological network on the territory of the reserve | Annually | Nature reserve, director, gamekeeper | State budget, support of the IO | Water Resources District Inspectorate |
| Ensuring water filling of lakes | Monitoring of channels and branches of the lake level | 8 monitoring points on supply channels (RL) on representative lakes (1 of 5) | Optimization of the hydroge-ological network on the territory of the reserve | Annually | Nature reserve, director, gamekeepers | State budget, support of the IO | Water Resources District Inspectorate |

| Management task | Activity | Estimated scope of work | Expected result (to be filled in for tasks only) | Term | Responsible body (Performers) | Alleged sources of financing | Monitoring |
|---|---|---|---|---|---|---|---|
| Ensuring water filling of lakes | Monitoring of collecting canals of the lake level | 8 monitoring points on the supply collecting canals connected to the channels and branches (RL) | Optimization of the hydrogeological network on the territory of the reserve | Annually | Nature reserve, director, gamekeepers | State budget, support of the IO | Water Resources District Inspectorate |
| | Improving the capacity of officials, experts and specialists in the field of water quality and water resources management | Development and adaptation of training materials; Conducting seminars on monitoring the state of water supplied to water users and dehkan farms | Training materials, recommendations, practice in application | 2022-2026 | Nature reserve, director, water users | State budget, support of the IO | Water Resources District Inspectorate |
| Monitoring of the state of water supplied to water users and dehkan farms | Improving coordination of complex estimates, monitoring and sharing information on water quality | Development of Recommendations for water quality control and information sharing; creation of a common database on water quality and monitoring. | Improvement of coordination of integrated water quality evaluations, monitoring and information sharing; formation of a database on water quality; analysis of the results of evaluation | 2022-2026 | Nature reserve, director, water users | State budget, support of the IO | Water Resources District Inspectorate |

| Management task | Activity | Estimated scope of work | Expected result (to be filled in for tasks only) | Term | Responsible body (Performers) | Alleged sources of financing | Monitoring |
|---|---|---|---|---|---|---|---|
| | | | of water quality in the collector-drainage network | | | | |
| Monitoring of the state of water supplied to water users and dehkan farms | Establishment of an accounting and reporting system to disseminate the results of monitoring programs at the national and international levels | Analysis of existing monitoring practices, use of mechanisms to improve monitoring practices | Reporting systems for disseminating the results of monitoring programs | 2022 | Nature reserve, director, water users | State budget, support of the IO | Water Resources District Inspectorate |

**11. Socio-economic component**

| Activity | Expected results | Term | Categories of participants | Cost (thousand TJS) | Sources of financing |
|---|---|---|---|---|---|
| 1. Communication of information to the population | | | | | |
| 1.1. Conducting a survey on the level of awareness of the population on the results of the implementation of the Poverty Reduction Strategy and Environmental sustainability plan in particular, as well as activities implemented within the framework of the Concept of Environmental Sustainability of the Republic of Tajikistan. | Survey | 2022 – 2026 | Residents of settlements, schoolchildren, employees of government bodies, RECCA | | State budget, grantors |
| 1.2. Preparation of information materials on the experience of the population in solving environmental problems, rational use and conservation of biodiversity, as well as distribution of these materials. | Prepared, discussed and distributed information materials | | Residents of settlements, schoolchildren, employees of government bodies, RECCA | | |
| 1.3. Conducting round tables to identify key issues for subsequent trainings. | Round tables. | | Residents of settlements, schoolchildren, employees of government bodies | | |
| 1.4. Conducting training sessions to inform the population about the results of the implementation of the Poverty Reduction Strategy and Environmental sustainability plan in particular for the past period, as well as about environmental sustainability measures included in the PRS for the future. | Training session | | Residents of settlements, schoolchildren, employees of government bodies. | | |

| Activity | Expected results | Term | Categories of participants | Cost (thousand TJS) | Sources of financing |
|---|---|---|---|---|---|
| 1.5. . Preparation of information materials on the experience of solving environmental problems, as well as introduction of measures for ensuring environmental sustainability by the population to the Strategy for the Development of the Republic of Tajikistan and the Development Plans for the respective districts, their publication in mass media. | Prepared information materials, activities included in the Strategy and Development Plans, published information. | | Republican, regional, district level mass media. | | |
| 1.6. Conducting seminars on the results of 2-year work and identifying the main problems for implementation in the next year. | Seminars, key problems. | | District, region | | |
| 1.7. Conducting round tables to inform the population about the progress of the PRS implementation in the field of ensuring environmental sustainability and identifying problems for subsequent periods. | Round tables, identified problems for subsequent periods. | | Residents of settlements, schoolchildren, employees of government bodies. | | |
| 1.8. Preparation of information materials on the mechanism for problem solving and their publication in mass media. | Information materials. | | Republican, regional, district level mass media. | | |
| 1.9. Conducting final seminars based on the results of work and identifying the main problems for subsequent periods. | Seminars, identified key problems. | | District, region, republic | | |
| 1.10. Support for information and educational centers created with the assistance of WWF. | Operating centers, support for beneficiaries. | | Residents of settlements, schoolchildren, employees of government bodies. | | |

| Activity | Expected results | Term | Categories of participants | Cost (thousand TJS) | Sources of financing |
|---|---|---|---|---|---|
| 2. Increasing the efficiency of the security service arrangement | | | | | |
| 2.1. Organization of coordination and joint work with other environment protection authorities and border service:<br>- Drawing up annual plans for joint work with the National Security Committee, border service, CEP under the Government of the Republic of Tajikistan for 2022;<br>- Organizing and holding jointly inspections and activities with the NSC, border service, directorates in charge of protected areas of district Hukumats. | Decrease in violations of the protection regime for the wildlife and violations of environmental legislation throughout the territory | 2022-2026 | 1. Hukumats of districts<br>2. CEP<br>3. NSC<br>4. Border Force | | State budget, grantors, raised funds |
| 2.2. Increasing mobility and efficiency of work through improved transport and communications:<br>- Renovation of the vehicle fleet and water transport;<br>- Purchase of necessary spare parts for existing vehicles. | Increased operating efficiency | | 1. Hukumats of districts<br>2. Grantors | | |
| 2.3.Strengthening the prevention of violations and communication with the population by increasing the number of meetings, lectures, improving their information content , preparing visual materials. | Reducing the number of violations of the reserve protection regime | | 1. Hukumats of districts<br>2. RECCA<br>3. Mass Media | | |
| 2.4. Training and professional development of workers of Hukumats. | Increase in quality of work | | 1. 1.Hukumats<br>2. 2.RECCA | | |

| Activity | Expected results | Term | Categories of participants | Cost (thousand TJS) | Sources of financing |
|---|---|---|---|---|---|
| 3. Ensuring nature protection and regulation of nature management in the region. | | | | | |
| 3.1. Strengthening co-operation between environmental agencies, business entities, law enforcement authorities, and border service. | Reducing violations of environmental legislation in the region | 2022-2026 | 1. Hukumats of districts<br>2. Law enforcement authorities<br>3. CSOs<br>4. Business entities | | State budget, grantors, raised funds |
| 3.2. Cooperation with local population to ensure sustainable nature management in the territories adjacent to the reserve. | Application of sustainable nature management practices in the territories adjacent to the reserve | | | | |
| 4. Improvement of spatial planning | | | | | |
| 4.1. Conducting a survey of the territories adjacent to the reserve to prepare materials for adjusting the boundaries of the Tigrovaya Balka Nature Reserve in accordance with the developed proposals for zoning | Optimization of the reserve area | 2022 | 1. Hukumats of districts,<br>2. Committee for Land Management<br>3. Ministry of Economic Development of the RT<br>4. Government of the RT | | State budget, grantors, raised funds |

| Activity | Expected results | Term | Categories of participants | Cost (thousand TJS) | Sources of financing |
|---|---|---|---|---|---|
| 5. Ensuring socio-economic development and sustainability | | | | | |
| 5.1. Improving socio-economic conditions of the population to eliminate the negative impact on biodiversity of the reserve: | | | | | |
| - measures for stable supply of electricity and provision of the population with various types of fuel<br>- introduction of alternative energy sources<br>- measures to provide the population with drinking water;<br>- measures to repair the existing non-operating pumping stations;<br>- cleaning feed ditches and water discharge lines,<br>- construction and repair of roads | Development and implementation of activities within the framework of the District Development Plans ( for all activities described in the section) | 2022-2026 | Hukumats of districts, Business entities Government of the RT | | State budget, grantors, raised funds |
| 5.2. Sustainable use of human resources, creation of new jobs, increase of incomes of the population: | | | | | |
| • increasing land productivity ,<br>• improving the economic situation of households by introducing alternative activities,<br>• restoration of local species of fruit trees and shrubs; organization of new orchards and fruit tree plantations; expansion of orchards;<br>• organization of a workshop for fruit processing and production of pomegranate juice<br>• development of new types of activities - tourism, birdwatching, wildlife photography, etc. | Development and implementation of activities within the framework of the District Development Plans ( for all activities described in the section) | 2022-2026 | Hukumats of districts, Business entities Government of the RT | | State budget, grantors, raised funds |

| Activity | Expected results | Term | Categories of participants | Cost (thousand TJS) | Sources of financing |
|---|---|---|---|---|---|
| 5.3. Improving the efficiency of agriculture, carrying out melioration activities | | | | | |
| Hydraulic engineering:<br>• leaching of saline lands ;<br>• complex reconstruction of irrigation systems (CRIS);<br>• mechanization of irrigation and introduction of new water-saving technologies (drip, sprinkler, subsoil irrigation, etc.);<br>Anti-erosion:<br>• terracing ;<br>• forest melioration;<br>• deep grounding ;<br>• strip farming;<br>• drain spraying;<br>• snow retention and regulation of snow melting;<br>• minimization of technogenic impact on soils. | Development and implementation of activities within the framework of the District Development Plans ( for all activities described in the section) | 2022 - 2026 | Hukumats of districts,<br>Business entities<br>Government of the RT | | State budget, grantors, raised funds |
| Agrotechnical<br>• scientifically grounded cotton-lucerne crop rotations;<br>• use of organic and mineral fertilizers;<br>• development of seed production and production of new varieties of seeds;<br>• subsoiling | Development and implementation of activities within the framework of the District Development Plans ( for all activities described in the section) | 2022 - 2026 | 1. Hukumats of districts,<br>2. Business entities<br>3. Government of the RT | | State budget, grantors, raised funds |

| Activity | Expected results | Term | Categories of participants | Cost (thousand TJS) | Sources of financing |
|---|---|---|---|---|---|
| Ecological reclamation<br>• Application of biological methods of plant protection<br>• Introduction of elements of adaptive landscape farming<br>• Introduction of environmentally friendly technology | Development and implementation of activities within the framework of the District Development Plans ( for all activities described in the section) | 2022-2026 | 1. Hukumats of districts,<br>2. Business entities<br>3. Government of the RT | | State budget, grantors, raised funds |

Abbreviations used in the table:

SDWM - State Directorate for Water Management
GWL - Groundwater level
FL - fuels and lubricants
OFN - On-farm network
IO - International organizations
WUA - Water Users Associations
WTF - Water treatment facilities
IFN- Inter-farm network
RL - representative lake
DF - dehkan farms

## ANNEX C1

# List of rare, endemic and relict plants of the Tigrovaya Balka Nature Reserve

| The name of the species in Latin | Protection status |
|---|---|
| **Family (Poacea)** | |
| *Stipa longiplumosa* Roshev. | — |
| **Family (Liliaceae)** | |
| *Eremurus roseolus* Vved. | CR |
| *Tulipa tubergeniana* Hoog. | CR |
| **Family (Alliaceae)** | |
| *Allium sordidiflorum* Vved. | — |
| *Allium bucharicum* Regel.2 | EN |
| **Family (Polygonaceae)** | |
| *Calligonum griseum* Korov.ex Pavl. | — |
| **Family (Ranunculaceae)** | |
| *Nigella bucharica* Schipcz. | — |
| **Family (Crassulaceae)** | |
| *Peudosedum bucharicum* Boiss. | — |
| **Family (Brassicaceae)** | |
| *Erysimum babatagi* Korsh. | — |
| *Catenularia hedysaroides* Botsch. | VU |
| *Neuroloma fruticulosum* (Regel et Schmalh.) Botsch. | — |
| *Cryptospora trichocarpa* Kar. et Kir. | — |
| *Matthiola integrifolia* Kom. | — |
| *Matthiola* czernjakovskae Botsch. et Vved. | — |
| *Matthiola bucharica* Czerniak. | — |
| *Lepidium seravechanicum* Ovcz.et Junuss. | — |
| **Family (Fabaceae)** | |
| *Medicago lanigera* C.Winkl. | — |
| *Astragal terekliensis* Gontsch. | — |
| *Astragal* kabadianus Lipsky | — |
| *Astragal* lancifolius Gontsch. | — |
| *Astragal densus* M.Pop | — |
| **Family (Zygophyllaceae)** | |
| *Zygophyllum gontscharovii* Boriss. | — |
| **Family (Rutaceae)** | |
| *Haplophyllum tenuisectum* Llncz. et Vved. | — |
| **Family Rhamnaceae** | |
| *Rhamrus baldachuanica* Grub. | — |
| **Family (Apioceae)** | |
| *Ferula botschantzevii* Korov. | EN |
| **Family (Boraginaceae)** | |
| Heliotropium pileiforme Czuk. | — |
| Nonea macropoda M. Pop. | — |
| **Family (Limonacea)** | |
| *Acantholimon afanassievii* Lincz. | — |
| **Family (Scrophulariaceae)** | |
| *Scrophularia kabadianensis* B. Fedtsch. | — |
| *Scrophularia glabella* Botsch.et Junuss. | — |
| **Family (Valerianaceae)** | |
| *Bryonia lappifolia* Vass. | VU |
| **Family Compositae (Asteraceae)** | |
| *Cousinia agelocephala* Tschern. | CR |
| *Cousinia pusilla* C. Winkl. | — |
| *Cousinia pulchra* C. Winkl. | — |
| *Cousinia corumbosa* C. Winkl | CR |
| *Cousinia hilariae* Kult | EN |
| *Gymnospermium darvasicum* (Regel) Takht | VU |
| *Jurines atopurpurea* C.Winkl. ex Iljin | — |
| *Jurinea darvasica* lljin | CR |
| *Saussurea caprifolia* lljin et F. Zapr. | EN |
| *Rosularia lutea* Boriss | VU |
| *Iris hoogiana* Dykes | EN |
| *Juno baldshuanica* (O.et B. Fedtsch) Vved | VU |
| *Juno tadshikorum* Vved | EN |
| *Erianthera rhomboidea* Benth | EN |
| *Kudrjaschevia korshinskyi* (Lipsky) Pojark | CR |
| *Kudrjaschevia nadinae* (Lipsky) Pojark | EN |
| *Astragalus darwasicus* Basil | CR |
| *Chesneya tadzhikistana* Boriss | VU |
| *Keyserlingia mollis* (Royle) Boiss | EN |
| *Oxytropis astragaloides* Boriss | EN |
| *Traagacantha alexeenkoana* (B. Fedtch.et Ivanona) Boriss | VU |
| *Allium stipitatum* Regel | EN |
| *Petillum eduardii* (Regel) Vved | — |
| *Tulipa anisophylla* Vved | CR |
| *Tulipa lehmanniana* Mercki | EN |
| *Tulipa liniifolia* Regel | VU |
| *Vassillczenkoa sogdiana* (Lincz) | CR |
| *Ficus carica* L. | EN |
| *Jasminum revolutum* Sims (J. humile L var revoluutum (Sims) Stockes) | VU |
| *Paeonia intermedia* C.A. Mey | VU |
| *Atraphaxis karataviensis* Lipsch. Et N. Pavl | VU |
| *Polygonum ovczinnikovii* Czuk | CR |
| *Androsace bryomorpha* Lipsky | VU |
| *Primula flexuosa* Turkev | VU |

| | |
|---|---|
| *Bergenia strachey* (Hook. F. et Thoms) Engl | CR |
| *Saxifraga albertii* Regel et Schmalh | VU |
| Bunium persicum (Boiss) B. Fedtsch. | EN |
| *Cephalopodum badachschanicum* Korov. | EN |

| | |
|---|---|
| *Seseli sclerophyllum* Korov | VU |
| *Zygophyllum darvasicum* Boris | VU |
| *Parasilaus asiaticus* (Korov) | VU |

## ANNEX C2

# List of rare and endangered species of animals found in the Tigrovaya Balka Nature Reserve

| The name of the species in Latin | Protection status |
|---|---|
| **FISHES – PISCES** | |
| *Acipenser nudiventris* (Lovetzky, 1828) | CR |
| *Pseudoscaphirhynchus kaufmanni* (Bogdanov, 1874) | CR |
| *Pseudoscaphirhynchus hermanni* (Kessler, 1877) | EN |
| *Aspiolucius esocinus* (Kessler, 1874) | CR |
| *Barbus brachycephalus* Kessler, 1872 | VU |
| *Barbus capito conocefalus* Kessler, 1872 | VU |
| *Abramis brama orientalis* Berg, 1872 | VU |
| *Capoeto brama kuschakewitschi* (Kessler, 1872) | EN |
| *Cobitis aurata aralensis* Kessler, 1877 | EN |
| **REPTILES – REPTILIA** | |
| *Agryonemis horsfieldi* (Gray,1844) | VU |
| *Crossobamon eversmanni eversmanni* Wiegmann, 1834) | EN |
| *Teratoscincus scincus* (Schlegel, 1858) | EN |
| *Alsophylax tadjikiensis* (Golubev, 1979) | EN |
| *Phrynocephalus interscapularis sogdianus* (Cernov, 1948) | EN |
| *Phrynocephalus mystaceus* (Pallas, 1776) | EN |
| *Phrynocephalus reticulatus boetgeri* (Bedriaga, 1905) | EN |
| *Varanus griseus* (Daudin, 1803) | EN |
| *Eremias scripta lasdini* (Tzarev., 1918) | EN |
| *Eremias grammica* (Lichtenstein,1823) | EN |
| *Eremias lineolata* (Nikolsky, 1896) | EN |
| *Eremias intermedia* (Strauch,1876) | EN |
| *Eremias nigrocellata* (Nikolsky,1896) | EN |
| *Eumeces schneideri* (Daudin, 1802) | EN |
| *Boiga trigonata melanocephala* (Annandale,1904) | EN |
| *Spalerosophis diadema* (Schlegel, 1837) | CR |
| *Lycodon striatus bicolor* (Nikolsky, 1903) | EN |
| *Naja oxiana* (Eichwald, 1831) | EN |
| *Macrovipera lebetina turanica* (Cernov, 1940) | VU |
| *Echis multisquamatus* (Cherlin, 1981) | EN |
| **BIRDS – AVES** | |
| *Gyps himalayensis* (Hume, 1869) | VU |
| *Gypaetus barbatus* (Linnaeus, 1758) | EN |
| *Circaetus gallicus* (Gmelin, 1788) | EN |
| *Pandion haliaetus* (Linnaeus, 1758) | EN |
| *Neophron percnopterus* (Linnaeus, 1758) | EN |
| *Aquila chrysaetus* (Linnaeus, 1758) | VU |
| *Aquila pennata* (Gmelin, 1788) | EN |
| *Accipiter nisus melanoschistus* (Hyme, 1869) | EN |
| *Falco cherrug coatsi* (Dementiev, 1945) | EN |
| *Falco pelegrinoides* (Temminck, 1829) | EN |
| *Ammoperdix griseogularis* (Brandt, 1843) | VU |
| *Phasianus colchicus bianchii* (Buturlin, 1904) | EN |
| *Otis tarda tarda* (Linnaeus, 1758) | CR |
| *Chlamydotis undulata* (Jacquin, 1784) | CR |
| *Burhinus oedicnemus* Linnaeus, 1758 | EN |
| *Glareola pratincola* (Linnaeus, 1766) | EN |
| *Pterocles orientalis* (Linnaeus, 1758) | EN |
| *Terpsiphone paradisi leucogaster* (Swainson, 1838) | VU |
| **MAMMALS – MAMMALIA** | |
| *Suncus etruscus* ( Savi, 1822) | VU |
| *Myotis emarginatus* (Geoffroy, 1806) | VU |
| *Hypsugo savii* (Bonaparte, 1837) | VU |
| *Eptesicus serotinus* (Schreber, 1774) | VU |
| *Eptesicus bottae* (Peters, 1869) | VU |
| *Vespertilio murinus* (Linnaeus, 1758) | VU |
| *Otonycteris leucophaeis* (Severtsov, 1873) | VU |
| *Tadarida tenioti* (Rafinesque, 1814) | VU |
| *Spermophilopsis leptodactulus* (Lichtenstein, 1823) | EN |
| *Hystrix indica* (Kerr, 1792) | VU |
| *Allactaga elater* (Lichtenstein, 1825) | EN |
| *Vulpes corsac tukmenica* (Ognev) | EN |
| *Mustela nivalis* (Linnaeus, 1766) | EN |
| *Vormela peregusna* (Gueldenstaedt, 1770) | EN |
| *Lutra lutra* (Linnaeus, 1758) | EN |
| *Hyaena hyaena* (Linnaeus, 1758) | CR |
| *Felis chaus oxiana* (Heptner, 1969) | EN |
| *Panthera tigris virgata* (Illiger, 1815) | EX |
| *Panthera pardus ciscaucasica* (Satunin, 1914) | EW |
| *Gazella subgutturosa* (Gueldenstaedt, 1780) | CR |
| *Ovis vignei bocharіensis* (Nasonov, 1914) | CR |
| *Cervus elaphus bactrianus* (Lydekker, 1900) | CR |

**ANNEX C3**

## Plants and animals included in the Red Book of the Republic of Tajikistan

| |
|---|
| **Invertebrates** |
| **Order Mantoptera** |
| **Family Mantoidea** |
| *Nierodula tenuidentata* Sausure |
| *Rivetina beybienkoi* Lindt |
| *Amblythepis misthenkoi* |
| **Order Homoptera** |
| **Family Margarodidae** |
| *Porphirophora cynadontis* |
| *Porphirophjra sophorae* |
| **Order Neteroptera** |
| **Family Pentatomidae** |
| *Cellodius abdominalis* |
| **Family Aradidae** |
| *Calisius turanicus* Kir |
| **Family Reduvidae** |
| *Stenolemus bogdanovi* Osh. |
| *Reduvius fedtchenkinus* |
| **Order Lepidoptera** |
| **Family Sphingidae** |
| *Amorpha philerema* Diak |
| *Celerio chamula arocyni* |
| **Family Notodontitae** |
| *Paragluphisia oxiana* |
| **Family Lasiocampidae** |
| *Taragama fainae* Geras |
| **Family Lemonidae** |
| *Lemonia tancrei* Punglr. |
| **Family Nolidae** |
| *Nola silvicola* Stshetkin |
| **Family Noctuidae** |
| *Pseudohadena seposita* Punglr. |
| *Catocala optima* |
| *Catocala timur* |
| *Lygephila lubrosa* |
| **Family Geometridae** |
| *Euphithecia diakonovi* Stshetkin |
| *Euphithecia dominaria* |
| **Vertebrates** |
| **Pisces** |
| **Order Acipenseriformes** |
| **Family Acipenseridae** |
| *Pseudoscaphirhynchus kaufmanii* Bogdanov |
| **Order Cypriniformes** |

| |
|---|
| **Family Cyprinidae** |
| *Aspiolucius esocinus* Kesler |
| *Barbus brachycephalus* Kesler |
| **Reptilia** |
| **Sauria** |
| **Family Geconidae** |
| *Grosabaton eversmanni* |
| **Family Agamidae** |
| *Phrynocephalus sogdianus* Cern. |
| **Family Varanidae** |
| *Varanus griseus* Daudin |
| **Family Laceridae** |
| *Eremias scripta* Str. |
| *Eremias grammica* Licht. |
| **Family Scicidae** |
| *Eumeces schneideri* Daudin |
| **Family Boidae** |
| **Serpenes** |
| *Erux tataricus* Lichtenstein |
| **Family Colubridae** |
| *Lycodon striatus bicolour* Nicolsci |
| *Boiga trigonatum melanocephala* Annandale |
| **Family Elapidae** |
| *Naja oxiana* Eichw |
| **Family Veperidae** |
| *Veperia lebetina turanica* Cernow |
| *Echis carinatus* Schneider |
| **Aves** |
| **Order Falconiformes** |
| **Family Acipitridae** |
| *Circaetus ferox heptneri* Dem. |
| *Neophron pencopterus* |
| **Family Falconidae** |
| *Falco cherrung coatsi* Idem. |
| *Falco peregrinus babilonicus* |
| **Order Galliformes** |
| **Family Phasianidae** |
| *Ammoperdix griseogularis* Brandt. |
| *Phasianus colchicus bianchi* |
| **Order Gruiformes** |
| **Family Otididae** |
| *Ortis undulate* |

| **Order Charadriformes** |
|---|
| **Family Burhinidae** |
| *Burhinus oedicnemus astuts* Hart |
| **Family Charadridae** |
| *Glareola pretinkola* |
| **Order Columbiformes** |
| **Family Pterolidae** |
| *Pteroclis orientalis* Pallas |
| **Mammalia** |
| **Order Insectivora** |
| **Family Soricidae** |
| *Suncus etruscus* Savi |
| **Order Chiroptera** |
| **Family Rhinolophidae** |
| *Rhinolophus ferrumegninum* Schreber |
| **Family Vespertilionidae** |
| *Eptesicus serotinus turcomanus* Eversmann |
| **Family Molossidae** |
| *Tadarida teniotis teniotis* |
| **Order Rodentia** |
| **Family Sciuridae** |

| *Spermopholopsis leptodactylus bactrianus* Scullu |
|---|
| **Family Hystricicidae** |
| *Hystrix leucura satunini* Muller |
| **Family Dipodidae** |
| *Allactaga elater* Lichtenstein |
| **Order Carnivore** |
| **Family Mustelidae** |
| *Mustela nivalis pallida* Heptneri |
| *Vormela peregusna* Satunin |
| *Lutra lutra seistanika* Birula |
| **Family Hyaennidae** |
| *Hyaena hyaena* Linnaeu |
| **Family Fellidae** |
| *Felis chaus pxiana* Heptneri |
| **Order Artiodactila** |
| **Family Bovidae** |
| *Gazelle subgutturosa guldeenstaend* |
| *Ovis vgnei bochariensis* Nasonov |
| **Family Cervidae** |
| *Cervus elaphus bactrianus* |

| **Plants** |
|---|
| **Fungi** |
| *Pleurotus komarnitzkyi* Vassilk |
| *Battarea phalloides* Pers |
| **Family Angiospermae** |
| *Capparis rosanoviana* B.Fedtsch |
| *Seidlitzia rozmarius* Bunge |
| *Cousinia adelocephala* Tschern |
| *Allium ophiophyllium* Vved |
| *Tulipa tubergeniana* Th. Hood |
| *Zygophyllum bucharicum* |