

"Agreed."

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Protected Natural Areas"

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2024.



"Approved."

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Environmental Protection under the
Government of the Republic of Tajikistan

Sheralizoda B.A.

2024.



**Tigrovaya Balka State Nature Reserve
Management plan 2025-2029, Republic of Tajikistan**



*Prepared by the PO "Tabiati Yoboi" under
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Restoration Project (TSLRP)
(P171524)" funded by the World Bank
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ABBREVIATIONS

WUA	Water Users Associations
FAGRT	Forestry Agency under the Government of the Republic of Tajikistan
ALRI	Land Reclamation and Irrigation Agency under the Government of the Republic of Tajikistan
WL	Wetlands
WRS	Water retention structures
SCLAGRT	State Committee on Land Administration and Geodesy of the Republic of Tajikistan
SNR TB	Tigrovaya Balka State Nature Reserve
SWMB	State Water Management Board (rayvodkhozes)
SISPNA	State institution of specially protected natural areas
DF	Dekhkan farms
CEPRT	Committee for Environmental Protection under the Government of the Republic of Tajikistan
PO	Public organization
SPNA	Specially protected natural areas
CDN	Collector-drainage network
IO	International organizations
IUCN	International Union for Conservation of Nature
MART	Ministry of Agriculture of the Republic of Tajikistan
IN	Interfarm network
NAST	National Academy of Sciences of Tajikistan
FRI	Forest Research Institute FAGRT
MP	Management plan
RL	Representative lake
RT	Republic of Tajikistan
UNESCO	United Nations Educational, Scientific and Cultural Organization

INTRODUCTION

This Medium Term Management Plan for the State Nature Reserve "Tigrovaya Balka" for 2025-2029 was developed by experts of the Public Organization (PO) "Tabiati yoboi" with the staff of the State Institution of Specially Protected Natural Areas (SISPNA) of the Committee on Environmental Protection under the Government of the Republic of Tajikistan (CEPRT) and the National Academy of Sciences of Tajikistan (NAST). During the development the "Guidelines for drafting a management plan for specially protected natural areas", published within the framework of "Tajikistan Sustainable Landscape Restoration Project (TSLRP) (P171524)" funded by the World Bank under the RESILAND CA+ Program, was used.

The purpose of development of the Management Plan of the State Nature Reserve "Tigrovaya Balka" is to ensure improvement of state management and planning in the sphere of organization and conduct of the Reserve's activities in accordance with the Law of the Republic of Tajikistan "On Specially Protected Natural Areas" dated December 26, 2011. The international obligations of the Republic of Tajikistan on biodiversity conservation and other international documents are also taken into account.

The management plan is intended to fulfill an important role in informing the public about the activities of the Tigrovaya Balka State Nature Reserve, as well as in promoting environmental knowledge among the population living around the reserve. The main objective is to foster in people a careful attitude to nature, to form a sense of personal responsibility for the state of the environment.

The Management Plan was based on the existing information on the Reserve's resources, analysis of its practical activities, as well as study and analysis of existing problems in the process of functioning. The baseline data for the work were specially conducted studies, stock materials and developments.

An important component of this work was interaction with the local population, regional state and local authorities, landowners and land users, scientific institutions, public environmental organizations. For this purpose, working meetings were held with the invitation of representatives of third-party stakeholder organizations and the local population, where the main directions and opportunities for further development of the Tigrovaya Balka SNR were identified and consensus on the issues under consideration was reached.

The list of participants in the working group for the creation management plan for SNR Tigrovaya Balka is provided in *Appendix 1*.

SECTION 1: BASIC INFORMATION ABOUT THE RESERVE

Management Plan – Tigrovaya Balka State Nature Reserve (2025-2029)

Name of protected area: Tigrovaya Balka State Nature Reserve

Management Authority: State Institution of Specially Protected Natural Areas of the Committee for Environmental Protection under the Government of the Republic of Tajikistan.

National Protected Area Category: Nature Reserve

IUCN Category: I-category

Date of PU preparation: May 2024

PU period (5 years): January 2025 - December 2029.

The State Nature Reserve "Tigrovaya Balka" was established on November 4, 1938 according to the resolution of the People's Commissariat of Agriculture of the Tajik SSR in order to preserve the natural complex characteristic of the southern deserts and floodplains of the Central Asian rivers, to protect rare animals and to conduct versatile scientific research. The Tigrovaya Balka Reserve is located in the interfluvium of the Vakhsh, Pyanj and Kafirnigan rivers, on the border with Afghanistan, in the place where the Amu Darya, the largest river of Central Asia, is formed. The protected area of 49,786 hectares covers an extensive area of tugai ecosystems along the banks of the Vakhsh River, areas of bumpy sandy desert Kashka-Kum, Mount Buritau, as well as the lowlands of the southern spurs of the Aruktau Range - Mount Khoja-Kazyon.

Tigrovaya Balka Reserve is the oldest desert-tugai reserve in the system of reserves of Tajikistan. Tugai forests occupy an area of 24.1 thousand hectares and it is the only place in the world where the pristine tugai formation has been preserved in significant areas. The territory of the reserve is not only a place of distribution of endangered rare, endemic and relict species of plants and animals, but also represents a natural and unmodified habitat of vulnerable representatives of fauna. Among them are: Bukhara deer, whose population in the reserve exceeds 300 individuals, gazelle, striped hyena (included in the IUCN Red Book), gray varanus, Tajik black and golden pheasant and many waterfowl.

On September 20, 2023, during the 45th meeting of the Intergovernmental Committee for the Protection of Tangible Cultural Heritage of UNESCO, the natural heritage of Tigrovaya Balka was inscribed on the UNESCO World Heritage List. The Outstanding Universal Value of the Reserve is recognized under Criterion IX - the site is an outstanding example of significant ecological and biological processes in the evolution of ecosystems and plant and animal communities.¹

1.1. Location and brief description

The reserve "Tigrovaya Balka" was organized by the Decree of the People's Commissariat of Agriculture of the Tajik SSR on November 4, 1938 in order to preserve the natural complex characteristic of the southern deserts and floodplains of Central Asia, to protect

¹ <https://whc.unesco.org/en/list/1685/>

rare animals and to conduct versatile scientific research. Initially its area amounted to 50 thousand hectares. On January 14, 1941 the reserve "Tigrovaya Balka" was transferred to the Tajik branch of the Academy of Sciences of the USSR, and then to the Academy of Sciences of the Tajik SSR. During the war years, by 1945 - 1946 the reserve area decreased to 5-7 thousand hectares. In 1951 the area of the reserve was increased to 27 thousand hectares, and then in 1953 it was again reduced to 20.9 thousand hectares. In 1959, the area of the reserve was increased to 41 thousand hectares and the reserve was transferred to the State Committee for Forestry. In the following years the area of the reserve was increased and from the 80s of the last century to the present day the area of the reserve is about 50 thousand hectares.

In the 30s of the last century and in the post-war years the riverine valleys in the south of the republic were intensively developed for cotton cultivation and in this connection the reserve temporarily lost part of its territory and then thanks to the enthusiasm of scientists and some government leaders - nature protectors, it was possible to preserve the reserve with its original territory. The territory of the Tigrovaya Balka Reserve is located in the South Tajik or Vakhsh Province, which covers the area south of the Hissar Ridge to the border with Afghanistan (*Map 1*). It is bounded on the east by the Hazratishokh Range. This province is the lowest part of the republic. Numerous valleys are divided by a number of low ridges: Babatag, Tuyuntau, Aktau, Rangontau, Karatau and others. The overwhelming part of them has gentle leveled slopes and small absolute heights of 1000-1500 meters.

The reserve is located in the lower reaches of the Vakhsh River, stretching along both banks of the river for 40 km to the confluence of the Vakhsh with the Pyandj River. In the north, the border runs directly with the lands of dekhkan farms, while in the south it runs along the state border along the Pyandj and Amu-Darya rivers. Administratively, the "Tigrovaya Balka" Reserve is located on the territory of the Jaihun, Kabadiyan, Shakhritus and Dusti districts, 60 km from the regional center of Bokhtar and 9 km from the district center of Jilikul settlement (*Map 2*). Taking into account the transferred lands to the collective farm and - collective farm enterprise (1.3 thousand ha), at present the total area of the reserve is **49.786 thousand ha**, including: taking into account the last allocated lands from Dusti, Kabadiyan and Jayhun districts - about 62,248 ha.

- forest area 24.1 thousand ha (47.3%)
- non-forest - 26.8 thousand ha (52.7%)

The forested area covers 16.1 thousand ha (31.6%), and sparse forests and glades - 8.0 thousand ha (14.1%).

Swamps, waters occupy 21.4% of the total area of the Reserve. In the left-bank part of the Reserve there are 16 large lakes, many small lakes, and in the right-bank part there are 5 large lakes and several small lakes.

The main agricultural land resources of the country are located in Khatlon province, some of which are directly adjacent to the protected area. The Tigrovaya Balka Reserve is an island of natural wildlife among the anthropogenic landscape transformed as a result of active economic activity.

Coordinates of the territory of the Tigrovaya Balka State Nature Reserve:

North-most point: 68°28'15.59 "E, 37°25'40.03 "N.

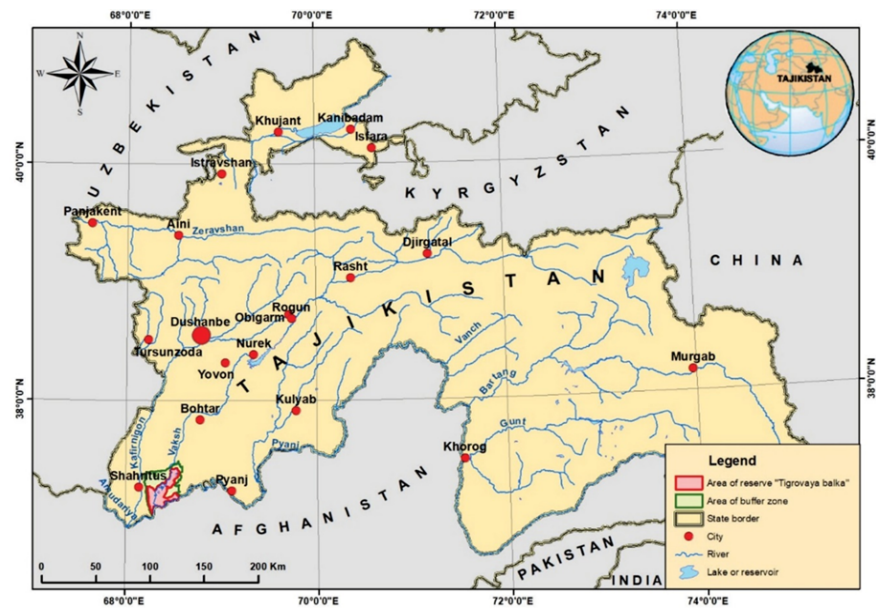
southernmost point: 68°16'59.5 "E, 37°2'3.61 "N.

westernmost point: 68°12'55.00 "E, 37°16'24.98 "N.

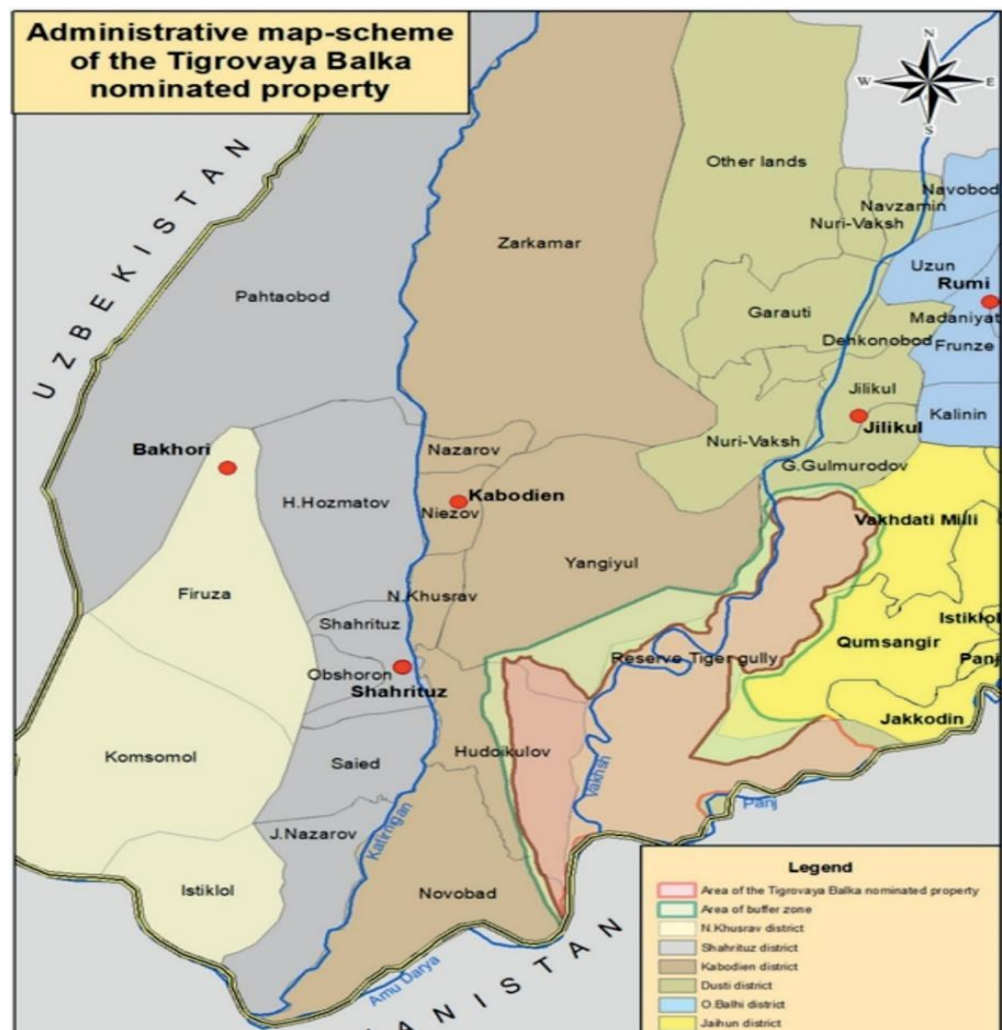
easternmost point: 68°33'44.62 "E, 37°11'33.96 "N.

Absolute elevations of the Vakhsh valley within the Reserve's territory are mainly a little more than 300 meters above sea level. The sandy part of the territory represented by the Kashka-Kum desert reaches 530 meters above sea level and the insignificant part of the mountainous territories of Khoja-Kazian reaches altitudes of 1000 - 1200 meters above sea level.

Transport accessibility: There is a good highway from Dushanbe to the central farmstead of the reserve - the distance is about 200 km.



Map 1: Location of Tigrovaya Balka in the Republic of Tajikistan (Nomination Dossier, 2021)



Map 2 : Administrative Map of Tigrovaya Balka Nature Reserve (Nomination Dossier, 2021)

1.2. Goal and objectives of the Tigrovaya Balka Nature Reserve

The State Natural Reserve "Tigrovaya Balka" is the oldest desert-tugai reserve in the system of nature reserves of Tajikistan. The reserve was established to preserve the natural complex characteristic of the southern deserts and floodplains of Central Asia, to protect rare animals and to conduct scientific research. Tugai forests occupy an area of 24.1 thousand hectares and it is the only place in the world where the pristine tugai formation has been preserved on significant areas. It is the only in the world desert-tugai reserve of the zone of dry subtropics of the Central Asian type for preservation of tugai plant complex and animals living in it: included in the IUCN Red List as gazelle (*Gazella subgutturosa*), Bukhara deer (*Cervus elaphus*), as well as in the Red Book of Tajikistan - striped hyenas, unique subspecies of pheasant - Tajik black-and-gold (*Phasianus colchicus*), striped hyena (*Hyaena hyaena*), reed cat, Turkestan otter, badger, porcupine, beauty bustard, Central Asian cobra, viper, sand ephah, gray varanus (*Varanus griseus*). Many species of waterfowl. In winter, many birds stop at the Reserve's water bodies, including white and black storks, cormorants, geese, swans, mallard ducks and coots.

The main tasks of the reserve are:

- ☐ Maximizing the preservation of territorially contiguous ecosystems, integrity of their structure for stable development of this unique wetland natural complex in combination with sandy-desert, low-altitude xerophytic vegetation under conditions of strong anthropogenic impact in the water area of the protected and in general project area.
- ☐ Develop mechanisms to organize conditions for non-interference of humans in natural processes occurring in the reserve, minimize the factor of emergency situations.
- ☐ Minimize and gradually completely eliminate transboundary ingress of all types of harmful substances not typical for the ecosystem into the Reserve.
- ☐ Provide optimal conditions to discourage poaching and minimize disturbance to large animal species.
- ☐ To organize conditions for research and educational work for the population of all ages and social composition.
- ☐ Organize all types of monitoring to study and forecast the progress of successional processes, including the dynamics of biological processes in wildlife.
- ☐ Develop different scenarios to mitigate the impact of economic activities in the water area of the reserve.
- ☐ Prevent invasive alien species from entering the Reserve's ecosystems.

1.3. Legal status of the territory of the reserve

The State Nature Reserve "Tigrovaya Balka" was established on November 4, 1938 and despite numerous territorial changes (transfer of some lands to agricultural bodies and their subsequent return to the reserve), the transfer of the reserve for management to various departments, its status has always remained unchanged - it has always been a state nature reserve).

1.4. Management Plan for the Tigrovaya Balka SNR

This management plan is a strategic document developed specifically for the Tigrovaya Balka Reserve and in accordance with the requirement of UNESCO. Given the unique integrity of the Tigrovaya Balka ecosystems, the document covers activities related to the management of the entire reserve.

The document was developed by the experts of PO "Tabiati yoboi" in close cooperation with the specialists of the State Institution of Protected Areas from October 2023 to May 2024 and with the participation of a group of national experts of Tajikistan (*Table 1, Figure 1*).

Table 1: Management Plan development activities in the Tiger Balk GPZ, October 2023 through May 2024.

Date	Event	Participants
14.12.2023	Workshop "Discussion of the structure and content of the management plan of the Tigrovaya Balka Nature Reserve"	35 people: SISPNA, CEP, NAST, FAGRT, Tabiati Yoboi, representatives of the Tigrovaya Balka SNR and the expert working group.
12.01.2024	Round table "Discussion and status of the Reserve's ecosystems, problems and barriers, list of rare, threatened and endangered plant and animal species recommended for inclusion in the Management Plan"	37 people: SISPNA, CEP, NAST, FAGRT, Tabiati Yoboi, representatives of the Tigrovaya Balka SNR and the expert working group.
25.01.2024	Round table "Discussion of the status of protection and categorization of rare, threatened and endangered species of plants and animals according to the requirements of IUCN and Ramsar Convention"	42 people: SISPNA, CEP, NAST, FAGRT, Tabiati Yoboi, representatives of the Tigrovaya Balka SNR, local residents and expert working group
27.02.2024	Expert working group meeting with local communities to discuss the developed Management Plan for the SNR TB for 2025-2029.	Total 57 people (20 women), the following villages: Namuna, Libob, Tursunzade and Beshai palangon of Gardi Gulmurodov Jamoat, March 8 village of Jilikul Jamoat of Dustin district, Vodiye chorum village of Istiklol Jamoat and Frunze village of Yakkadin Jamoat of Jaihun district of Khatlon province.

The main objective of developing a management plan is to achieve a reasonable balance between the need to conserve and protect the natural resources of the Tigrovaya Balka State Nature Reserve and the need to meet the needs and traditional uses of the local population utilizing the resources in the buffer zone of the Reserve without damaging the unique ecosystems of the Reserve.

The first two sections of the document describe the physical and geographical characteristics of the Tigrovaya Balka Reserve, the third section is devoted to the description of socio-economic aspects, with special attention to the analysis of the way of life and economic activities of the population living in the vicinity of the reserve. The fourth section describes the administrative resources of the Reserve. The fifth section is devoted to the description of pressures and threats to the conservation of the Reserve, the sixth section describes the management system and structure of the Tigrovaya Balka Reserve. The last two sections provide a description of the Reserve's management plan, timeline, and monitoring of activities in Tigrovaya Balka for the period 2025-2029.



Figure 1: Participants of the workshop "Discussion on the structure and content of the management plan for the Tiger Balk Nature Reserve", December 14, 2023 (photo by Tabiati Yoboi PO)

SECTION 2. DESCRIPTION OF THE NATURAL CONDITIONS OF THE TIGROVAYA BALKA RESERVE

This section provides an ecological description and main characteristics of the Tigrovaya Balka Nature Reserve. Taking into account the uniqueness and dynamics of the Reserve's ecosystems, all natural objects of the Reserve are described as a whole.

2.1 Climatic conditions

The climate of Southern Tajikistan is sharply continental with sharp fluctuations in daily and annual temperatures, low precipitation, and low relative humidity. The climatic regime of the southern part of the Reserve is much harsher than in its northern part. Special rigidity of exoteric conditions is characterized by the period from May to November, when precipitation stops, relative air humidity drops to a minimum and evaporation of moisture from the soil surface and through the leaf surface of plants sharply increases. At such time, plants almost completely preserve (stop) biological activity of the organism, resuming it at the onset of favorable conditions.

The territory of the Reserve is characterized by extremely low precipitation, high summer temperatures and sometimes low winter air temperatures. The average annual air temperature usually exceeds 15.0°C and is $15.60 - 16.0^{\circ}\text{C}$, the average monthly temperature of the hottest month (July) $+29.20^{\circ}\text{C}$ (reaches 30.0°C), and the coldest (January) $+0.90^{\circ}\text{C}$. The maximum of high temperatures reaches $46.0 - 48.0^{\circ}\text{C}$ in July, and the lowest - in January up to -28.0°C . The duration of the frost-free period is 230 days, which makes the growing season favorable for woody and shrub vegetation, and some species of vegetation vegetate almost all year round (reeds, erianthus, selenium, silt).

The average annual precipitation is 159 mm, the bulk of which - more than 70% - falls between December and April. As a rule, there is no precipitation in the summer months. In winter precipitation falls in the form of wet snow, rain and less often snow, which does not fall for more than 1-2 days.

2.2 Relief

The territory of the reserve "Tigrovaya Balka" is divided into three geomorphologic types by the character of relief:

- ☐ floodplain;
- ☐ low-lying;
- ☐ semi-desert.

The relief of the floodplain terrace is flat, with depressions, in which there are old lakes, usually horseshoe-shaped, densely overgrown with aquatic vegetation. The floodplain type of relief of the Reserve's territory is characterized by the presence of a large number of lakes of various shapes, mostly elongated and curved. The typical shape of lakes in the floodplain part of the Reserve is determined by the nature of their formation - it is the former channel of the Vakhsh River, which constantly changes its position forming a new channel.

The low-altitude type of relief is represented by the territory of the reserve, occupying the watershed ridge Aruk-Tau, dividing the floodplains of the Vakhsh and Kafirnigan rivers. The semi-desert type of relief is represented by hilly sandy deposits of aeolian origin.

2.3 Terrestrial hydrology and water resources

Wetlands (hereinafter - WL) occupy 21.4% of the total area of the Reserve. The Reserve is located in the south of the Vakhsh valley, in the Tigrovaya Balka tract, and occupies mainly the

left-bank floodplain of the Vakhsh River covered with riparian vegetation. The hydrological network of the Reserve is formed by the Pyandj and Vakhsh rivers and their tributaries. The territory of the Reserve is connected with the Vakhsh River, which is glacially and snow fed. The Vakhsh River is formed by the confluence of the Surkhob and Obikhingou Rivers. Its basin is located within Central and Northwest Tajikistan. From source to mouth, the Vakhsh River is 524 km long (*Table 2*).

The Panj River, flowing through the southwestern part of the reserve, is both the border with the Islamic State in Afghanistan and plays a role in the existence of the aquatic ecosystem.

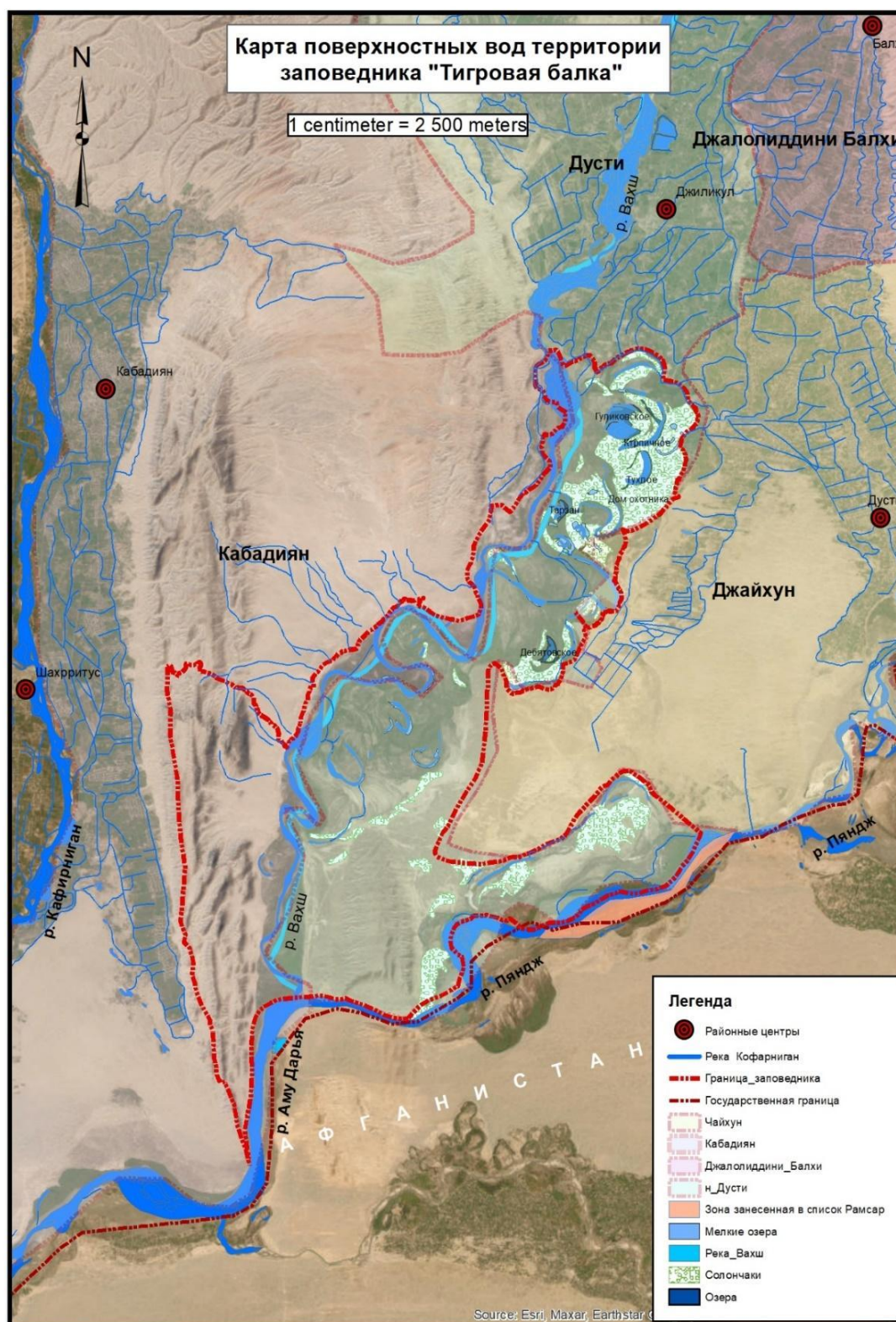
The minimum average annual water discharge at the Tigrovaya Balka gauging station occurs in January-February and is 198 m³/sec. Maximum discharges are observed in July-August and reach up to 1685 m³/sec. The amplitude of water horizon fluctuations is 3-4 m. The average monthly water temperature varies from 2.1-3.7⁰ C (January - February) to 14-15⁰ C (July - August).

Table 2: Key indicators of hydrological characteristics of river flow in the Tigrovaya Balka Reserve (Nomination Dossier, 2021)

River	Length, km	Water flow rate, m ³ /sec			Average annual runoff, billion m ³
		Minimum	Maximum	Annual	
Vakhsh	524	120	4150	640	19,2
Kafirnigan	387	31,3	1640	163	5,23
Panj	921	500	4300	1020	31,7

The ecosystems of the Tigrovaya Balka floodplain depend on the meandering river and its dynamics. These dynamics are caused by changes in river flow, regular seasonal fluctuations (low flows in winter, high flows in summer), and rare and exceptional floods (extreme floods).

The Tigrovaya Balka Reserve directly borders four districts of Khatlon province of Tajikistan (Dusti, Jaihun, Kabadiyan, Shakhritus). The Vakhsh and Kafirnigan rivers are the source of irrigation for the lands of these districts. According to experts, the basin has sufficient fresh water reserves exceeding its own needs for any scenarios of land irrigation development.



Map 3: Surface water map of the Tigrovaya Balka Nature Reserve

2.4 Water consumption

The Nurek HPP, the largest in Central Asia, was built on the Vakhsh. A total of 8 power plants were built along the river: Perepadnaya (1958, 29.5 MW), Golovnaya (1962, 240 MW), Tsentralnaya (1964, 15.1 MW), Nurek (1972, 3000 MW), Baypazinskaya (1986, 600 MW), Sagtudinskaya-1 (2008, 670 MW), Sagtudinskaya-2 (2011, 220 MW), Rogun (2018, 3600 MW).

Due to the regulation of the Vakhsh River flow by a number of hydroelectric power plants, the water level in the river has decreased. The problem of dewatering of significant areas due to the cessation of spills has arisen. During the 2000s, despite the difficult financial situation of the Republic of Tajikistan, many problems of the Reserve's preservation were raised, many of them were solved, including, to a large extent, the state allocated targeted funds for the restoration of the Reserve's infrastructure, which had been damaged during the nineties, initiated work on the restoration of the gazelle population, etc. The Reserve's population was also restored. Unfortunately, neither in the 70-80s nor in the last decades cardinal measures were taken to optimize water supply to the tugai-floodplain ecosystem, given that the natural flood regime is disturbed by the system of hydraulic structures, but, as preliminary expert assessments have shown, it can be compensated without damage to the water supply systems of both the hydropower system and the needs of irrigated agriculture of the surrounding areas.

The issue of protection and conservation of the unique ecosystem of the reserve "Tigrovaya Balka" becomes urgent due to changes in the water regime of the Vakhsh River. According to R. Rakhmatilloev (2022), the amount of sediment load in the Tigrovaya Balka has decreased by 11.3 times and turbidity by 7.05 times, which leads to intensive erosion of the river bed, lowering of water levels in lakes and groundwater levels in the reserve, thus violating the long-term natural regimes of sediment deposition, channel formation, and the entire hydrological regime of the river in the reserve.

The construction and operation of the Nurek reservoir has had a significant impact on the distribution of annual flow and sediment load of the Vakhsh River downstream of the dam site, including the Tigrovaya Balka Nature Reserve. This impact started from the date of filling of the Nurek reservoir (late 1960s of the XX century) and its subsequent exploitation.

Figure 2 shows the distribution of maximum, average and minimum monthly water discharges of the Vakhsh River at the "Tigrovaya Balka" gauging station before the construction of the Nurek reservoir and monthly water discharges after the construction of the Nurek reservoir. Average monthly discharges by months reached the level of 1400 m³/s, minimum monthly discharges during the flood period (late June, July and early August) in some years dropped to the level of 900 m³/s. Under such flow fluctuations, the water regime was formed for many years, and the flora and fauna of the Tigrovaya Balka Nature Reserve developed.

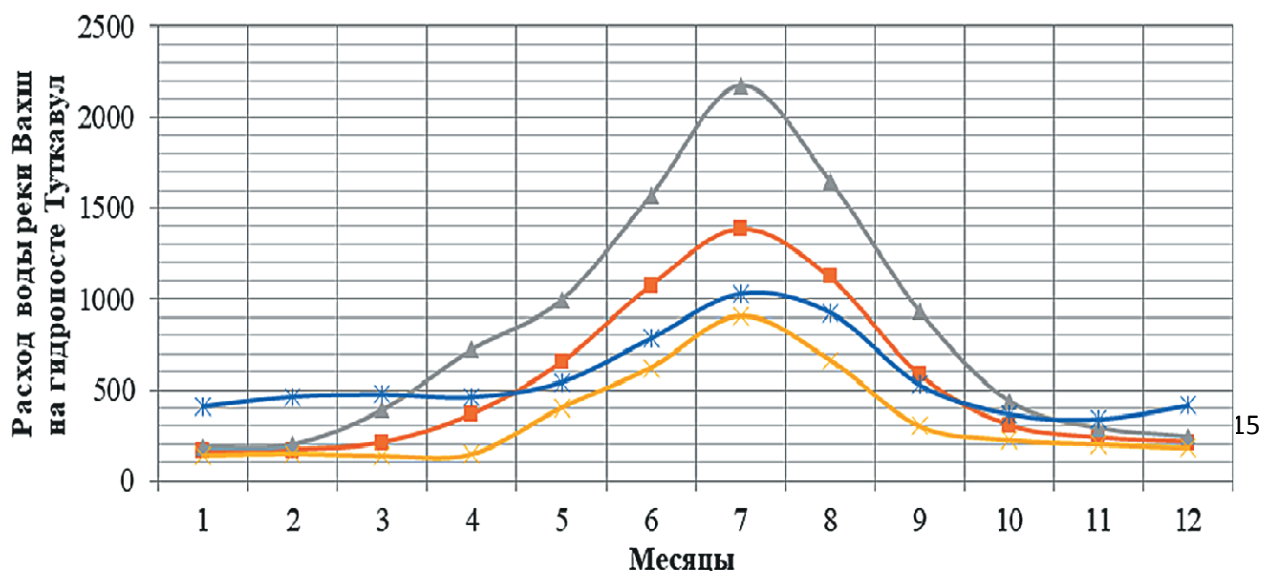


Figure 2: Water discharge of the Vakhsh River before and after construction of the Nurek reservoir at the gauging station "Tigrovaya Balka" (Rakhmatillaev R. et al. 2022).

During the filling phase of the reservoir, runoff by months has fluctuated from +148% to -34% compared to the incoming runoff, and this process has lasted for many years. During this time interval, the annual runoff has decreased by 13%. The fluctuation of water discharge after commissioning of the Nurek reservoir was from +181% to -71%, but in annualized terms, the decrease in runoff volume during the observation period was -6%. After commissioning of the Nurek reservoir, water releases from the reservoir were carried out according to the dispatch schedule. The character of flow variation became more even, maximum releases from the reservoir were carried out in July, when there is the greatest demand for irrigation in Tajikistan, Turkmenistan and Uzbekistan. July river discharge at the "Tigrovaya Balka" site was at the level of 1000 m³ /s with insignificant fluctuations. Also, the winter flow of the Vakhsh River was higher almost twice and more than the river flow before the overtopping of its channel. The commissioning of the Nurek reservoir also affected the sediment discharge and turbidity of this river in Tigrovaya Balka.

The reduction of sediment discharge and runoff by more than 11 times on an annual basis and by more than 20 times during floods, and the reduction in water turbidity during floods by up to 15 times after the construction of the Nurek dam led to intensive erosion of the river channel, lowering of water levels in lakes and groundwater levels in the reserve, and disruption of the long-term natural regimes of sediment deposition, channel formation and the entire hydrological regime of the river in Tigrovaya Balka.

It should be noted that the water flow in the Tiger Bar post for the last 3 years is not measured for technical reasons. The total water flow rates for 2019-2020 are provided in *figure 3*. According to the IUCN independent assessment of Tiger Balk for nomination for World Natural Heritage listing, there has been a 50% reduction in water consumption since 2016 (IUCN Evaluation Report - April 2023).

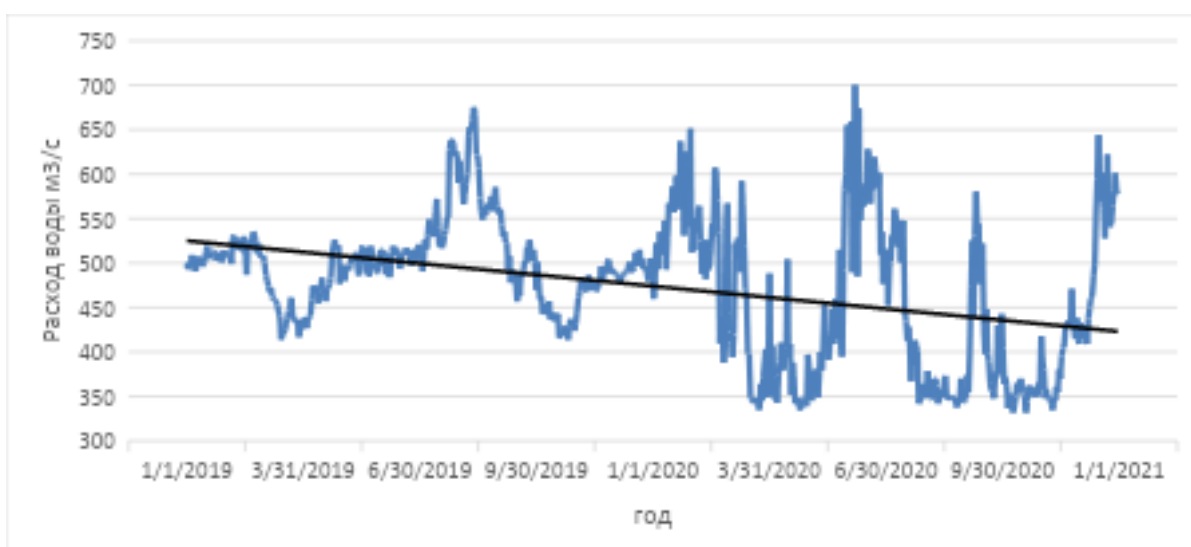


Figure 3: Graph of change in average monthly water discharge at the Tigrovaya Balka site

In recent years, meandering of the Vakhsh River channel to the left bank has been observed on the territory of the Reserve, which threatens soil washing away, flooding of left-bank overgrown tugai areas and destruction of lakes - old lakes. In this regard, it is necessary to conduct erosion studies of the Vakhsh river channel in the Tigrovaya Balka site in order to build special hydraulic structures such as a barrage, raised threshold or sluice, allowing to regulate the speed and level of water and its flow on the territory of the reserve, digging of channels, construction of dams and regulation of the flow of the stream, filling of lakes and flooding of the territory.



Figure 4: Irrigation canal of Dusti district feeding the lakes of the Reserve (photo by N. Mirzoev)

It is worth noting the economic component of water consumption in the Reserve. Water for irrigation purposes is supplied by the Agency for Land Reclamation and Irrigation under the Government of the Republic of Tajikistan (ALRI), which operates in all four districts around "Tigrovaya Balka". Services for water supply are charged by ALRI. The current tariff (dated May 30, 2018) for water supply services is 2 Diram per 1m³ (excluding VAT) or 200 Somoni per 1,000 m³ (US\$18 per 1,000 m³). Tariff regulation related to the use of water and other resources is carried out by the Antimonopoly Service under the Government of Tajikistan. Despite the relatively low tariff, the collection rate for water supply services in the republic as a whole does not exceed 60%. This indicator for the Reserve districts ranges from 32% (Dusti) to 71% (Kabadiyan).

At present, the fixed assets of irrigation systems, drainage and related infrastructure on the AMI balance sheet have undergone 50% wear and tear, and pumping stations - 65% wear and tear. Critical deterioration of fixed assets of the water management infrastructure shows the extreme need for their rehabilitation, restoration and reconstruction (*Figure 4*).

2.4.1 Mineralization

From Nurek gauging station to Levakand, the average mineralization of water in the river varies insignificantly within the range of 450-550 mg/l. Sulfate concentration varies from 15 to 32 mg/l (1-3 MAC), chloride concentration 80-135 mg/l (does not exceed MAC), phenols are not detected, there are single cases of exceeding MAC for HCCH (0.117mg/l), average annual concentrations of metals (zinc, copper) along the length of the river did not change significantly

and were within 1-4 MAC. By the closing gauging station of the lower Vakhsh River (g/post Tigrovaya Balka) all polluting indicators (pesticides, metals) are no longer observed, and the average annual mineralization content increases to 867 mg/l. Water type is sulphate-calcium with increased content of hydrocarbonates and sodium.

While at the river section (Nurek) annual average concentrations of nitride nitrogen were in the range of 0.001-0.007mg/l (downstream of the city), at the downstream section (Levakand) they increased to 0.022-0.066mg/l (1-3 MAC) with a maximum concentration of 0.158mg/l (7.9 MAC). In the lower reaches (gauging station Tigrovaya Balka) nitride nitrogen value becomes low again (0.008). Water quality class in the Vakhsh River basin changed from 2 (clean) to 3 (moderately polluted water).

2.4.2 Lakes

On the territory of the Tigrovaya Balka Reserve there is a series of large and small lakes covered in places with impassable riparian and sometimes with woody vegetation (*Figure 5*). These lakes are old lakes of Vakhsh or its branches. The waters of some lakes are fresh and still keep an open connection with the river, filling up during floods, while others are fed by groundwater. The areas of lakes are diverse and vary from several tens of square meters to several tens of hectares. The greatest depth of lakes reaches 5 m, their average depth is 1.5 - 2 m.

There are 16 large and many small lakes in the left-bank part of the reserve, and 5 large and several small lakes in the right-bank part. In accordance with the Decree of the Government of the Republic of Tajikistan No. 269 of June 30, 2021 "On changing names of geographical objects within the Republic of Tajikistan" the following names of the lakes of Tigrovaya Balka were changed:

- ☐ Lake Gulikowski to Mohiyon
- ☐ Lake Korczowy to Pariyon
- ☐ Tukhlai Lake to Anohita
- ☐ Brick Lake to Hutalon
- ☐ Lake Spill to Balchiyon
- ☐ Horseshoe Lake to Revahshiyon
- ☐ Lake Bazovsky to Moni
- ☐ Lake Balabanovsky to Sharifiyon
- ☐ Lake Nine to Kewaunee
- ☐ Grandfather Lake to Housravon
- ☐ Pioneer Lake to Nasriyon
- ☐ Kabansky Lake to Lodgvardi
- ☐ Lake Aikul to Bobacon



Figure 5: Lake Daryo-Kul overgrown with reeds (photo by N. Saidov)

It should be noted that there is almost no monitoring in lakes within the WL. Only at Mokhiyon Lake a hydrometric gauge is installed to monitor the water horizon. This rail is not tied to the absolute elevation of the terrain. Analysis of the data shows that the change in water horizon in October compared to September is 0.2-10.0cm and decreases to 0.10-0.80cm compared to November. Qualitative sampling of lake water is not carried out.

Numerous old lakes of the Reserve are wintering grounds for a large number of waterfowl and waterfowl species. The old lakes are located in the river floodplain and were filled with flood waters in spring. This made the reserve an ideal habitat for native and wintering birds. About 100 species of birds migrate here in spring and fall. Unfortunately, after the construction of the Nurek hydropower plant, the water in the Vakhsh River was regulated, the reserve lost spring and summer floods, the conditions for wintering birds deteriorated, many lakes dried up, and the ecological situation worsened. Waterfowl and waterfowl birds continue to winter on the remaining lakes.

2.4.3 Groundwater

Groundwater is the main source of domestic drinking water supply. In Tajikistan, 46 groundwater deposits have been identified, with potential reserves of 18.7 km³/year. Groundwater reserves in the Vakhsh River basin are 1.45 km³, in connection with which it is necessary to carry out monitoring and research in the field of protection and rational use of groundwater. Groundwater regime in the territory of the "Tigrovaya Balka" Reserve is formed under the influence of Vakhsh River horizon fluctuations and irrigation irrigation and to a lesser extent due to atmospheric precipitation against the background of significant evaporation and weak groundwater outflow. The territory of the reserve is characterized by shallow depths of level occurrence, small slopes of groundwater mirror (0.001-0.002) and low filtration properties of water-bearing rocks. The depth of groundwater table on the territory of the Reserve repeats the surface relief.

The territory of Tigrovaya Balka and its buffer part belong to the poorly drained zone characterized by slow groundwater flows and high evaporation values. Ground waters occur at a depth of 0-3 meters. There are areas with shallow groundwater table (less than 1m) in areas of bowl-shaped depressions. Maximum levels are observed in November-December, minimum levels in July-August. Seasonal amplitude of groundwater level fluctuation is 0.4-2.0 m. In the coastal zone on the groundwater level regime has a great influence on the change of river discharge, which explains the significant amplitude of level fluctuations up to 2 meters.

Poor conditions of outflow and inflow of mineralized water have imposed its imprint on groundwater mineralization of the whole territory of the Reserve. Within the wetlands of the Reserve, groundwater mineralization is 1-3 g/l. Water is of sulfate-chloride-sodium or calcium composition. Conditions of groundwater supply and flow impose conditions on its mineralization and chemical composition. Multiyear and seasonal dynamics of mineralization is subordinated to climatic factor.

Weakly mineralized groundwater (1-3 g/l) is found in the river channel part of the Vakhsh River and in the central part of the floodplain in the area of the dried-up Golubogo Lake. Mineralized groundwater is confined to areas of highly saline soils and solonchaks. Very strongly saline groundwater - brines (more than 50 g/l) occur in a small area - 436.4 ha (1.5%). Groundwater mineralization in the Pyandj River floodplain is slightly higher than in the Vakhsh River floodplain. To monitor groundwater regime in the buffer zone of the Reserve, there are 7 observation wells in the Dusti area (Table 3).

Table 3: Observations of groundwater regime in the buffer zone, Dusti district (2023)

№ observation well	Depth of wells, m	Absolute mark, m	Average annual groundwater level in 2023, m	Average annual mineralization in 2023, g/l
Pakhtakor site				
№ 19c	9,00	347,70	1,24	2,20
№ 49c	6,00	346,90	1,28	2,70
№ 33c	6,30	344,50	0,44	1,80
№ 3c	4,40	343,00	0,73	3,00
Palwan tugai				
№ 65	50		4,61	3,70
№ 32	30		6,12	3,20
№333a	50	331,1	1,19	3,19

Based on the data in *table 3*, the average annual depth of groundwater occurrence varies from 0.44 to 6.12 meters from the ground surface. Groundwater mineralization ranges from 1.80 to 3.7 g/l.

Distribution of irrigated lands in the buffer zone of the reserve "Tigrovaya Balka" by depth of groundwater table as of 1.01.2023 is as follows (*Table 4*).

Table 4 Distribution of irrigated lands in the buffer zone by depth of groundwater table, 1.01.2023.

№	Name of districts and jamoats (administrative units)	Irrigated area, ha	Distribution of irrigated lands by groundwater table depth, ha					
			up to 1.0m	1,0-1,5 M	1,5-2,0 M	2,0-3,0 M	3,0-5,0 M	Over 5m
	1.Dusti district							
1	J.G.Gulmurodov	3091,0	0	4	127	901	1751	308
	2.Jaihun district							
1	J. Yakadin	1448,0	35	35	278	304	427	369
	3.Kabadiyan district							
1	J. Istiklol	4477,5	241	65	327	1125	380	2339,5

The area with groundwater depth in J. G. Gulmurodova is -1032ha; in J. Yakadin - 652ha and J. Istiklol - 1758ha. The area with groundwater salinity more than 1 g/l is (table 5):

J.G.Gulmurodov - 3059 ha;

J. Yakadin - 1323 ha;

J. Istiklol - 494.5 ha

With shallow groundwater table and high evaporation, the process of secondary salinization develops on the territory, therefore it is necessary to perform artificial drainage of the territory.

Table 5 Distribution of irrigated lands by groundwater salinity in the buffer zone

№	Name of districts and Jamoats	Irrigated area, ha	Distribution of irrigated lands by groundwater salinity, ha		
			up to 1g/l	1 -3g/L	More than 3g/l
	1.Dusti district				
1	J.G.Gulmurodov	3091,0	32	2936	123
	2.Jaihun district				
1	J. Yakadin	1448,0	125	1323	0
	3. Kabadiyan district				
1	J. Istiklol	4477,5	3983	494,5	0



Figure 6: Layout of the collectors

There are 6 collector-drainage networks in the buffer zone of the Reserve, the runoff of which flows into the territory of Tigrovaya Balka (Table 4 and 5).

The total length of collector-drainage network (CDN) is 67.7 km, of which 39.5 km or 58.3% is in unsatisfactory condition (Table 6, Figure 6).

Name of DPT	Total length, km	Including in poor condition, km	Note
Dusti district			Clean and repair 39.5 km of DPTs
VD-11	6,2	3,72	
VD-12	7,4	5,18	
Reset #2	7,4	4,44	
K-6-1	6,0	4,20	
Bottom line:	27,0	17,5	
Jaihun District			
VD-9	11,7	7,00	
VD-10	29,0	15,0	
Bottom line:	40,7	22,0	
Total:	67,7	39,5	

These collectors have not been cleaned for years and do not provide normal ecological and reclamation conditions of the territory. It is necessary to clean and repair the 39.5 km long DPT. Besides, it is necessary to build sedimentation pits at the mouths of flowing collectors directly in the "Tigrovaya Balka" in order to reduce the pollution of the reserve from sediment. In the buffer zone of the reserve (on the sites of Mir and Agranom, J. Djilikul, Dusti district) there are 4 vertical drainage wells (#30,32,44,45) for irrigation of lands and water supply of the farm. Table 6 Extent and condition of drainage network in the buffer zone, Dusti and Jaihun districts

The highest values of average monthly water discharge in collectors are in July-August-November, and salinity in autumn-winter period. Maximum average annual water discharge is observed in collectors VD-9, K-6-1, VD-12. The maximum mineralization is observed in VD-12, VD-11, discharge No.2 and K-6-1.

Close groundwater in the floodplain terrace, continuously fed and refreshed by river water, and in the recent past periodic overflows, provided the vegetation of the reserve with moisture throughout the year. The peculiarity of ecological conditions also lies in the fact that the long summer drought causes very high air dryness. These contrasting interactions of soil and atmospheric moisture characterize the conditions of existence of riparian vegetation.

The cessation of flooding of the floodplain by flood waters of the Vakhsh River has led to a significant decrease in groundwater level. Discharge of irrigation water in the northern part of the floodplain (up to the Kashka-Kum hill) causes groundwater rise in summer to a depth of 1.0-1.5 m and partially floods the vegetation cover. The lowering of groundwater level contributes to the increase of salt concentration in the soil, which is the cause of gradual destruction of stands and emergence of halophyte plants.

2.5 Forest categories and flora biodiversity

All forest plantations of the Reserve are categorized as protected forests. They perform a variety of protective functions: soil-protecting, bank protection and water-regulating functions, as well as a habitat for wild animals.

The vegetation of the region where the Tigrovaya Balka Reserve is located is peculiar and quite typical for Central Tajikistan. Out of 20 vegetation types identified for Tajikistan (P.N.Ovchinnikov, 1973), there are 18 types representing zonal vegetation in the region. Floodplain forests (tugai) are characterized by their dynamism and close relationship with the activities of the Vakhsh and Pyandj rivers.

The main tree species in tugay forests are turanga (sisolist poplar) and elk, from shrubs - comb and Karabarak (saltbush). Riparian forests also react in their evolution to the river behavior, passing the stages of emergence, development and degradation. The type of riparian community is always a product of the system of interaction with the river.

Riparian vegetation is such a community of forest vegetation, which is confined exclusively to river floodplains of desert and semi-desert areas of Central Asia, having no analogues in forest communities. In the most pristine form, tugai are preserved in Tajikistan only on the territory of the reserve "Tigrovaya Balka".

All riparian types are united into three groups on the basis of water availability, i.e. groups of wet, wet and dry riparian areas are identified. Additionally, relict riparian forests are noted. The most common forest types are:

- Tamarisk tugai, occupying 40% of the floodplain area;
- Turango-oleaster reed cane tugai, occupying 20% of the area;
- Licorice tugai, occupying 13%;
- Relict tugai, occupying 14 %.

These four main types occupy 87 % of the total forest area. In addition, there are pistachios with an admixture of Bukhara almond, widespread in the mountainous part of the Reserve's territory. However, they occupy a small area and are in a sparse state.

The first three types of tugai forests correspond to the types of lands with good protective properties and satisfy the fauna of the Reserve as forage base and fauna stations. The relict tugai belong to the desert type of lands for wild fauna.

2.5.1 Forest conditions

The characteristic feature of the Reserve's area is hot and dry summer and warm and wet winter, which causes mass winter-spring vegetation of plants. In the floodplains of the Pyandj

and Vakhsh rivers, the vegetation is represented by oleaster, turanga (*Populus pruinosa* Schrenk), tamarisk, shrub saltbush (Karabarak). The main representatives of the grass cover are: sugar and common reeds, hornwort, erianthus, licorice and camel's thorn, etc.

The overflow terrace occupying the interfluvium of the Pyandj and Vakhsh rivers, composed of consolidated sands and heavy sandy loams, is occupied by juzgun, saltwort, saxaul, and parnolistnik, and the grass cover is represented by yantak, selenium, and ilak. This part of the Reserve is a low grass semi-savanna.

The mountainous part of the Reserve, located on the right bank of the Vakhsh River, is represented by a belt of semi-savannas with single trees of pistachio, Bukhara almond and parnolis. The dominant plant associations on the territory of the Reserve are turanium-fallow plant communities capable of tolerating high summer temperatures, lack of moisture and a significant degree of soil salinity.

In the floodplains of the Vakhsh and Pyandj rivers, large areas are occupied by reeds. Reeds on the banks of lakes and wetlands are impassable thickets 45 m- high. Such thickets are natural barriers that prevent access of animals to open areas and sparse low-growing reeds and plantations, which are the main feeding grounds for wild inhabitants of the Reserve. Such thickets, once dried up, pose a fire hazard as they become flammable and are an excellent combustible material, especially in spring.

Other areas are occupied by thinned reeds, 1,5-2,5 m high, which are not only feeding grounds but also resting places for wild animals. The spread of reed thickets is connected with the fact that the low areas of the Vakhsh River floodplain are flooded by discharge water from the agricultural fields adjacent to the reserve, occupied by cotton.

If the water table remains at a depth of 12 m from the ground surface for a number of years, woody vegetation with giant grasses (common and sugar cane, erianthus), candyrus, licorice develops in such areas. When groundwater level drops, the process of salinization and simultaneous change of vegetation starts - loch, not tolerating salinization, dries up, giving place to turanga, which, when salinization continues and salt concentration in soil increases, gives place to comb and saltwort as typical halophytes (plants able to tolerate high levels of salinization). With continued salinization, such areas degenerate into solonchaks without any vegetation.

2.5.2. Tamarisk tugai

Tamarisk tugai is located mainly on alluvial-floodplain, loamy and sandy loam soils (*Figure 7*). The depth of groundwater table is 4.5-6 meters. The soils are highly saline and the salinization process continues. Tree canopy closure is 0.5 and lower. The height of plantations is 3-4 m. There is no undergrowth. This type of plantations is the most widespread.



Figure 7: Tamarisk tugai in the Palvontugaya tract (photo by N. Saidov)

2.5.3. Turango-oleaster reed cane tugai

Turango-oleaster reed cane tugai is located on alluvial-floodplain loamy soils. Ground waters are located at a depth of 1 - 1.5 m, slightly saline. Periodically flooded. The tree canopy consists of turanga and oleaster. The stands are sparse, canopy closure 0.2 - 0.4. The height of small groups of comb is high. The grass cover is dominated by reed (*Figure 8*).



Figure 8: Turango-oleaster reed cane tugai in Tigrovaya Balka Nature Reserve (photo by N. Saidov)

2.5.4 Licorice tugai

Licorice tugai is distributed mainly on alluvial-floodplain loamy soils. Turanga dominates in the tree stand, and there is also elk up to 30%. The height of the tree layer reaches 8-9 meters. Canopy closure is 0.3- 0.5. These are the most dense stands. Undergrowth is sparse, mainly from comb. Riparian forests of this type are located in areas adjacent to the second river

terrace, near lakes - old lakes overgrown with reeds (*Figure 9*).



Figure 9: Tugai licorice overgrowing with reeds around the lake "Blue Zaton" (photo by N. Saidov)

2.5.5. Relict tugai

The relict tugai is located in a desert sandy zone where alluvial soils have been covered with sand. The depth of groundwater table is 5-7 meters. Tugai is represented by saxaul (*Figure 10*) and saltwort. This type is confined to ancient river valleys.

2.6 Flora of the Tigrovaya Balka Nature Reserve

The flora of the Tigrovaya Balka Nature Reserve is rich and diverse. More than 400 species of plants from different genera have been registered here. Typical representatives of the Reserve's flora are presented in *Figures 11-13*. The full list of plant species of the Reserve is given in *Appendix 2*.



Figure 10: Haloxylon in the Tigrovaya Balka Nature Reserve (photo by N. Saidov)



Figure 11: Wild onion blooming in the Tigrovaya Balka Nature Reserve (photo by N. Saidov)



*Figure 12: Ferrula blooming on the Palvontugai tract in the Tigrovaya Balka Nature Reserve
(photo by N. Saidov)*



Figure 13: Populus pruinosa (Populus pruinosa Schrenk) is the main forest forming species in the tugay forests of the Reserve (photo by N. Saidov).

2.7 Fauna of the Tigrovaya Balka Nature Reserve

The location of the Reserve at the junction of two zoogeographic provinces, as well as the high mosaic of natural conditions in a relatively small area of the Reserve determines the diversity of its fauna. The full list of animal species of the Reserve is given in *Appendix 3*.

The **fish fauna** of the Reserve and the Vakhsh River within its boundaries is relatively poor and is represented mainly by carps. About 20 fish species are found in the water bodies of the Reserve. The Red Book of the RT includes aspiolucius esocinus, big and small Amu Darya shovelnose. There are carp, Turkistan mustache, Aral mustache, Bukhara roach, aspiolucius esocinus, Aral aspiolucius, Samarkand varicorhinus, capoetobrama kuschakewitschi, sheat-fish and occasionally Cobitis taenia (Maksunov, 1968). The dominant species is the carp, which

sometimes weighs up to 8 kg. Sheat-fish are also common in lakes. In lakes, sheat-fish are dark reed-shaped, smaller than in the Vakhsh River. The lakes of the Vakhsh floodplain are also inhabited by an extremely curious representative of the fish kingdom - a small gambusia - a destroyer of malaria mosquito larvae. It was introduced to the lower reaches of the Vakhsh in 1938.

It is also necessary to mention the large Amu Darya false shovelnose, the oldest fish of Central Asia. It belongs to the sturgeon family and is the closest relative of shovelnoses found in the Mississippi River in North America and in the Yangtze River in China (Mirzoev, 2021).

Amphibian fauna: Reptiles of the Reserve "Tigrovaya Balka" are most richly and diversely represented. The most numerous group of herpetofauna of the Reserve is the group of lizards, including 22 species, 8 of which live only in the South-West region of Tajikistan - in the Reserve and its vicinity. Snakes are quite common in the Reserve. In the Tigrovaya Balka Reserve they are well represented by 12 species, including venomous snakes such as Central Asian cobra (*Naja oxiana*, Eichwald), Central Asian gyurza (*Macrovipera lebetina turanica*, Chernov) and carpet viper (*Echis multisquamatus*, Cherlin).

The desert territories of the reserve are rich in reptiles. Miracle gecko and fringed gecko, steppe agama, several species of toad-agamas, gray varanus, etc. are common here.

Characteristic inhabitants of sandy substrate - sands / or sandy biotopes - include lizards - round-headed lizards, ephahs, and others. Steppe agama and geckos are quite numerous on the territory of the Reserve. The water snake inhabits water reservoirs. The gray varanus is found in all parts of the Reserve, but prefers fixed sands and semi-desert foothills. Nowadays it has become a very rare species, but in recent years its numbers in the Reserve have been recovering. The cat snake (*Boiga trigonata melanocephala*, Annandale) is also endangered.

The development of the Vakhsh valley and floodplain has deprived many reptile species of their natural habitat, which has led to a decrease in their numbers and range. It is the territory of the reserve that is the last "island of safety" for them.

The **fauna of mammals** is very diverse. Of the 84 mammal species known to date in Tajikistan, 45 are registered in the Tigrovaya Balka Reserve. Among them the Central Asian leopard (*Panthera pardus ciscaucasica*, Satunin), gazelle (*Gazella subgutturosa*, Gueldenstaedt), double-humped deer (*Cervus elaphus bactrianus*, Lydekker), striped hyena (*Hyaena hyaena*, L.), as well as in the Red Data Book of the Republic of Tajikistan (2015, 2017) (in addition to species included in the IUCN Red List), porcupine (*Hystrix indica*, Kerr), weasel (*Mustela nivalis*, L.), marbled polecat (*Vormela peregusna*, Gueldenstaedt), Central Asian otter (*Lutra lutra* L.), reed cat (*Felis chaus oxiana*, Heptner), urial (*Ovis vignei bochariensis*, Nasonov) and others. The nature reserve "Tigrovaya Balka" is named in honor of the Caspian tiger, which disappeared in the middle of the last century. The Persian leopard once permanently lived here, now this animal visits the reserve only from the adjacent territories. The most common predators of tugai are jackal and reed cat. Other predators of the reserve include the steppe wolf.



Figure 14: Bukhara deer (*Cervus elaphus bactrianus* Lydekker) in Palvontugaya tract, image from camera trap (N. Saidov)



Figure 25: A gazelle (*Gazella subgutturosa*, Gueldenstaedt) at the junction of the Royal Dacha and the tract Kashka-Kum of the Tigrovaya Balka Nature Reserve, photo from a camera trap (N. Saidov).

The Bukhara deer or Hangul (*Cervus elaphus bactrianus*, Lydekker) is one of the most characteristic representatives of the floodplain forests of Central Asia and, of course, it is a great value of the Reserve (Figure 14). In Tajikistan it lived in the floodplains of the rivers Panj, Vakhsh, Kafirnigan, Amu Darya and Syr Darya. The destruction of tugai has led to a catastrophic decline in its population.

The gazelle (*Gazella subgutturosa*, Gueldenstaedt) prefers the semi-frozen sands of the Kashka-Kum desert (Figure 15). The number of gazelles also continues to decline due to the development of the Kashka-Kum desert and currently numbers no more than 40 specimens.

In the lowlands of the reserve, along the right bank of the Vakhsh River, in the foothills of Khoja-Kaziyon, a small population of wild rams - urials (*Ovis vignei bochariensis*, Nasonov) can still be found, the number of which, according to expert estimates, is 250-300 individuals (Amirov, 2017).

The fauna of invertebrate animals is extremely rich. No less than 15 species of insects of the Reserve are included in the Red Book of the Republic of Tatarstan. Among them are Bukhara lacewing, Turang's hawkmoth, Tugai pheosia, Turang's order ribbon, Tugai lampides and others.

Birds

Birds take the first place by diversity of species composition among all vertebrates of the Reserve. The bird fauna of tugai forests is the richest and most diverse. Turang forests with old hollow poplars attract white-winged woodpeckers (*Dendrocopos leucopterus leptorhynchus* Severtzow), roller (*Coracias garrulus semenovi* Loud et Tschusi), hoopoes (*Upupa epops epops* L.), tits (*Parus major bokharensis* Licht), brown pigeons (*Columba eversmanni* Bp.), house sparrows (*Passer indicus* Sharpe) and saxaul sparrows (*Passer ammodendri korejewi* Zar. et Harms.). A few herons (*Egretta alba* L.), night herons (*Nycticorax nycticorax* L.), short-toed snake eagles (*Circus ferox* (Gm.) and black vultures (*Aegypius monachus* (L.)) nest in the trees.

A nest of Remez (*Remiz pendulinus* Sev.) can be found on the thin branches of oleaster. Red-tailed Warblers dwell in the bushes of the tamarisk, and in the thorny bushes of the dereza tree the Crane Shrikes build their nests. The black-and-gold or Tajik subspecies of the common pheasant (*Phasianus colchicus bianchii* L.), an endemic of southwestern Tajikistan, can be found in tugai thickets (Figure 16). According to the expert assessment of ornithologists there are 1200-1500 heads of this species in the Reserve. The Reserve is a kind of genetic reserve of this species of pheasant for distribution throughout the Vakhsh valley and in general southern regions of the republic.



Figure 163 Female black-and-gold pheasant (*Phasianus colchicus bianchii*) in Palvontugaya tract, photo from camera trap (N. Saidov)

The bird population of old lakes half overgrown with reeds and cattails is quite diverse. Large and small grebes nest here. Nests of mallard (*Anas platyrhynchos* L.), broad-billed duck (*Anas clypeata* L.), red-nosed duck (*Aythya rufina* Pall.), herons (*Egretta alba* L.) and other birds are found here.

Little Cormorants (*Microcarbo pygmaeus* (Pallas)), Red-headed Ducks (*Aythya ferina* L.), Tufted Ducks (*Aythya fuligula* (L.)) winter on ice-free lakes. Mallards (*Anas platyrhynchos* L.), gray ducks (*Anas strepera* L.), teal (*Anas crecca* L.), cackling ducks (*Bucephala clangula* (L.)), harriers (*Mergus albellus* (L.)), great mergansers (*Mergus merganser* L.) are common. Gray (*Ardea cinerea* L.), small (*Egretta garzetta* (L.)) and great (*Egretta alba* L.) white herons can be found in coastal reeds. On the lakes and channels of the left-bank part of the Reserve a large number of waterfowl of commercial birds winters, and almost half of their total number are coots (*Fulica atra* L.) and diving ducks (*Aythya rufina* (Pall.)). As of today, from 7 to 28 thousand birds winter in the reserve annually.

The avifauna of sandy and clay semi-deserts of the Reserve is relatively poor. In the sandy desert one can meet the spinnery warbler, some diurnal species of birds of prey, occasionally one can meet the red-breasted bustard or the jack, which has become a very rare species. In the grass and saltwort desert – *Buteo rufinus*, occasionally Crested Larks, single individuals of the Steppe Kestrel. The species diversity of the semi-desert lowlands of Khoja-Kaziyon is also poor. The desert barn owl is a rather constant inhabitant of these places. Summer avifauna of the Reserve is relatively poor. There are about 60 nesting species of birds.

In total, more than 240 bird species nest, winter and migrate in the Reserve (Nomination Dossier, 2021). Local sources indicate the presence of 55 rare, threatened and endangered bird species occurring in the Reserve (Rakhimov, 2021; Nomination Dossier, 2021), however, an independent peer review by IUCN in the process of nominating the Reserve for inclusion in the list of World Natural Heritage sites revealed that only 9 threatened bird species can be found in the Reserve (IUCN Evaluation Report - April 2023). Thus, the available documentation on biodiversity of birds and other species does not adequately reflect the actual situation of species diversity and needs to be revised (*Table 7*).

Table 7 Quantitative characteristics of wintering birds of the "Tigrovaya Balka" Reserve according to annual bird surveys (by groups)

Squad	Number of species	Numbers	%
1. Crane-like	5	70 272	41,4%
2. Passerines	40	47 706	28,1%
3. Geese	13	43555	25, 6%
4. Paddlefish	4	3641	2,1%
5. Plovers	10	2344	1,4%
6. Chicken	3	715	0,5%
7. Grebes	4	461	0,3%
8. Birds of prey	17	437	0,2%

9. Pigeoniformes	5	308	0,2%
10. Long-legged	3	115	0,07%
11. Crustaceans	2	34	0,02%
12. Woodpeckers	1	7	0,005%

2.8 Cultural specificities

The territory of Khatlon province has a rich ancient history and many preserved historical and cultural monuments. Only in the areas close to the reserve there are the following historical-natural and historical-cultural monuments of interest not only for archaeologists, but also for the majority of residents and pilgrims:

- The holy spring "Chiluchor chashma" (44 springs), located in the desert 12 km from the district center of Shakhritus settlement. It is the most visited place not only by pilgrims, but also by many people throughout the year. It is believed that the water in the springs has healing powers. The water is drunk and there are places for ablution or bathing.
- Ancient settlement "Takhti Sangin" (Oksa Temple), located 34 km from the district center of Kabadiyan settlement. It is believed that it was erected in the Kushan era of the III-IV centuries BC by Alexander the Great. Frescoes with bas-relief of Alexander the Great were discovered in the temple.
- The mausoleum "Khoja Masad" dates back to the IX - X centuries and is located near the regional town 12 km from Bokhtar.
- Ajina Tepa Buddhist Monastery, located 12 km from the town of Bokhtar.

SECTION 3. SOCIO-ECONOMIC CONDITIONS

3.1 Administrative division

Administratively, the "Tigrovaya Balka" Reserve is located in the territory of Jayhun, Kabadiyan, Shakhritus and Dusti districts, 60 km from the regional center of Bokhtar and 9 km from the district center of Jilikul settlement. The Reserve is located near the state border with Afghanistan.

The population of Jaihun district as of January 1, 2022 is 144.8 thousand people, the area is 967 km².

As of January 1, 2022, the population of Kabadiyan district is equal to 200.1 thousand people and the area is 1834.4 km².

The population of Shakhritus district as of January 1, 2022 is 141.1 thousand people, the area is 1525 km².

As of January 1, 2022, the population of the Dusti district is 125.7 thousand people, the area is 1 236.2 km².

Over 611.7 thousand people live on the territory of 4 administrative districts close to the Reserve. The total population in the vicinity of the Reserve's territory is more than 143 thousand people. The predominant age group is the population aged from 15 to 60 years (about 60%), followed by the population aged from 0 to 15 years (children) - about 35% and the population aged over 60 years - about 5%. The average number of people in a family is 5.5.

3.2 Socio-economic potential around the territory of the Tigrovaya Balka SPA

The population living around the Reserve is multi-ethnic. The population of Kabadian, Shakhritus, Jaihun and Dusti districts is mainly engaged in agriculture. During Soviet times, all arable irrigated lands were almost completely occupied by cotton. Since 1995, the population has gradually shifted to grain and vegetable farming. In Soviet times the population was supplied with coal, gas and electricity. Until 2000 coal was practically not imported, now it is imported at an affordable price (1 ton of coal costs 118 \$US).

The following groups of resources should be attributed to the natural resources of the Reserve's territory that have economic value in the first place:

1. Land resources
2. Water resources
3. Pastures
4. Fruits and medicinal herbs
5. Other resources

The use of land is the main source of income for the local population, so from the economic point of view it should be referred to the most important resource of the studied territories.

- Development of tourism infrastructure
- Creating conditions for scientific and ecological tourism in the vicinity of the reserve
- Taking measures to improve land productivity and its condition
- Prevention of land erosion
- Relioration measures and improvement of land condition
- Development of agricultural products sales network
- Improvement of seed quality
- Training of local population in modern methods of cultivation of agricultural lands

-Provision of agricultural fertilizers and agricultural machinery

About 90% of the population is engaged in agricultural activities. As in the whole of Tajikistan, the demographic trend shows rapid population growth due to still high birth rates. One of the main reasons for the high birth rate of the population is the way of life in villages and existing traditions, which causes active involvement of children in a wide range of economic activities related to nature management, such as firewood collection, grazing, cultivation of agricultural land, etc. and the result is the perception of children as the main helpers in households.

Modern economic difficulties have resulted from the decrease in state support for the population and the increase in the poverty level of the rural part of the population, which also takes place in the territories close to the reserve. Agricultural production and, first of all, cotton, grain and vegetable growing is the basis of the economy in the area. In addition, livestock rearing is an important component of the rural economy.

3.3 Economic activity of the population

Various types of economic activities in which the population of the territories close to the Reserve is involved are directly related to the issues of sustainable conservation of the Reserve's natural resources. On the other hand, the regulation of economic activities of the population should be carried out very carefully, as it is expected that in this very issue the population may be less willing to abandon some established traditions and show negative reactions.

All types of economic activities of the population of the territories close to the reserve can be conditionally divided into three groups:

1. Types of economic activities that have a negative impact on the protection and sustainable use of natural resources of the Reserve (cutting of forest resources for firewood, fishing, hunting). It is recommended to strengthen control and tighten administrative measures with regard to such activities in order to prevent negative impacts
2. Activities that do not have a negative impact, but due to the methods used have a negative impact on the state of natural resources. These are collection of medicinal and food plants and grazing of livestock. With regard to such activities it is recommended to change the methods of natural resources utilization in order to reduce their negative impact.
3. Types of activities that are poorly developed on the territory of the districts, which do not have a negative impact on the state of natural resources and may have a positive effect. With regard to such activities, measures are recommended for their development to involve the population of jamoats.

3.4 Personal income and standard of living

The majority of the population is employed in agriculture, while a smaller part is employed in industry, science and culture, private entrepreneurship, construction, trade, administration and services. These indicators are currently relative, because due to instability of production, financial difficulties, a significant part of the working population is actually unemployed and goes to work in non-CIS and CIS countries.

Socio-economic analysis of the Reserve's territory indicates that the average annual income of families living in this region (excluding migrant earnings) is 2,500 to 5,000 somoni (US\$227-450). This amount is insufficient to support family members, buy fuel and energy resources, pay for electricity, buy clothes and meet other household needs.

It should be noted that due to the unwillingness of the population to disclose all sources of income, as well as due to the existence of other specific aspects of economic activity, the results

of the study on income can be very contradictory. First of all, additional income is formed at the expense of labor migrants, and accurate statistical data are not kept.

According to the collected information, the majority of the population on the territory of the Reserve is employed in farms and own farms. The structure of gross incomes of the population can be determined approximately. It can be concluded that the population's income consists of monetary incomes received by the population in the form of pensions, salaries and other monetary state payments, as well as other economic benefits that the population receives from various types of farming: cotton farming, vegetable growing, grain farming, potato farming and livestock farming, as well as beekeeping and some other incomes (primarily, incomes of labor migrants).

The low standard of living is complemented by the problem of delivery of agricultural products to the markets due to the lack of a system of procurers, low purchase price of single wholesalers. Because of this, the population is forced to sell their products at very low prices. The State is taking measures to improve the socio-economic situation of the population in each district. Each family is allocated a homestead plot (vegetable garden) and an additional plot of land for personal use.

It is necessary to emphasize the acute problem of recent years - lack of energy resources in the region. Lack of electricity has a negative impact on the quality of living standards of the population. This is what forces the population to cut down trees and shrubs, including in the nearby territories of the reserve. The entire area near the reserve is agrarian. Due to insufficient water for more efficient farming, salinity of soils, insufficient production facilities and other activities, people use the reserve to improve their economic situation. A summary table of the main problems and economic aspects in Dusti, Kabadiyan and Jaihun districts is given in *Annex 5*.

SECTION 4. ADMINISTRATION AND RESOURCES OF THE TIGROVAYA BALKA STATE PARK

4.1 The staff composition of the Tigrovaya Balka SNR as of 2024 is presented in Table 8.

Table 8.

According to the staffing table	Actual	
	Total	Including those with higher education
Total number of employees of SNR TB		
57	57	5
Guideline		
3	2	2
Heads of subdivisions of the SNR TB		
3	3	3
Chief specialists		
3	3	3
Leading specialists		
3	3	3
security personnel of SNR TB		
45	45	3
Accounting and planning staff		
2	1	1
Service personnel		
15	15	3

4.2 Financial support for the activities of SNR TB.

The structure of funds received to support the core activities of SNR TB according to the data for 2024 is presented in Table 9.

Table 9.

Funding source	In somoni
Funds received from the state budget of the Republic of Tajikistan	
Including: Salaries and wages of employees of SNR TB	629,805.00
Household goods	4,500.00
Fuel consumption (gasoline, diesel)	12,000.00
Building renovation	1,500.00
Expenses for economic needs	8,000.00
Expenses for utilities and heating	3,000.00
Annual biotechnical activities	12,000.00
Expenses for internet services	4,000.00
Total:	674,805.00

4.3 Infrastructure of SNR TB

The infrastructure of SNR TB is currently insufficient.

Table 10.

Name	Quantity	Condition
Buildings:		
TNP administration office	1	The main office of the SNR TB administration is located in Dusti district of Khatlon province. Gamekeeper offices and posts in Jaihun, Dusti and Kabadiyan districts
Toyota Rav 4x4 cars	1	New
Fire engine	1	New
Tractor DT 75	1	Working
Telephones - office	1	Working
Mobile	All employees	
Uniform	Availability of 70%	
Weapons	-	-
Binoculars	2	Working
Computers	3	Working
Digital camera	1	Working
GPS navigation device	1	Working
Camera trap	3	Working
Drone	1	Working

4.4 Key stakeholders, excluding SISPNA, are summarized in Table 11.

Table 11.

№№	Stakeholders
1	Committee for Environmental Protection under the Government of the Republic of Tajikistan
2	Ministry of Economic Development and Trade of RT
3	Ministry of Foreign Affairs of Tajikistan
4	Committee for Tourism Development under the Government of the Republic of Tajikistan
5	National Academy of Sciences Tajikistan
6	Local executive authorities
7	Local population living around the SNR TB
8	International environmental organizations

The protection of the SNR TB and its protection zones is carried out by state inspectors permanently residing directly on the territory of the reserve, as well as by employees of nature protection departments of the districts of Khatlon region surrounding the reserve.

The main types of violations are illegal hunting and fishing, illegal presence and travel within the reserve.

Scientific research and ecological monitoring in the territory of the SNR TB are organized and carried out by staff members together with scientists of NAST according to approved joint plans during the year. Mainly, scientific works include: counting and condition of wild animals, birds, phenological observations of plants, determination of food reserves, time of arrival and departure of birds.

Environmental education activities are carried out by the Reserve's staff and the Department of Science and Environmental Education of the SISPNA with the involvement of POs and international organizations.

SECTION 5. PRESSURES AND THREATS

Many of the pressures on the Reserve's ecosystems were formulated in the Nomination Dossier for the subsequent inscription of Tigrovaya Balka as a UNESCO World Heritage Site. During the development of this document, as well as through field visits and consultations of the working group, new threats and pressures were identified that relate specifically to the conservation and protection of the Tigrovaya Balka Reserve.

5.1 Development of industry and agriculture (soil salinization and change of hydrological regime of the territory)

Economic pressure on the existing ecosystems of the Reserve is associated with the development of agriculture and livestock breeding in the adjacent territories. Outside the Reserve, the foothill ecosystems are mostly plowed and turned into agricultural land (Figure 17).

Low elevation ecosystems are also anthropogenically impacted and utilized as winter pastures, with areas and water levels decreasing during the summer months.

The territory of the Tigrovaya Balka Reserve is almost completely surrounded by fields located on higher terraces. The tugai was influenced not only by the Vakhsh River, which previously formed the regime of floodplain terraces, but also by numerous irrigation facilities of surrounding agricultural farms, which complicated the dynamics of both surface and subsurface runoff. One of the central tasks of the Reserve is to solve the problem of secondary water regime formation on the Reserve's territory under the influence of anthropogenic factor.

Due to regulation of the Vakhsh River flow by hydroelectric power plants, the water level in the river has fallen. The problem of dehydration of large areas appeared due to the absence of floods. Floods in the Vakhsh played another positive role. Floods covered vast areas with water during the period of the most intensive evaporation (July-August), thus preventing salinization of the territory, and during the recession of floods, the water carried away excess salts with surface and groundwater.

This threat, together with the release of wastewater from agricultural fields, was identified by IUCN as the main threats to natural resources in the independent assessment of the nomination of Tigrovaya Balka for inscription on the UNESCO World Natural Heritage List (IUCN Evaluation Report - April 2023). However, if technologies to improve the efficiency of water use for irrigation purposes in the vicinity of the reserve are installed and the water flow regime of existing dams is carefully considered to normalize the hydrological regime, such conditions will ensure long-term conservation of natural resources, while the relatively small area of riparian forests will be able to adapt to changing conditions. Since 2016, there has been a 50% reduction in water consumption for irrigation purposes. It is therefore very important to prevent any future modifications to the river (such as the construction of additional dams in the upper reaches of the reserve), as such modifications will exacerbate threats to the water resources of Tigrovaya Balka (IUCN Evaluation Report - April 2023) (*Figure 18*).

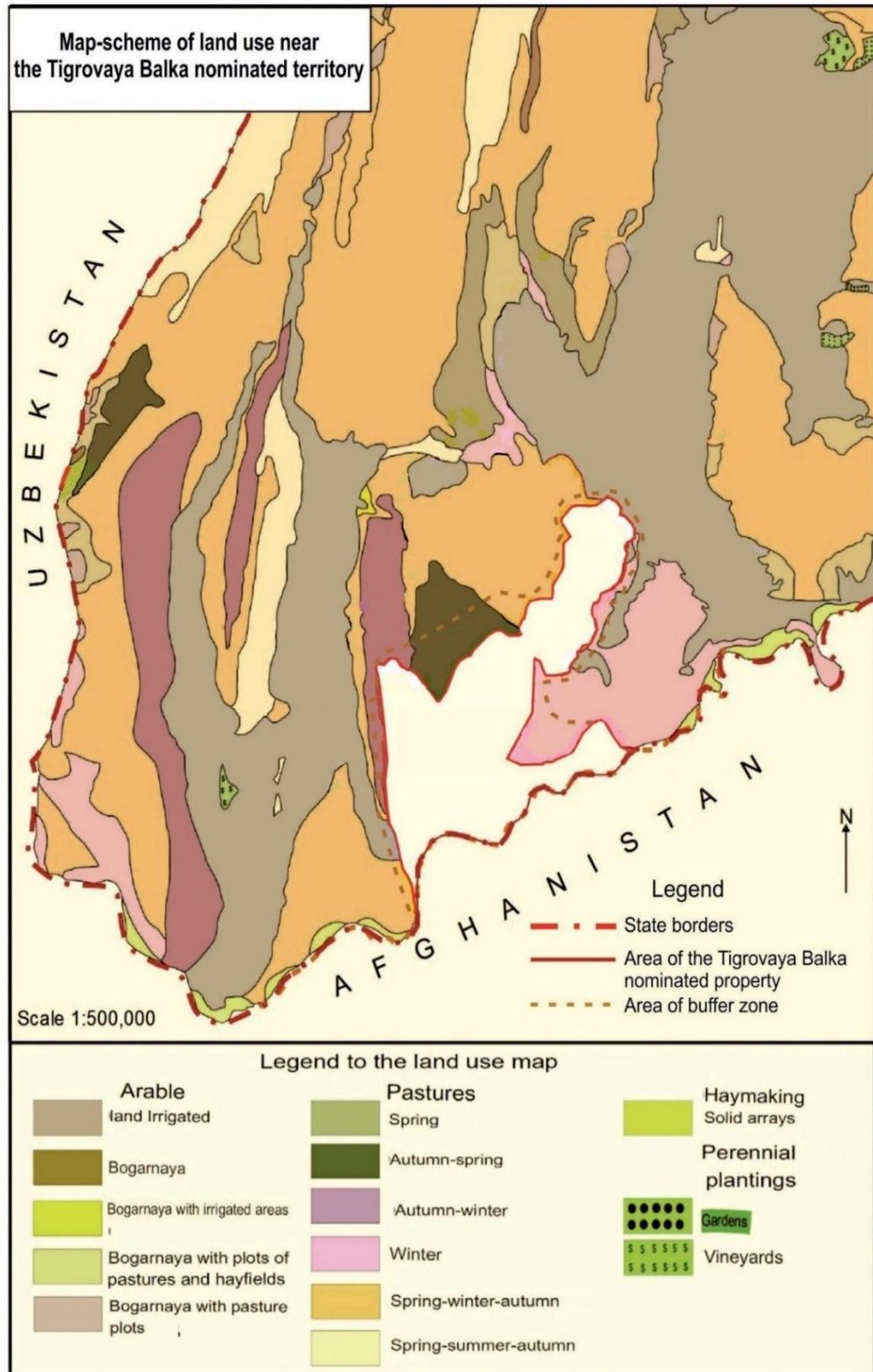


Figure 174: Land use around the Tigrovaya Balka SNR area (Nomination Dossier, 2021)

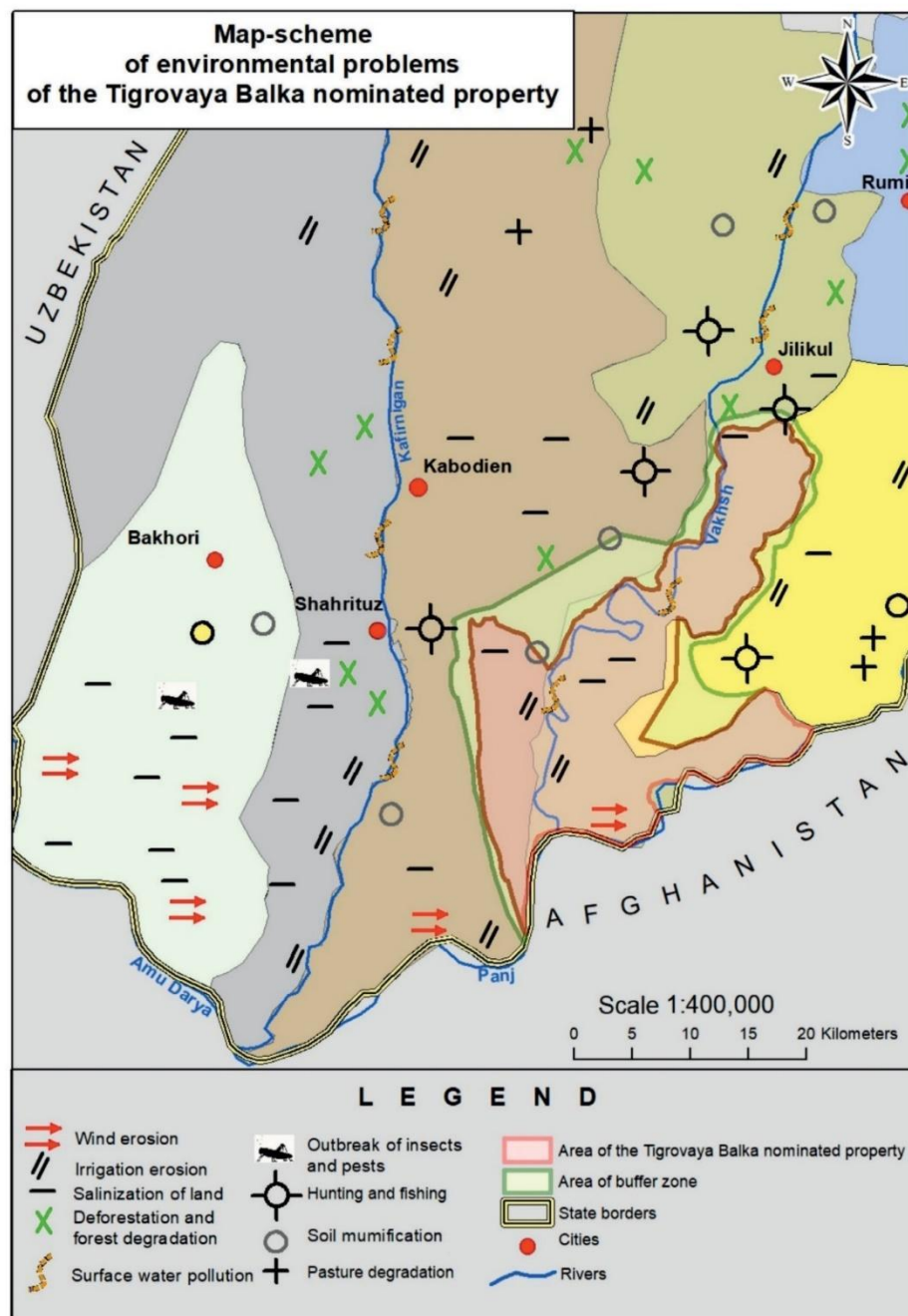


Figure 5: Schematic representation of environmental issues around the Tigrovaya Balka SNR (Nomination Dossier, 2021)

5.2 Lack of assessment of existing water use, as well as the absence of systems for monitoring the degree of mineralization of discharge water in the buffer zone of the Reserve

In order to use irrigation canal waters to improve water availability in the reserve, it is necessary to assess the existing water use, determine the possibility of reducing water losses and saving water during land irrigation, as well as the possibility of water resources transit to the reserve. The unregulated discharge of wastewater from agricultural lands and the associated release of pesticides into the Reserve's water bodies pose a definite problem. Currently, the impact of these substances on riparian inhabitants is decreasing. Nevertheless, pesticide pollution of water bodies leads to deterioration of the ecological situation and affects the fish food base. Addressing the runoff problem is one of the central objectives of the Tiger Balk management

plan. The problem can be fully solved only with simultaneous solution of environmental problems of the whole region where the Reserve is located.

5.3 Lack of monitoring systems for water horizons in large lakes

It would seem that a characteristic feature of the water regime of the lakes is a sharp fluctuation of water level in them during the year, depending on the water level in the Vakhsh and the position of the river channel in relation to the lakes. This was the case before. However, in recent years, the water level in the Vakhsh River has been decreasing and the lakes are mainly filled with discharge water from agricultural fields. The abundance of underwater and above-water vegetation indicates the ongoing process of waterlogging. Against this background, some lakes dry up seasonally and their shores turn into swamps.

In 2010, the Reserve's staff cleaned the canals, as a result of which the water level in Halka-Kul Lake rose by 4.5-5 meters. In recent years, the water level in the lake has dropped to 4 meters due to overgrowing of channels and streams with vegetation. The most important condition for preserving the viability of the hydrobiont population of the Reserve is the regulation of lake water levels.

5.4 Lack of monitoring systems for groundwater level regime within the Reserve 5.4.

Another problem is the rise of groundwater level in the areas of the Reserve adjacent to developed and developed irrigated lands. Intensive irrigation leading to groundwater table rise occurs in May-September, i.e. in the period of strong evaporation, which entails the process of secondary salinization, therefore it is necessary to perform artificial drainage of the territory.

At present there are no monitoring points on the territory of the Reserve to observe groundwater regime, therefore it is necessary to develop a network of monitoring wells at the rate of one well per 400 ha (155 wells in total).

5.5 Invasive species in water bodies

In terms of fish fauna, the main problem is the presence of a predatory fish, the snakehead, which entered the waters from China many decades ago. It is now a major threat, being an invasive species, as it destroys fish fry of the local fauna. There is a biological method to control this species by breeding fish species that are its natural enemy in the areas where it spreads.

5.6 Excessive and unregulated grazing of livestock

The total area of pasture lands on the territory of the Reserve is 3.664 thousand hectares. Natural pastures and hayfields are a source of cheap fodder production and are of great importance in the development of livestock breeding in the district. In addition, they are the most valuable gene pool for breeding and introduction of new species and varieties of fodder plants necessary for the restoration of fodder land productivity.

With the established norm of grazing of one head of cattle - 1 ha, 0.5 ha for cattle and 1 ha for horses, the actual load on the existing pastures does not exceed the permissible norm. However, the practiced excessive and unregulated grazing impoverishes and reduces the species diversity of grassy vegetation of rangelands. Especially medicinal, valuable technical and food plants suffer from overgrazing. Due to trampling by cattle during the period of seed ripening, plants are deprived of the possibility of natural reproduction. At the same time, weeds and poisonous species of plants clog pastures.

Due to unsystematic use of pasture lands and long-term absence of measures to restore their productivity, such processes as the depletion of pasture resources, pressure on biodiversity,

up to the disappearance of rare plant species, desertification of the most actively used territories are intensifying every year. Degradation of pasture lands is especially progressing on mountain slopes.

As anthropogenic impact on natural forage lands increases and the number of domestic animals in the Reserve and buffer zones constantly increases, the forage base and habitats of wild animals are deteriorating, thus leading to a decrease in their numbers, especially herbivores (gazelle and Bukhara deer).

5.7 Anthropogenic factor (illegal logging, high poverty rate, low environmental awareness)

A significant number of the population of the Reserve's territory is poor due to the lack of income, food and fuel; as a result, the population actively uses land and other resources of the Reserve. Lack of jobs, demographic growth, which is typical for the country as a whole, leads to increased environmental pressure on natural resources - grazing, illegal hunting, cutting of forests, collection of plant resources. For neighboring kishlaks, the reserve is a source of additional income, fuel resources, hunting and a place for recreation. In recent years, illegal mass felling of tree and shrub vegetation caused by the energy crisis and socio-economic problems has been revealed. It is worth noting the low level of environmental awareness and education of the local population.

There are resources within the Reserve that can affect the socio-economic status of the local population. The most important such resource is tourism. Given the unique nature of the Reserve, the buffer zones of the Reserve are of interest for scientific and ecological tourism. However, the use of these mechanisms is possible only after the functional zoning of the Reserve's territory.

The 2011 Law of the RT "On Specially Protected Natural Areas", which regulates the activities of the "Tigrovaya Balka" Reserve, does not provide for eco-tourism as a permitted activity within the Reserve, which may represent a barrier to the development of this activity, thereby limiting opportunities for the involvement of the local population in the Reserve's activities.

The Ramsar Convention has a long-standing commitment to the full and effective participation of indigenous peoples and local communities in wetland management. The Ramsar Convention calls on its member countries to promote and strengthen the active participation of indigenous peoples and local communities as key stakeholders in the conservation and integrated management of wetlands (Resolution XII.2, paragraph 19). Also, the UNESCO World Heritage Convention calls on participating countries to "promote the management and development of sustainable tourism at World Heritage sites by fostering awareness, capacity building and balanced participation of all stakeholders to protect the sites and their outstanding universal value"². Whereas "one of the central objectives of the Convention is to enhance the role of local people in the implementation of the Convention and encourage their participation in the conservation of their cultural and natural heritage".³ The creation of programs that promote conservation of natural resources of the WL with the involvement of local communities (such as ecotourism and others) will not only be an additional source of income, mitigating anthropogenic negative impacts, but will also directly fulfill the prescriptions of the Ramsar Convention and the UNESCO World Heritage Convention.

² <https://whc.unesco.org/en/tourism/>

³ <https://whc.unesco.org/en/compendium>

5.8 Environmental pressures (pollution, climate change, desertification)

With the ongoing global climate change and increasing desertification of the Pamir-Alai territory in the coming years, there is a high probability that the number of springs will decrease, channel processes will change and seasonal rivers will dry up. In the future, natural ecosystems may slightly change their boundaries. It is expected that water availability in the territory will decrease due to a decrease in surface runoff. It is also expected that extreme weather events, including mudflows and heavy rains in the spring season, and soil drought at the end of the summer-autumn season, will intensify and become more frequent. Under these conditions, negative consequences will be aggravated by the fact that the norms and rules defining the existing regime of the Reserve are not adapted to the ongoing natural and climatic changes.

The processes threatening ecosystems and their resources are associated with intensification of desertification, deterioration of growing conditions due to changes in temperature regime and deterioration of moisture redistribution by vegetation cover, as well as increased soil degradation:

- gradual change of vegetation towards more adapted to moisture deficit;
- replacement of productive semi-savannah, meadow and meadow-steppe communities by deserted ones;
- simplification of community structure and reduction of floristic diversity;
- reduction of protection and anti-erosion function of grass cover and increased erosion;
- possible spread of diseases and plant damage caused by lack of moisture;
- Increased impact of extreme weather events (dust storms, wind, mudflows, avalanches, etc.) on flora and vegetation;
- emergence of aggressive and weedy plant species not previously characteristic of the area.

5.9 Natural disasters and risk preparedness (fires)

A serious threat to the Tigrovaya Balka Reserve is posed by fires in both riparian forests and reed beds, especially in the floodplains of the Vakhsh and Pyandj rivers, where large areas are occupied by reed beds. Most fires are caused by careless handling, especially during the hottest summer months. Reeds, elm, willows, Asian poplars are the most exposed to fire danger, as they become easily flammable and are excellent combustible material. Due to the underdeveloped technological infrastructure of forestry and the lack of fire-fighting equipment, the damage from forest fires can be significant, although the number of fires is usually small. The territory of the Reserve belongs to the highest class of fire flammability, and at the same time the Reserve is not provided with necessary fire fighting means - motor pumps, fire extinguishers, technical means, means of observation and communication, necessary stock of fuel and lubricants, etc.

The Reserve has a fairly extensive network of unpaved roads. Practically any district or quarter of the reserve territory can be accessed by road at any time of the year. The Reserve's roads are primarily intended for fire protection. Fire, so-called mineralized strips, have a total length of 90 km and are ploughed every year during the fire-dangerous season. There are 4 fire observation towers on the territory of the Reserve.



SECTION 6. TIGROVAYA BALKA SNR MANAGEMENT

This section provides a description of the management system within the Tigrovaya Balka Reserve, focusing on the reserve's structure, management and legislative framework.

6.1 Structure of the Tigrovaya Balka SNR

The protection and management of the WL is carried out by the State Nature Reserve, which is subordinate to the Committee for Environmental Protection under the Government of the Republic Tajikistan (CEP). The Reserve is headed by a director appointed by the Director of the SPNA with the consent of the Chairman of the CEP.

The structure of the State Nature Reserve "Tigrovaya Balka" consists of 7 working positions, namely: director, deputy director, chief specialist (chief forester), chief specialist-accountant, 2 leading specialists and specialist. Staff salaries range from 739 somoni (\$68) to 1261 somoni (\$115). The technical and service staff consists of 50 people. The Director is fully responsible for the Reserve's activities, ensures compliance with the law, state discipline and fulfillment of approved plans.

Protection of the Reserve is carried out by a special inspector service, which is a part of the Reserve staff and is headed by the Director. The Director of the Reserve is the main state inspector for nature protection on its territory. Protection of the Reserve's territory and observance of its regime is carried out by methods:

- daily rounds;
- forest guards (by gamekeepers);
- raid patrols.

Protection of forests from fires is carried out by the Parks Fire Department, which has fire-chemical stations provided with machinery and equipment in accordance with the established norms. The reserve has an office, a museum, an information center, a garage for fire-fighting equipment and 11 gamekeeper cordons: Daryokul, Hutalon, Tarzan, Hunting, Central, Royal, Turkmenmazor, Namuna and 3 in Pavlan tugay, where gamekeepers live. The gamekeepers keep watch every day and are on duty 3 days a week in the gamekeeper cordons in rotation. The staff is sufficient to manage and protect a relatively small reserve.

The developed "Management Plan for the Tigrovaya Balka State Reserve and adjacent area for the period 2025-2029" defines specific protection measures, scientific research, condition monitoring, conservation, environmental education and interaction with local communities, timeframes for their implementation, participants, and sources of funding. The Reserve's management plan covers the broader landscape and addresses threats from adjacent areas. The reserve is financed from the state budget (Environmental Protection Committee). The 2021 nomination dossier shows that the Reserve's budget is growing.

It is prohibited (according to the law on SPNA) on the territory of the Tigrovaya Balka Nature Reserve:

1. Activities that threaten the existence of natural complexes and protected historical and cultural sites;
2. Exploration and mineral development;
3. Cutting of trees, shrubs, haphazard use of flora and fauna;
4. Activities of enterprises that pose a special environmental hazard;
5. Actions that alter the hydrological regime;
6. Construction of trunk roads, pipelines, power lines and other communications not related to the Reserve's activities;

7. Placement of living organisms for the purpose of acclimatization.

In accordance with the Regulation on the Reserve "Tigrovaya Balka" it is allowed to carry out works that do not contradict the objectives of the nature protection activities of the Reserve, namely:

1. Implementation of measures to restore natural complexes disturbed as a result of anthropogenic impact;
2. Carrying out research works aimed at preserving biodiversity in the protected area;
3. To carry out fire prevention and sanitary measures necessary to preserve and improve the condition of natural complexes. In doing so, apply biological methods of controlling forest pests and diseases;
4. Biotechnical measures (planting of tree species natural to this ecosystem, clearing of watering holes, arrangement of feeding grounds, laying out salt pans, etc.).

6.2 Zoning

The reserve consists of 5 technical zones:

- technical zone No. 1 consists of 3 sections and 6 blocks, total area 3278 ha.
- technical zone No. 2 consists of 3 sections and 5 quarters, total area 2864 ha.
- technical zone No. 3 consists of 3 sections and 4 blocks, total area of 2620 ha.
- technical zone No. 4 consists of 12 sections and 29 blocks, totaling 26083 hectares.
- technical zone No. 5 consists of 3 sections and 20 blocks, total area 14941 ha.

The reserve is regulated by the Law of the RT of 2011 "On Specially Protected Natural Areas", where the definition of "reserve" means "a territory or water body, completely withdrawn from economic activity, aimed at preservation and study of typical and unique natural complexes, gene pool of plants and animals, monitoring the dynamics of natural processes and phenomena". Local self-government bodies have no jurisdiction except for the buffer zone. According to the law, the purpose of the buffer zone is to prevent or minimize negative impacts on protected areas (*Figure9*). Its size and management regime are determined by the authorized state body.

The 2011 RT Law allows "limited agricultural activities" but prohibits most other land uses in the buffer zone of the PA. The Reserve Buffer Zone is intended to minimize the impact of agricultural development outside the Reserve boundary. The 2011 law establishing the reserve buffer zone prohibits hunting, fishing, tree cutting, and "irrigation works resulting in alteration of the hydrological regime and drainage of wetlands" (IUCN Evaluation report - April 2023). Thus, the law restricts agricultural activities around the reserve.

Buffer zone

At present, the State Nature Reserve "Tigrovaya Balka" is directly adjacent from four sides to the dekhkan farms of Dusti, Jayhunsky, Kabadiansky and Shaartuzsky districts, the territory of which is a buffer zone of the reserve.

6.3 Review of hydrological works carried out

In 2005, the Committee for Nature Protection and Forestry together with WWF and PO "Kuhiston" Foundation with the participation of specialists from the Ministry of Water Resources of the Republic of Tajikistan conducted studies of the water regime of the Reserve's lakes to substantiate the project on restoration of water supply. As a result, it was determined that the required water supply to the lake system in the southern part of the Reserve is 51 million m³ per year.

At the end of 2005, with WWF financial support, work was carried out to clean the water supply channel into Lake Khalkakul (Korolevskaya Dacha cordon). As a result, the lake, which had dried up to puddles, was returned to its natural state. In 2006, work was also carried out on construction of a drain to discharge water from wetlands to the north of the Pozharka cordon into Lake Kulikovskoye. At the same time, engineering and technical measures were taken to construct a new sluice on the water supply channel of Lake Tukhloye - Khudaykul channel. A canal for emergency water discharge from the Khudaykul channel into Lake Balabanovskoye was constructed near the Tarzanie cordon.

The measures taken to improve hydrological conditions had a positive effect, but in 2007, when the reservoir of the Sangtuda HPP was filled and the water level of the Vakhsh River decreased, the groundwater supply to the lakes decreased. This caused a drop in the level of Daryakul Lake and, accordingly, in all downstream lakes of the Reserve. Hydrological studies were conducted in 2007 at the request of WWF, which led to the development of a set of measures for water supply of the Reserve's lake system and preservation of its natural ecological landscapes.

In 2023, with the support of CEPF-WWF, the project on restoration of natural state of lakes of the Tigrovaya Balka SNR was also implemented, during which the following activities were carried out: repair of 2 sluices on the main bypass canal in Poyoni Mazor village and up to the Kirpichny lake; cleaning of ponds and restoration of sluices and watering of 5 lakes: Kirpichny, Turkmenmanzor, Shurkul, Jilikul and Malebny. The watering condition of the lakes is good and there is an increase of water level in bypass channels and lakes. It is also planned to purchase equipment, fire-fighting transportation and field equipment.

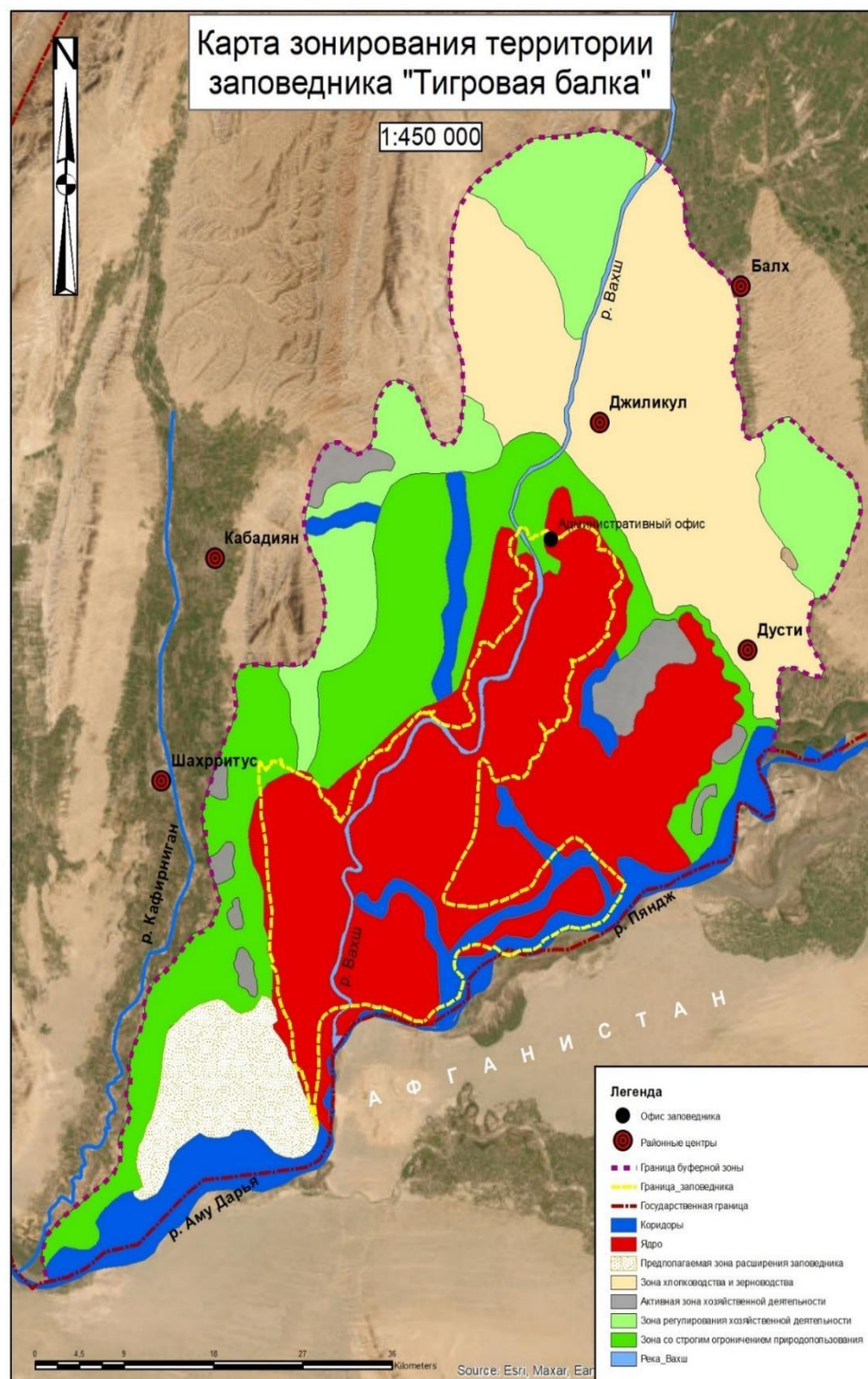


Figure 19: Tigrovaya Balka zoning map

SECTION 7. OBJECTIVES OF THE MANAGEMENT PLAN RESERVE FOR 2025-2029 AND THREATS

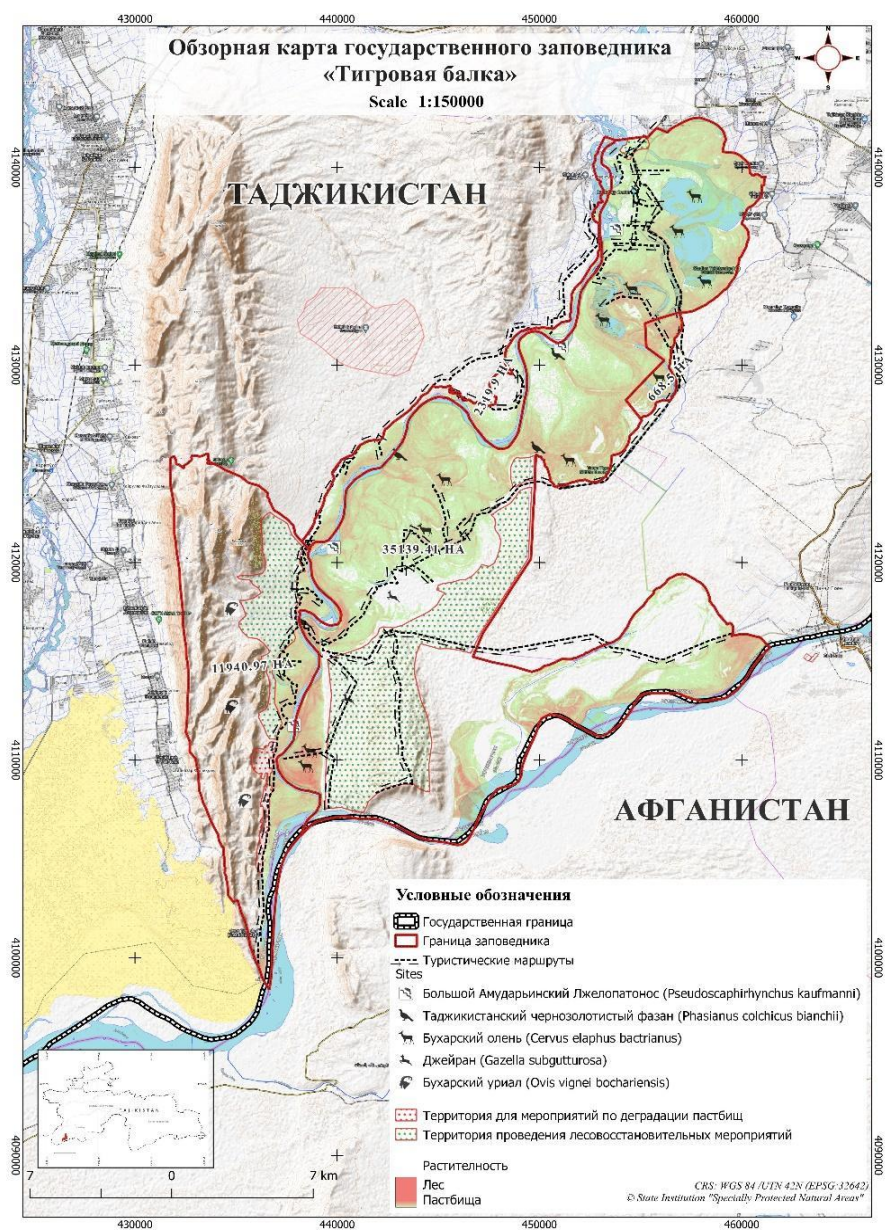
The main objective of the MP tasks is to prevent or minimize the identified threats in the implementation of the activities of the SNR TB management plan (*Table 12*). Given the importance of preserving and preventing degradation of natural ecosystems in the territory of the Tigrovaya Balka State Nature Reserve, a management plan for 2025-2029 was specifically developed.

Table 12: Ratio of challenges to identified threats in MP 2025-2029.

№	Task	Addressed threat
Task 1	Maintaining and improving the ecological condition of the Reserve through the implementation of conservation measures and activities aimed at preserving biodiversity and restoring the environment, implementation of permanent monitoring.	Threats 1, 2, 3, 4, 5
Task 2	Carrying out organizational measures to improve the condition of natural ecosystems and implementing fire prevention measures.	Threat 9
Task 3	Organization of research works in the Reserve with the participation of Research Institutes and leading scientists of the country's universities	Threat 2
Task 4	Environmental monitoring of the state of natural ecosystems of the Reserve and adjacent territories (buffer zone).	Threats 3, 4, 5, 6
Task 5	Advanced training of scientific personnel and specialists in the field of environmental protection	Threats 2, 8
Task 6	Carrying out eco-educational work with the population, eco-propaganda and development of cognitive excursion visit of specially prepared eco-educational routes strictly in the buffer zone of the Reserve.	Threat 7
Task 7	Agriculture. Objective - to improve the efficiency of land resources utilization	Threats 1, 6
Task 8	Development of alternative energy sources	Threat 7
Task 9	Improvement of forest resources and biodiversity in the territories of the areas adjacent to the Reserve	Threats 7, 8, 9
Task 10	Ensuring access to clean drinking water	Threats 1, 7, 8

7.1. Plans for reforestation and degraded pastures in SNRTB

Within the framework of the "Tajikistan Sustainable Landscape Restoration Project (TSLRP) (P171524)" funded by the World Bank under the RESILAND CA+ Program, reforestation and degraded pastures for biodiversity conservation will be carried out in the Tigrovaya Balka Reserve and adjacent buffer zones to the Reserve. The area for reforestation and degraded pastures in the Reserve is given in the developed map 4. The map data shows that within the framework of the TSLRP project, reforestation and degraded pastures in the Reserve will be carried out on an area of more than 5000 ha during 2025-2027. The forest areas of the Reserve are shown in *Figure 20*.



Map 4: Area for reforestation measures and degraded pastures in the SNR TB



Figure 20: Vakhsh River in the central part of the Tigrovaya Balka Reserve (photo by N. Saidov)

SECTION 8. TIGER BALK RESERVE MANAGEMENT PLAN 2025-2029 (FOR A PERIOD OF 5 YEARS): MAIN MANAGEMENT OBJECTIVES AND THREAT PREVENTION ACTIVITIES

BLOCK 1. RESERVE ACTIVITIES

Program on the Reserve - "Conservation of unique ecosystems of the Reserve and its components"

Program Goal: Implementation by the Reserve of the functions of a regional nature protection, scientific, practical and propaganda center for the conservation of the region's ecosystems and their components.

Expected results: reduction of violations of the Reserve's protection regime; improvement of the efficiency and quality of inspection work; reduction of violations of environmental legislation in the region; application of rational nature management in the territories adjacent to the Reserve.

Objectives and activities	Actions	Timeline	Performer	Indicators (Expected Results)	Finance Costs, thousand somoni	Sources of funding
Task 1	Maintaining and improving the ecological condition of the Reserve by implementing conservation measures and activities aimed at preserving the Reserve's biodiversity and restoring the environment					
Activity 1.1	Improvement of hydrological regime of the territory of tugai ecosystems of the Reserve by means of measures on clearing of canals for water supply to the lakes of the Reserve with the length of 1000 m annually.	2025-2029	SISPNA, SNR TB	Volumes of work performed by year Filling of lakes with water	300.00	Donors and the State Budget
Activity 1.2	Restoration of forest saxaul plantations / care of plantings in degraded desert ecosystems annually on the area of 100 ha.	2025-2029	SISPNA, SNR TB	Volumes of work performed by year - desert lands overgrown with saxaul	250.00	Donors
Activity 1.3	Annual biotechnical measures strictly in the buffer zone (on allocated lands from Dusti, Kabadia or Jaihun districts) to improve wildlife habitats.	2025-2029	SISPNA, SNR TB	Increase in the number of valuable and rare wildlife species	100.00	Donors

Activity 1.4	Restoration of the population of rare and endangered species of fauna such as: gazelle, Bukhara deer, pheasant and red-breasted bustard by strengthening protection and breeding them in zoological nurseries in conditions close to their natural habitat. Organization of permanent monitoring of the condition of rare and valuable animal species.	2025-2029	SISPNA, SNR TB	Achievement of optimal numbers and improvement of population status of rare and valuable animal species	100.00	Donors
Activity 1.5	Carrying out biotechnical measures to reduce the number of alien species in the Reserve's lakes – snakehead (Channa argus). Creation of favorable conditions for attracting large gulk around the lakes to regulate the number of snakehead.	2025-2029	SISPNA, SNR TB	Decrease in the number of snakehead	25.00	Donors
Activity 1.6	Organization of permanent monitoring of the condition of rare and valuable plant species.	2025-2029	SISPNA, SNR TB	Annual reports	0.00	State budget
Activity 1.7	Support regeneration and afforestation of haloxylon (and other endemic species such as dove-colored leaf poplar (turanga), oleastercalligonum, etc.).	2025-2029	SISPNA, SNR TB	Area of restored riparian forests and reduction of wind erosion and improvement of water retention capacity of the territory	100.00	Donors
Task 2	Carrying out organizational measures to improve the condition of natural ecosystems and implementing fire prevention measures.					
Activity 2.1	Drawing up Operational Plans for extinguishing forest fires. Annual cleaning and plowing of firebreaks	2025-2029	SNR TB	Wildfire suppression plans. Annual reports on clearing and plowing of firebreaks	100.00	State budget and donors
Activity 2.2	Complement the pre-disaster risk assessment in the participatory process	2025-2029	SNR TB	Evaluation report	20.00	Donors

Program "Development of scientific research and environmental monitoring" Program Goal: To develop the scientific basis for the conservation and restoration of the Reserve's ecosystems Expected results: data on ecosystem components obtained; increased mobility, volume and quality of work; increased information on the state of the region's ecosystems and their components; improved ability to analyze data; more complete and better collection and analysis of information on the state and change of the Reserve's ecosystems to adjust its conservation regime.						
Task 3	Organization of research works in the Reserve with the participation of Research Institutes and leading scientists of the country's universities					
Activity 3.1	Organization and conduct of scientific research in the Tigrovaya Balka Nature Reserve 1. According to the dynamics of changes in the state of fauna and flora 2. Organization of an optimal network of permanent observation points and improvement of the primary data collection system (regularity, reliability). 3. Annual systematic observation of wild animals and the condition of their habitat. 4. Monitoring of the hydrological regime of riparian complexes and the degree of mineralization of discharge water in the buffer zone of the Reserve 5. Conducting continuous monitoring of the condition of forest ecosystems and the presence of forest pests and diseases 6. Conduct continuous monitoring in the buffer zone of the Reserve by type of land use and degree of direct negative impact on agro-ecosystems and indirect impact on the protected area.	2025-2029	SNR TB, SISPNA, NAST and other Universities of Tajikistan and CIS and non-CIS countries	Scientific reports on the conducted research on the dynamics of changes in the state of fauna, flora and landscapes of the SNR TB.	300.00	Donors and the State Budget

	7. Annual comprehensive monitoring of the Reserve's ecosystems (forest, water, swamp, desert, etc.) and agro-ecosystems in the buffer area.					
Activity 3.2	Perform a comprehensive ecological and geochemical assessment of the natural systems of the Reserve and adjacent areas.	2025-2029	SNR TB, SISPNA, NAST	Scientific reports on the conducted research on the dynamics of changes in the state of fauna, flora and landscapes of the TPZ TB	100.00	Donors and the State Budget
Activity 3.3	Keeping gamekeeper's diaries and compiling a nature chronicle of the GTZ TB	2025-2029	SNR TB, SISPNA, NAST	Annual Nature Annals for the TPZ TB	25.00	State budget and donors
Activity 3.4	Jointly with the Institute of Zoology and Parasitology of NAST to conduct research and install camera traps on wildlife sites	2025-2029	SNR TB, SISPNA, NAST	Prepared research reports	25.00	State budget and donors
Activity 3.5	In cooperation with the Forest Research Institute under the FAGRT (FRI), conduct research on the following topics: "Study of the state and dynamics of change in tugai forest complexes". "Conducting a survey and determining the current sanitary condition of forest plantations of the Tigrovaya Balka Reserve".	2025-2029	SNR TB, SISPNA, NAST, FRI	Research reports and practical recommendations produced	30.00	State budget and donors
Activity 3.6	Jointly with the Institute of Botany of the National Academy of Sciences to conduct scientific research on the flora of the Reserve	2025-2029	SNR TB, SISPNA, NAST	Availability of prepared maps and scientific publications	30.00	Donors, State Budget

Activity 3.7	Organization of application of modern methods of monitoring of natural complex and registration of scientific information. GPS-mapping of objects of study and protection. Map-making: • habitats and locations of rare animal species (Bukhara deer, gazelle, Bukhara mountain sheep (urial), striped hyena, reed cat), etc; • availability of foraging areas for cloven-footed.	2025-2029	SNR TB, SISPNA, NAST	Availability of prepared maps and scientific publications	50.00	Donors, State Budget
Activity 3.8	Organization of scientific research on the state of the population of the red-breasted bustard, Tajik pheasant and water birds: • GPS mapping of bird nesting sites. • studying biology and influencing factors.	2025-2029	SNR TB, SISPNA, NAST	Availability of prepared maps and scientific publications	50.00	Donors, State Budget
Task 4:	<u>Environmental monitoring of the state of natural ecosystems of the Reserve and adjacent territories (buffer zone).</u>					
Activity 4.1	Development and publication of monitoring guidelines for the Reserve staff	2025	SISPNA, SNR TB, NAST	Availability of prepared monitoring manuals	20.00	Donors, State Budget
Activity 4.2	Ensure annual systematic observation of wild animals and their habitat condition	2025-2029	SISPNA, SNR TB, NAST	Obtaining data on the status of wildlife populations	20.00	Donors, State Budget
Activity 4.3	Monitoring of the hydrological regime of riparian complexes and the degree of mineralization of discharge water in the buffer zone of the Reserve	2025-2029	SISPNA, SNR TB, NAST	Obtaining data on the state of the hydrological regime	20.00	Donors, State Budget

Activity 4.4	Continuous monitoring of the condition of forest ecosystems and the presence of forest pests and diseases	2025-2029	SISPNA, SNR TB, NAST	Obtaining data on the state of forest ecosystems and the presence of pests and diseases of forest plantations	20.00	Donors, State Budget
Activity 4.5	Conducting continuous monitoring in the buffer zone of the Reserve by type of land use and degree of direct negative impact on agro-ecosystems and indirect impact on the protected area	2025-2029	SISPNA, SNR TB, NAST	Obtaining data on the status of land use in the buffer zone and the extent of its impact	20.00	Donors, State Budget
Activity 4.6	Annual comprehensive monitoring of the Reserve's ecosystems (forest, water, swamp, desert, etc.) and agro-ecosystems in the buffer area.	2025-2029	SISPNA, SNR TB, NAST	Availability of monitoring data to adjust the territorial management system	20.00	Donors, State Budget
Activity 4.7	Conduct a baseline study to assess carbon stocks in the project area and explore the potential for carbon finance to scale up ecosystem restoration and other mitigation measures	2025-2029	SISPNA, SNR TB, NAST	Explore the potential of carbon finance to scale up ecosystem restoration	50.00	Donors, State Budget
Task 5	<u>Advanced training of scientific personnel and specialists in the field of environmental protection</u>					
Activity 5.1	Preparation of training programs for scientific and engineering staff of the Reserve on the following topics: "Maintaining environmental monitoring within the framework of the nationwide environmental monitoring system" "Rules for conducting phenological observations of wild animals, taking into	2025-2029	SISPNA, SNR TB, NAST	Availability of prepared programs for training of the Reserve's scientific staff and engineering technicians	150.00	Donors, State Budget

	account their species characteristics" • "Counting wild animals of the Reserve in their natural habitat" • "Museum business and modern opportunities for its further development" • "Opportunities for ecotourism development in PAs and rules for working with ecotourists". • "Ecosystem approach in the management of protected areas" • "Legislative and legal mechanisms regulating the environmental protection activities of protected areas" • <u>Exchange of experience on reserve management with other reserves of Tajikistan, CIS and Russian Federation.</u>					
Activity 5.2	Annual classes and educational training seminars with scientific and engineering staff of the Reserve on the basis of the Information Center at the Reserve on the developed topical topics	2025-2029	SISPNA, SNR TB, NAST	Number of sessions conducted and number of employees trained	150.00	Donors, State Budget
Activity 5.3	Build the capacity of interested local government staff regarding the impacts of climate change and biodiversity loss.	2025-2027	SISPNA, SNR TB, NAST	Improving the quality of work	100.00	Donors, State Budget
Environmental Education Development Program. <u>Program goal:</u> to increase the public value of the Tigrovaya Balka Nature Reserve and ensure its support by the general public as an object of national heritage. <u>Expected results:</u> increased public awareness; increased awareness of the local population about the reserve, formation of a positive opinion; increased awareness of the population about local nature; increased environmental education of visitors; application of ecologically effective farming methods by the local population; organization of ecological routes strictly in buffer zones.						

Task 6	Carrying out eco-educational work with the population, eco-propaganda and development of cognitive excursion visit of specially prepared eco-educational routes strictly in the buffer zone of the Reserve.					
Activity 6.1	Conduct trainings and short-term courses to prepare and train 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	2025-2029	SISPNA, SNR TB, NAST	Improving the quality of work. Number of events held and number of trainers trained	50.00	Donors
Activity 6.2	Study the possibilities of cognitive ecotourism, identify excursion routes, define the procedure and rules for visiting excursion routes in the buffer zone of the Reserve, develop tariffs for conducting ecological excursions and coordinate them with the CEP	2025-2029	SISPNA, SNR TB	Approval excursion routes, rules and tariffs for visiting ecological routes in the buffer zone	20.00	Donors, State Budget
Activity 6.3.	Preparation of ecological routes ("ecological trails") on the ground (in the buffer zone of the Reserve), technical equipment, equipping with information materials	2025-2029	SISPNA, SNR TB	Availability of approved excursion routes	20.00	Donors, State Budget
Activity 6.4	Conducting eco-educational work with the local population through talks, trainings and workshops on nature protection, restoration of lost biodiversity and ecosystem approach in the use of natural resources.			Application of rational nature management in the territories adjacent to the reserve. Indicator - number of activities and number of persons trained	20.00	Donors, State Budget
Activity 6.5	Prepare and publish an illustrated booklet on ecological routes and promotional booklets	2025-2029	SISPNA, SNR TB	Availability of advertising booklets on ecological routes in	20.00	Donors, State Budget

				the buffer zone of the Reserve		
Activity 6.6	Popularization of the Tigrovaya Balka Nature Reserve through mass media	2025-2029	SISPNA, SNR TB	Raising awareness of the local population	0.00	State budget
Activity 6.7	Regular informing of the local population about the Reserve's activities through local authorities	2025-2029	SISPNA, SNR TB	Increasing environmental awareness of the population and tourists	0.00	State budget
Activity 6.8	Museum development	2025-2029	SISPNA, SNR TB	Increasing the number of visitors, attracting tourists	0.00	State budget
Activity 6.9	Technical and financial support for young Tajik researchers	2025-2029	SISPNA, SNR TB	Practical research on the impact of climate change on biodiversity	80.00	Donors
Task 7	Enhancing the international status of the WL and interaction with the Ramsar Convention					
Activity 7.1	Adjustment of Ramsar Convention protected WL parameters in the SNR TB for the Convention site	2025-2029	SISPNA, CEP	Fulfilling the terms of the Ramsar Convention	20.00	Donors, State Budget
Activity 7.2	Inclusion of the WL on the territory of the Reserve in the list of objects protected by the Ramsar Convention on the territory of the RT	2025-2029	SISPNA, CEP	Enhancing the international status of the SNR TB	100.00	Donors, State Budget
Activity 7.3	Evaluate the effectiveness of WL management using Ramsar Site Management Effectiveness Tracking Tool (R-METT) (recommended every 3 years)	2025-2029	SISPNA, CEP	Improving the efficiency of WL management	20.00	Donors, State Budget
Activity 7.4	Support to CEP in implementing the Ramsar management plan (e.g. smart patrolling, biodiversity monitoring, integrated water resources	2025-2029	SISPNA, CEP	Improving the efficiency of WL management	200.00	Donors, State Budget

	management, staff capacity building, awareness raising)					
BLOCK II						
INTERACTION WITH THE ADMINISTRATION OF THE ENTIRE TERRITORY ADJACENT TO THE TIGROVAYA BALKA NATURE RESERVE						
Improved territorial management within the buffer zone of the Tigrovaya Balka Nature Reserve in Dusti, Jaihun, Kabadiyan and Shakhritus districts						
Objectives and activities	Actions	Timeline	Performer	Indicators (Expected Results)	Financial Costs, thousand somoni	Sources of funding
Task 8	Agriculture					
	Objective - to improve the efficiency of land resources utilization					
Activity 8.1	Conducting trainings/seminars with farmers of Jayhun, Dusti, Kabadia and Shahritus districts	2025 -2029	Local executive bodies of state power, Associations of farms, POs	Sustainable management of land resources in the buffer zone of the Reserve without factors of negative impact on nature	50.00	Donors, State Budget
Activity 8.2	Measures to regularize grazing in the buffer zone of the Reserve: 1. Determination of rangeland productivity (cadastral assessment) in the buffer zone territory 2. Determination of pasture capacity and permissible loads on pastures by seasons of the year	2025 -2027	Local executive bodies of state power, SCLAG RT, MART RT	Improvement of pasture condition	50.00	Donors, State Budget

	<u>3.</u> Determination and establishment of pasture boundaries on the ground and installation of boundary posts, and identification of permanent and temporary pasture users <u>4.</u> Control over the correct use of grazing lands by users					
Activity 8.3	Organization of nurseries, gardens, greenhouses for growing productive agricultural crops	2025-2029	WUA, Local executive bodies of state power, land users	Improvement of land resources, reduction of land degradation	500.00	Land users, grants from donor organizations
Activity 8.4	Construction (purchase) of small processing enterprises for processing of agricultural products (fruits, vegetables) - 3-4 in each rayon	2025-2029	Local executive bodies of state power, land users, POs	Reducing the pressure on the reserve	1000.00	Grants from donor organizations
Activity 8.5	Cultivation of medicinal plants - demonstration plots - 4 in each district	2025-2029	Local executive bodies of state power, land users	Increased income of the population and reduced pressure on the reserve	500.00	Grants from donor organizations
Activity 8.6	Development of beekeeping, fish farms, seed production	2025-2029	Local executive bodies of state power, land users, academic institutions	Increased income of the population and reduced pressure on the reserve	500.00	Grants from donor organizations
Activity 8.7	Implementation of erosion control measures (terracing, forest amelioration, etc.)	2025-2029	Local executive bodies of state power, land users	Improvement of land resources	500.00	Grants from donor organizations
Activity 8.8	Development of agricultural products marketing network	2025-2029	Local executive bodies of state power, MART	Increased income of the population and decreased utilization of the	500.00	Grants from donor organizations

				natural resources of the reserve		
Activity 8.9	Rehabilitation of on-farm and inter-farm irrigation systems	2025-2029	Local executive bodies of state power, WUAs, land users, projects	Improving land resources, increasing agricultural productivity and reducing pressure on the reserve's resources	2000.00	Grants from donor organizations
Activity 8.10	Educate rural people and others about the importance of domestic and wild bees for pollination through improved beekeeping, processing and marketing of bee products	2025-2029	SISPNA, SNR TB	Reducing the pressure on the reserve's resources, increasing the income of the population around the reserve	200.00	Donors
Task 9	Development of alternative energy sources					
Activity 9.1	Installation of solar panels on the territory of the buffer zone of the Reserve in farms of Kabadia, Dusti, Shahritus districts	2025-2029	SISPNA, SNR TB, POs	Provision of the population with alternative electricity	1000.00	Donors
Task 10	Improvement of forest resources and biodiversity in the territories of the areas adjacent to the Reserve					
Activity 10.1	Implementation of forest amelioration measures	2025-2029	Local executive bodies of the state authorities, MART, FRI, CEP, SISPNA, SNR TB, POs	Improvement of natural resources	300.00	Donors, State Budget
Activity 10.2	Strengthening of slopes with trees	2025-2029	Local executive bodies of the state authorities, MART, FRI, CEP, SISPNA,	Increasing the area covered by forests, reducing degradation of land resources	300.00	Donors, State Budget

			SNR TB, WUA,POs			
TOTALS:					9, 225. 00	

Approved
Chairman of the Committee for Environmental
Protection under the Government of the Republic of Tajikistan

_____ Sheralizoda B. A.

" _____ " June 2024

8.1. APPROVED ANNUAL PLAN FOR THE TIGROVAYA BALKA NATURE RESERVE FOR 2025.

Activity	Responsible authorities	Actions	Financing, in somoni	
			State budget	Donors
Organization of permanent monitoring of the state of the natural environment	SNR TB	Maintaining the Nature Chronicle SNR TB	0.00	50,000.00
Improvement of the hydrological regime of the tugai ecosystems of the Reserve by clearing canals for water supply to the Reserve's lakes with a length of 1000 m annually.	SISPNA, SNR TB	Volumes of work performed by year Filling of lakes with water	0.00	60,000.00
Restoration of forest haloxylon plantations / care of plantings in degraded desert ecosystems annually on the area of 100 ha.	SISPNA, SNR TB	Volumes of work performed during the year - desert lands overgrown with saxaul	0.00	50,000.00
Annual biotechnical measures strictly in the buffer zone (on allocated lands from Dusti, Kabadia or Jaihun districts) to improve wildlife habitats.	SISPNA, SNR TB	Improving the condition and increasing the number of valuable and rare wildlife species	0.00	20,000.00
Restoration of the population of rare and endangered species of fauna such as: gazelle, Bukhara deer, pheasant and red-breasted bustard by strengthening protection and breeding them in zoological nurseries in conditions close to their natural habitat. Organization of permanent monitoring of the condition of rare and valuable animal species.	SISPNA, SNR TB	Achievement of optimal numbers and improvement of population status of rare and valuable animal species	0.00	20,000.00
Carrying out biotechnical measures to reduce the number of alien species in the Reserve's lakes - snakehead. Creation of favorable conditions for attracting large gulk around the lakes to regulate the number of snakehead.	SISPNA, SNR TB	Decrease in the number of snakehead	0.00	5,000.00

Support regeneration and afforestation of haloxylon (and other endemic species such as dove-colored leaf poplar (turanga), oleaster, calligonum, etc.).	SISPNA, SNR TB	Area of restored riparian forests and reduction of wind erosion and improvement of water retention capacity of the territory	0.00	20,000.00
Drawing up Operational Plans for extinguishing forest fires. Conducting annual cleaning and plowing of firebreaks	SNR TB	Wildfire suppression plans. Annual reports on firebreak clearing and plowing.	0.00	20,000.00
Provision of the security service with vehicles, uniforms, communication equipment, binoculars and cameras	SISPNA	Availability of vehicles, uniforms, communication equipment, binoculars, cameras, etc.	0.00	50,000.00
Organization and conduct of scientific research in the Tigrovaya Balka Nature Reserve on the dynamics of changes in the state of fauna and flora	SNR TB, SISPNA, NAST and other Universities of Tajikistan and CIS and non-CIS countries	Scientific reports on the conducted research on the dynamics of changes in the state of fauna, flora and landscapes of the SNR TB	0.00	60,000.00
Keeping gamekeeper's diaries and compiling a nature chronicle of the SNR TB	SNR TB, SISPNA, NAST	Annual chronicle of nature for the SNR TB	0.00	5,000.00
Jointly with the Institute of Zoology and Parasitology of NAST to conduct research and install camera traps on wildlife sites	SNR TB, SISPNA, NAST	Prepared research reports	0.00	5,000.00
Together with the FRI to conduct scientific research on the following topics: "Study of the state and dynamics of change in riparian forest complexes". "Conducting a survey and determining the current sanitary condition of forest plantations of the Tigrovaya Balka Reserve".	SNR TB, SISPNA, NAST, FRI	Research reports and practical recommendations produced	0.00	6,000.00
Jointly with the Institute of Botany of the National Academy of Sciences to conduct scientific research on the flora of the Reserve	SNR TB, SISPNA, NAST	Availability of prepared maps and scientific publications	0.00	6,000.00

Organization of application of modern methods of natural complex monitoring and registration of scientific information. GPS-mapping of objects of study and protection. Map-making: habitats and locations of rare animal species (Bukhara deer, gazelle, Bukhara mountain sheep (urial), striped hyena, reed cat), etc; availability of feeding grounds for cloven-footed.	SNR TB, SISPNA, NAST	Availability of prepared maps and scientific publications	0.00	10,000.00
Organization of scientific research on the state of the population of the Red-breasted bustard, Tajik pheasant and water birds: GPS mapping of bird nesting sites. studying biology and influencing factors.	SISPNA, SNR TB, NAST	Availability of prepared maps and scientific publications	0.00	10,000.00
Development and publication of monitoring guidelines for the Reserve staff	SISPNA, SNR TB, NAST	Availability of prepared monitoring manuals	0.00	20,000.00
Ensure annual systematic observation of wild animals and their habitat condition	SISPNA, SNR TB, NAST	Obtaining data on the status of wildlife populations	0.00	4,000.00
Monitoring of the hydrological regime of riparian complexes and the degree of mineralization of discharge water in the buffer zone of the Reserve	SISPNA, SNR TB, NAST	Obtaining data on the state of the hydrological regime	0.00	4,000.00
Conducting continuous monitoring of the condition of forest ecosystems and the presence of forest pests and diseases	SISPNA, SNR TB, NAST	Obtaining data on the state of forest ecosystems and the presence of pests and diseases in forest plantations	0.00	4,000.00
Conducting continuous monitoring in the buffer zone of the Reserve by land use type and degree of direct negative impact on agro-ecosystems and indirect impact on the protected area	SISPNA, SNR TB, NAST	Obtaining data on the status of land use in the buffer zone and the extent of its impact	0.00	4,000.00

Annual comprehensive monitoring of the Reserve's ecosystems (forest, water, swamp, desert, etc.) and agro-ecosystems in the buffer area.	SISPNA, SNR TB, NAST	Availability of monitoring data to adjust the territorial management system	0.00	4,000.00
Conduct a baseline study to assess carbon stocks in the project area and explore the potential for carbon finance to scale up ecosystem restoration and other mitigation measures	SISPNA, SNR TB, NAST	Explore the potential of carbon finance to scale up ecosystem restoration	0.00	10,000.00
Preparation of training programs for scientific and engineering staff of the Reserve	SISPNA, SNR TB, NAST	Availability of prepared programs for training of the Reserve's scientific staff and ITRs	0.00	30,000.00
Annual classes and educational training seminars with scientific and engineering staff of the Reserve on the basis of the Information Center at the Reserve on the developed topical topics	SISPNA, SNR TB, NAST	Number of sessions conducted and number of staff trained	0.00	30,000.00
Build the capacity of interested local government staff regarding the impacts of climate change and biodiversity loss.	SISPNA, SNR TB, NAST	Improving the quality of work	0.00	20,000.00
Conduct trainings and short-term courses to prepare and train 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	SISPNA, SNR TB, NAST	Improving the quality of work. Number of events held and number of trainers trained	0.00	10,000.00
Study the possibilities of cognitive ecotourism, identify excursion routes, define the procedure and rules for visiting excursion routes in the buffer zone of the Reserve, develop tariffs for conducting ecological excursions and coordinate them with the CEP	SISPNA, SNR TB	Approval excursion routes, rules and tariffs for visiting ecological routes in the buffer zone	0.00	4,000.00
Preparation of ecological routes ("ecological trails") on the ground (in the buffer zone of the Reserve), technical equipment, equipping with information materials	SISPNA, SNR TB	Availability of approved excursion routes	0.00	4,000.00

Conducting eco-educational work with the local population through talks, trainings and workshops on nature protection, restoration of lost biodiversity and ecosystem approach in the use of natural resources.		Application of rational nature management in the territories adjacent to the reserve. Indicator - number of activities and number of persons trained	0.00	4,000.00
Prepare and publish an illustrated booklet on ecological routes and promotional booklets	SISPNA, SNR TB	Availability of advertising booklets on ecological routes in the buffer zone of the Reserve	0.00	4,000.00
Popularization of the Tigrovaya Balka Nature Reserve through mass media	SISPNA, SNR TB	Raising awareness of the local population	0.00	0.00
Regular informing of the local population about the Reserve's activities through local authorities	SISPNA, SNR TB	Increasing environmental awareness of the population and tourists	0.00	0.00
Museum development	SISPNA, SNR TB	Increasing the number of visitors, attracting tourists	0.00	0.00
Technical and financial support for young Tajik researchers	SISPNA, SNR TB	Practical research on the impact of climate change on biodiversity	0.00	16,000.00
Adjustment of Ramsar Convention protected WL parameters in the SNR TB for the Convention site	SISPNA, CEP	Compliance with the terms of the Ramsar Convention	0.00	4,000.00
Inclusion of the WL on the territory of the Reserve in the list of objects protected by the Ramsar Convention on the territory of the RT	SISPNA, CEP	Enhancing the international status of the SNR TB	0.00	20,000.00
Evaluate the effectiveness of WL management using Ramsar Site Management Effectiveness Tracking Tool (R-METT) (recommended every 3 years)	SISPNA, CEP	Improving the efficiency of WL management	0.00	4,000.00

Support to CEP in implementing the Ramsar management plan (e.g. smart patrolling, biodiversity monitoring, integrated water resources management, staff capacity building, awareness raising)	SISPNA, CEP	Improving the efficiency of WL management	0.00	40,000.00
Conducting trainings/seminars with farmers of Jayhun, Dusti, Kabadia and Shahritus districts	Local executive bodies of state power, Associations of farms, POs	Sustainable management of land resources in the buffer zone of the Reserve without factors of negative impact on nature	0.00	10,000.00
Measures to regulate cattle grazing in the buffer zone of the Reserve	Local executive bodies of state power, SCLAG RT, MART	Improvement of pasture condition	0.00	10,000.00
Organization of nurseries, gardens, greenhouses for growing productive agricultural crops	WUA, Local executive bodies of state power, land users	Improvement of land resources, reduction of land degradation	0.00	100,000.00
Construction (purchase) of small processing enterprises for processing of agricultural products (fruits, vegetables) - 3-4 in each district	Local executive bodies of state power, land users, POs	Reducing the pressure on the reserve	0.00	200,000.00
Cultivation of medicinal plants - demonstration plots - 4 in each district	Local executive bodies of state power, land users	Increased income of the population and reduced pressure on the reserve	0.00	100,000.00
Development of beekeeping, fish farms, seed production	Local executive bodies of state power, land users, academic institutions	Increased income of the population and reduced pressure on the reserve	0.00	100,000.00
Implementation of erosion control measures (terracing, forest amelioration, etc.)	Local executive bodies of state power, land users	Improvement of land resources	0.00	100,000.00
Development of agricultural products marketing network	Local executive bodies of state power, MART	Increased income of the population and decreased utilization of the natural resources of the reserve	0.00	100,000.00

Rehabilitation of on-farm and inter-farm irrigation systems	Local executive bodies of state power, WUA, land users, projects	Improving land resources, increasing agricultural productivity and reducing pressure on the reserve's resources	0.00	400,000.00
Educate rural people and others about the importance of domestic and wild bees for pollination through improved beekeeping, processing and marketing of bee products	SISPNA, SNR TB	Reducing the pressure on the reserve's resources, increasing the income of the population around the reserve	0.00	50,000.00
Implementation of forest amelioration measures	Local executive bodies of the state authorities, MART, FRI, CEP, SISPNA, SNR TB, POs	Improvement of natural resources	0.00	60,000.00
Strengthening of slopes with trees	Local executive bodies of the state authorities, MART, FRI, CEP, SISPNA, SNR TB, WUA, POs	Increasing the area covered by forests, reducing degradation of land resources	0.00	60,000.00
Salaries and wages of employees of SNR TB			629,805.00	0.00
Household goods			4,500.00	0.00
Fuel consumption (gasoline, diesel)			12,000.00	0.00
Building renovation			1,500.00	0.00
Expenses for economic needs			8,000.00	0.00
Expenses for utilities and heating			3,000.00	0.00
Annual biotechnical activities			12,000.00	0.00
Expenses for internet services			4,000.00	0.00
TOTAL:			674,805.00	1,927,000.00


 SISPNA

Kh. Shamsiddinzoda

Appendix 1.

LIST OF PARTICIPANTS IN THE WORKING GROUP FOR THE TB GPZ MANAGEMENT PLAN

1. Shamsiddinzoda Kh. - Head of the State Institution of Specially Protected Natural Areas (SISPNA) of the Committee for Environmental Protection under the Government of the Republic of Tajikistan.
2. Asadullo Khairullo - Director of SNR TB.
3. Najmudinov N. Project Manager from PO "Tabiati yoboi".
4. Saidov N. - Specialist on management of specially protected natural areas and biodiversity conservation of TSRP
5. Khudoyorov F. - employee of PO "Tabiati yoboi".
6. Fattokhov H. - employee of PO "Tabiati yoboi".
7. Faizulloev S. - an employee of PO "Tabiati yoboi".
8. Khisoriev A. - Consultant on hydrology.
9. Ustyan I.P. - Chief Specialist of the Institute of Forestry, Tajikistan.
10. Murodov R. - Senior researcher of the Institute of Zoology and Parasitology, NAST.
11. Ilnazarov Behruz - Cartographer and GIS consultant.

Appendix 2.

List of plant species of the GBR TB

Horsetail family - Equisetaceae

Equisetum ramosissimum

Economic value: not poisonous, well eaten by cattle and horses. Due to the high content of silicic acid in the stems, it serves as a polishing material for carpentry and metalworking. (Pavlov, 1942; Larin, 1950).

Family. Hornbeam - Ophioglossaceae

2. Ophioglossum bucharicum

Family Polypodiaceae - true ferns

No

GYMNOSPERMAE - HOLOSPERMS

Ephedraceae - Conifers

3. Ephedra strobilacea

It is not important in Tajikistan due to its small distribution. It plays an important role in the fodder balance of desert plains of Central Asia. It has good sand-strengthening properties. (Larin, 1950, etc.).

ANGIOSPERMAE - COATED SEEDS

Class Monocotyledoneae

Family. Typhaceae

4. Typha latifolia.

5. Typha minima

Family Potamogetonaceae - pondweeds

6. Potamogeton lucens

7. Ruppia maritima

It is of great importance as food for waterfowl. (Larin, 1950)

Family Juncaginaceae - Sitnicaceae

No

Family. Alismataceae - chasubers

8. Alisma plantago-aquatica L.

It is poisonous, irritates skin in animals, causes inflammation in the stomach and bloody urine. Roots and leaves are used in folk medicine in fresh and dried form. It has astringent and diuretic properties, is used for dropsy, hemorrhoids. Fresh rhizome is used in homeopathy. (Rollov, 1908; Pavlov, 1942; Larin, 1950).

Family Butomaceae - Susacaceae

9. Butomus umbellatus L. sp. pl.

There are indications that leaves are harmful to livestock. Rhizomes and seeds are used in folk medicine. (Larin, 1950).

Family Hygrocharitaceae- watercresses.

10. Vallisneria spiralis

Good fodder for ducks and fish. Ornamental plant in aquariums.

Family Gramineae(Poaceae) - cereals.

11. Aeluropus litoralis (Gouan) Parl. Fl. Ital.

Fodder plant of satisfactory quality, perfectly tolerates strong soil salinity.

12. *Poa annua* L. Sp. pl.
Economic value. Good eaten by cattle.
13. *Poa bulbosa* L. sp. pl.
Economic value. An excellent fodder plant on early-spring pastures. (, 1951)
14. *Eremopoa persica* (Trin) Roshev
15. *Sclerochloa dura* (L) P.B. Agrost
Weed.
16. *Sphenopus divaricatus* (Gouan) Rehb. Fl. Germ. excurs.
17. *Cutandia memphitica* (Spreng.) Richt. Pl. eur.
18. *Vulpia persica* (Boiss. Et Buhse) V. Krecz. Et Bobr.
In ephemeral groupings.
19. *Vulpia ciliata* (Danth.) Link, Heb. Berd.
Good fodder grass for early spring pastures.
20. *Nardurus Krausei* (Rgl.) V. Krecz. Et Bobr.
Economic value.. Eaten by cattle satisfactorily.
21. *Lolium subulatum* (Banks et Sol.) Eig in Journ.
Doesn't matter.
22. *Bromus japonicus* Thunb. Fl. Japon
Fodder, weed.
23. *Bromus Popovii* Drob. in Fedck, Repert.
Weed.
24. *Bromus Sevetzovii* Rgl.
Fodder plant. (Pryakhin, 1937; Pleshko and Pehacek, 1944)
25. *Bromus scoparius* L. in Amoer. Acad.
A low-value fodder plant. (Pryakhin, 1937).
26. *Bromus oxyodon* Schrenk in Bull.
Economic. meaning. A well-eaten plant. Fodder plant. (Pryakhin, 1937, Koyalovia, 1951).
27. *Bromus Danthoniae* Trin in C.A.M.
Fodder. (Sovetkina, 1938).
28. *Anisantha tectorum* (L) Nevski. (L Nevski).
Fodder. (Koyalovich, 1951).
29. *Boissiera squarrosa* (Soland.) Nevski
Economic value. Fodder.
30. *Taeniatherum crinitum* (Schreb.) Nevski
Fodder plant. (Pleshko, Pehacek, 1944)
31. *Hordeum leporinum* Link in Linnaea
Economic value. Vicious weed.
32. *Aegilops triuncialis* L. sp. pl.
Fodder. (Koyalovia, 1951).
33. *Aegilops cylindrica* Host in Gram. Acist.
unmarked, collected by us).
Economic value. Fodder.
34. *Aegilops squarrosa* L. sp. pl.
Fodder plant. (Pleshko, Pkhacek, 1944).
35. *Avena trichophylla* C. Koch in Linnaea
Fodder. (Pleshko, 1954).
36. *Trisetum Cavanillesii* Trin.
Economic value. Fodder.
37. *Schismus arabicus* Nees, Fl. Afr. Austr.
Fodder. (Larin, 1950).
38. *Calamagrostis dubia* Bge in Mem
Economic value. coarse fodder. (Pavlov, 1947).
39. *Calamagrostis glauca* (M.B.) Trin in Hohen.
Economic value. coarse fodder.
40. *Polypogon demissus* Steud. Syn. pl. gram.
(Larin, 1950). coarse fodder, weedy. (Larin, 1950).

41. *Arundo donax* L. Sp.pl.
Economic value. used for buildings. (Danilevsky, Kononov, Nikitin, 1940).
42. *Phragmites communis* Trin. Fund. Agrost.
Economic value. coarse fodder. Suitable for silage. (Nikitin et al., 1937).
43. *Phalaris minor* Retz. Obs.
Economic value. Fodder.
44. *Phleum paniculatum* Huds. Fl. Angl. ed.
Fodder. (Sovetkina, 1938).
45. *Enneapogon persicus* Boiss. Diagn.
B as a fodder.
46. *Stipa Hohenackeriana* Trin. et Rupr.
Fodder. (Nikitin, 1940).
47. *Eragrostis pilosa* (L.) P.B. Agrost.
Economic meaning. Fodder plant.
48. *Eragrostis megastachya* (Koel.) Link, Host, Berd
Economic value. Weed.
49. *Crypsis schoenoides* (L.) Lam.
Economic value. Fodder.
50. *Cynodon dactylon* (L.) Pers. Syn.
A valuable fodder, a vicious weed. (Pleshko, Pehacek, 1944).
51. *Aristida pennata* Trin. in Acta Petrop.
Economic value. winter fodder. (Sovetkina, 1938).
52. *Aristida Karelini* (Trin. Et Rupr.) Roshev.
Economic value. Winter fodder. (Pleshko, Pehacek, 1944).
53. *Aristida plumosa* L. Sp.pl. td.
A pasture plant. (Sovetkina, 1938).
54. *Imperata cylindrica* (L.) P.B. Agrost.
Fodder (in hay). (Pleshko, Pehacek, 1944).
55. *Saccharum spontaneum* L. Mantissa.
It can be used for silage (Larin, 1950).
56. *Erianthus ravennae* (L.) P. Beauv. Agrost.
It is used as a building material. (Pleshko, Pehacek, 1944).

Family Cyperaceae - sedges

57. *Cyperus fuscus* L. sp.pl.
It doesn't matter.
58. *Cyperus rotundus* L.
Hoz. sign. Weed.
59. *Acroellus laevigatus* (L.) Palla in Koch..
Economic value. Does not have.
60. *Schoenoplectus juncoideus* (Roxb.) Palla in Engl.
Economic value. Does not have.
61. *Schoenoplectus triquetiformis* V. Krecz.
62. *Schoenoplectus litoralis* (Schrader.) Palla in Engl.
Economic value. Does not have.
63. *Bolboschoenus strobilinus* (Roxb.) V. Krecz.
Economic value. A mediocre fodder plant. (Pavlov, 1947; Medvedev, 1957).
64. *Bolboschoenus maritimus* (L.) Palla in Koch.
(Larin, 1950; Medvedev, 1957). (Larin, 1950; Medvedev, 1957).
65. *Fimbristylis dichotoma* (L.) Vahl.
Economic value. Does not have.
66. *Cladium mariscus* (L.) Pohl, Tent.
Economic value. construction material. (Rollov, 1908; Abramov and Gaze, 1950).
67. *Carex physodes* M.B.
One of the most important plants. Fodder plant. (Larin, 1950; Kollovich, 1956).
68. *Carex pachystylis* Gay in Ann.
It is of great fodder value on winter-spring pastures.

- (Larin, 1950; Kollovich, 1956).
69. *Carex diluta* M.B.
Economic value. Fodder value. (Larin, 1957).
70. *Carex acutiformis* Ehrh. Beitr.
Economic value. A poor fodder plant. Tannins and traces of alkaloids are found in rhizomes.
(Grossheim, 1946; Larin, 1950, 1957).
71. *Carex fedia* Nees ex Wight.
Economic. meaning. Does not have.

Family. Araceae

72. *Eminium Lehmannii* (Bge.) O. Kuntze.
Poisonous. Extract from tubers has the effect of strophanthin, used in heart diseases. Deserves pharmacological study.

Family. Juncaceae

73. *Juncus compressus* Jacq. Enum. Stirp.
Economic value. Does not have.
74. *Juncus Gerardi* Lois. In Desv.
(Pavlov, 1947; Larin, 1950). (Pavlov, 1947; Larin, 1950).
75. *Juncus articulatus* L. - articulate titmouse.
Economic value. Does not have.
76. *Juncus Nevskii* V. Krecz. Et Gontsch
In folk medicine it is used as diuretic. (Grossheim, 1946; Abramov and Gaze, 1950).
77. *Juncus subulatus* Forsk. Fl. Aegypt.
Economic value. Does not have.

Family. Liliaceae - lilyaceae.

78. *Merendera robusta* Bge.
Economic value. Plant poisonous. It is used for poisoning rodents. In folk medicine bulbs are used for rheumatism and heart diseases. (Larin, 1950; Sadykov and Yunusov, 1960).
79. *Gagea graminifolia* Vved.
Economic value. Does not have.
80. *Gagea divaricata* Rgl.
Economic value. Does not have.
81. *Gagea Olgae* Rgl.
In folk medicine it is considered medicinal. (Larin, 1950; Kanoda, 1951).
82. *Gagea Chomutovae* Pascher.
Economic value. Ornamental. Eaten by animals in spring. (Larin, 1950).
83. *Gagea ova* Stapf in Denkschr.
Economic value. Does not have.
84. *Gagea stipitata* Merckl. ex Bge.
In folk medicine bulbs are used for gastric diseases and body aches. (Sakhobiddinov, 1948; Larin, 1950).
85. *Gagea gageoides* (Zucc.) Vved.
Economic value. eaten by animals.
86. *Tulipa Tubergeniana* Hoog in Gard.
Economic value. ornamental plant.
87. *Tulipa lanata* Rgl.
Economic value. ornamental plant.
88. *Tulipa Lehmanniana* Merckl. Ex Bge.
Economic value. ornamental plant.
89. *Tulipa sogdiana* Bge. In Mem.
Economic value. ornamental plant.
90. *Asparagus brachyphyllus* Turcz.
In folk medicine, decoction of rhizomes and above-ground parts is used for rheumatism, joint pains and as diuretic. (Larin, 1950; Sakhobiddinov, 1948).

Family. Amaryllidaceae - Amaryllisaceae.

91. *Allium Griffithianum* Boiss. Diagn.
Economic value. eaten by sheep.
92. *Allium Popovii* Vved.
Economic value. Does not have.
93. *Allium incrustatum* Vved.
Economic value. Does not have.
94. *Allium giganteum* Rgl. In Gartenfl.
Economic value . Interest for food industry. (Medvedev, 1957)
95. *Allium baissunense* Lipsky.
A strongly poisonous plant, containing poisonous origins with strong hemolytic action.
(Sovetkina, 1939).
96. *Ixiolirion tataricum* (Pall.) Herb.
Household. ornamental plant. In folk medicine it is used as an internal remedy for dropsy and diarrhea. (Larin, 1950; Komarov, 1953; Romanova and Ibragimov, 1955).

Family. Iridaceae.

97. *Iris falcifolia* Bge. In Mem.
Economic value. Decorative.
98. *Gynandririris maricoides* (Rgl.) Nevski.
Economic value g. Decorative.

Family. Orchidaceae - orchids.

99. *Eulophia turkestanica* (Litv.) Schlechter in Fedde.
Economic value. Does not have.

Family. Salicaceae - willow.

100. *Populus pruinosa* Schrenk.
Possibly used in afforestation and consolidation of desert sands.

Family. Polygonaceae - buckwheat.

101. *Rumex Halaczii* (Rech.) Rech.
A field weed. (Ikramov et al., 1967 b).
102. *Calligonum Paletzkianum* Litv.
103. *Calligonum setosum* Litv.
104. *Calligonum microcarpum* Borszcz
105. *Calligonum griseum* Korov. ex Pavl.
106. *Calligonum Przewalskii* Losinsk.
107. *Calligonum junceum* (Fisch. et Mey) Litv.
All species of jujube are good sand builders.
108. *Polygonum paronychioides* C.A. Mey
Economic value. Does not have.
109. *Polygonum heterophyllum* Lindm..
Economic value. Does not have.
110. *Polygonum aviculare* L.
Economic value. Good pasture plant. In folk medicine used as an astringent and strengthening agent, and also as a diuretic. (Ikramova et al., 1967 b, Larin, 1950).
111. *Polygonum corrigioloides* Jaub. et Spach.
Economic value. Does not have.
112. *Polygonum inflexum* Kom.
Economic value. Does not have.
113. *Polygonum junceum* Ledeb.
Economic value. Does not have.
114. *Polygonum argyrocoleum* Steud. in Kotschy.
Economic value. eaten by cattle.

Family. Chenopodiaceae.

115. *Chenopodium glaucum* L.
Economic value. In the leaves in the flowering phase contains 60 mg% of vitamin C.
From . There is 9-13% fat in the seeds. (Larin et al., 1951).
116. *Chenopodium album* L.
Economic value. Vicious weed.
117. *Spinacia turkestanica* Iljin
The best fodder species in rainfed areas. (Pavlov, 1947; Larin et al., 1951).
118. *Atriplex nitens* Schkuhr.
The presence of alkaloids of unknown composition has been determined.
119. *Atriplex oblongifolia* Waldst. et Kit.
Economic value. Does not have.
120. *Atriplex dimorphostegia* Kar. et Kir.
Fodder plant. (Larin et al., 1951; Adylov, 1959)
121. *Atriplex tatarica* L.
Fodder (Pavlov, 1947; Ataev, 1948; Larin et al., 1951).
122. *Atriplex ornata* Iljin.
Economic value. Does not have.
123. *Atriplex megalotheca* M. Pop
Economic value. Does not have.
124. *Atriplex tunbergiaefolia* (Boiss. et Noe) Boiss. Fl. Or.
Economic value. Does not have.
125. *Atriplex flabellum* Bge in Boiss.
A wild forage plant. (Ilyin, 1936).
126. *Atriplex moneta* Bge in Boiss.
Economic value. Does not have.
127. *Ceratocarpus utriculosus* Bluk.
Fodder in spring.
128. *Bassia hyssopifolia* (Pall.) Kuntze.
It is not eaten by cattle. (Larin et al., 1951).
129. *Kochia prostrata* (L.) Schrad.
A good fodder plant. (Larin et al., 1951).
130. *Corispermum papillosum* (O. Ktze.)
Fodder plant. (Larin et al., 1951).
131. *Agriophyllum minus* Fisch. et Mey.
A valuable summer-autumn fodder plant. (Larin et al., 1951).
132. *Agriophyllum latifolium* Fisch. et Mey.
A valuable summer-autumn fodder plant. (Larin et al., 1951).
133. *Kalidium caspicum* (L.) Ung.-Sternb.
Fodder for camels. The extract together with green soap is used as an insecticide against plant pests. (Larin et al., 1951).
134. *Halostachys Belangeriana* (Moq.) Botsch.
Economic value. Does not have.
135. *Halocnemum strobilaceum* (Pall.) M.B.
It is eaten by camels in the fall and winter. It contains potash and is used for soap making. (Larin et al., 1951).
136. *Salicornia europaea* L. Sp. pl
Economic value. Used in folk medicine as an antiscorbutic and diuretic.
137. *Suaeda paradoxa* Bge.
Fodder for camels. (Larin et al., 1951).
138. *Suaeda microphylla* Pall. Hlustr.
It is used in soap making. (Larin et al., 1951; Hakobyan, 1954).
139. *Suaeda arcuata* Bge in Mem.
Herb contains many alkaloids. (Massagetov, 1947).
140. *Suaeda acuminata* (C.F. Mey.) Mog.

- Economic value. Does not have.
141. *Suaeda heterophylla* (Kar. et Kir.) Bge.
Winter fodder for camels, goats. (Larin et al., 1951).
142. *Salsola pestifera* A. Nels.
A plant rich in potash, used for cooking soap and as fuel. It is a satisfactory fodder plant. (Larin et al., 1951).
143. *Salsola Paulsenii* Litv.
A satisfactory fodder plant. (Larin et al., 1951).
144. *Salsola aperta* Pauls. in Vidsensk.
Economic value. Does not have.
145. *Salsola arbuscula* Pall. Reise.
A good fodder plant. Recommended for culture. (Larin et al., 1951).
146. *Salsola Richteri* Kar. ex Litv.
A valuable medicinal plant containing salso alkaloid in its fruits and used in hypertension. It is a recognized sand suppressant. (Sovetkina, 1938; Ilyin, 1938; Larin et al., 1951; Sokolov, 1952; Zemlinsky, 1958; Gammernan et al., 1963).
147. *Salsola orientalis* S.G. Gmel.
Main fodder along with wormwood on autumn-winter pastures. (Larin et al., 1951).
148. *Salsola incanescens* C.A. Mey.
Fodder plant. A small content of alkaloids has been found. (Massagetov, 1947).
149. *Salsola micranthera* Botsch.
Economic value. Does not have.
150. *Salsola dendroides* Pall. illustr.
Economic value. Good forage, contains alkaloids. (Massagetov, 1947; Larin et al., 1951).
151. *Salsola sclerantha* C.A. Mey.
Economic value. Valuable pasture fodder.
152. *Salsola carinatiformis* Kinz.
A good fodder plant. (Ikramova et al., 1967a).
153. *Salsola turkestanica* Litv.
Fodder plant. (Ikramova et al., 1967a).
154. *Salsola gemmascens* Pall. Hlustr.
One of the most valuable fodder plants. In complex with wormwood. (Nechaeva and Nikolaeva, 1956; Morozova, 1959).
155. *Salsola forcipitata* Iljin.
A valuable pasture fodder. (Ikramova et al., 1967a).
156. *Salsola Vvedenskyi* Iljin et. M. Pop
Economic value. Does not have.
157. *Climacoptera longistylota* (Iljin) Botsch.
Medium fodder plant. (Larin et al., 1951).
158. *Climacoptera bucharica* (Iljin) Botsch.
Good eaten by cattle in fall and winter. (Kinzikaeva, 1965).
159. *Climacoptera transoxana* (Iljin) Botsch.
A valuable fall-winter fodder for sheep, goats. (Kinzikaeva, 1965; Ikramova et al., 1967a).
160. *Climacoptera Sukaczewii* Botsch.
Economic value. Does not have.
161. *Aellenia subaphylla* (C.A. Mey.)
It is of great fodder value on fall-winter pastures. It contains alkaloids, including. Extract from green twigs dyes fabrics in brown, yellow-brown color. Decoction is used for washing laundry, washing hair and strengthening them. The ash is used for cooking soap, as well as for anthrax treatment and wound healing. (Larin et al., 1951; Sokolov, 1952).
162. *Aellenia iliensis* (Lipsky) Aellen.
Economic value. Does not have.
163. *Horaninovia ulicina* Fisch. et Mey.
A fixer of mobile sands, a medium fodder plant.

164. *Seidlitzia rosmarinus* (Ehrh.) Bge.
Winter fodder. Used to obtain potash.
Contains alkaloids. (Larin et al., 1951; Sokolov, 1952).
165. *Girgensohnia oppositiflora* (Pall) Fenzl.
A good fodder plant. The herb has a lot of alkaloids.
(Larin et al., 1951; Ikramova et al., 1967a).
166. *Anabasis turkestanica* Korov. et Iljin.
Economic value contains alkaloids. (Ikramova et al., 1967a).
167. *Hammada leptoclada* (M. Pop.) Iljin.
Contains alkaloids (Sokolov, 1952; Adylov, 1959).
168. *Haloxylon persicum* Bge.
Economic value. Mainly used as fuel. Good
sand-breaker. (Larin et al., 1951).
169. *Haloxylon aphyllum* (Minkv.) Iljin.
The main use is as fuel. (Larin et al.,
1951; Goryaev et al., 1959).
170. *Halocharis hispida* (Schrenk) Bge.
Medium-sized fodder plant. Many alkaloids of unknown
Composition. (Larin et al., 1951).
171. *Halimocnemis mollissima* Bge.
It is eaten in winter by small cattle. (Larin et al., 1951).
172. *Gamanthus gamocarpus* (Moq.) Bge.
Economic value. After fruiting, one of the best fall and winter fruits.
fodder plants. (Larin, 1951; Ikramova et al., 1967a).

Family. Amaranthaceae.

173. *Amaranthus retroflexus* L.
Economic value. eaten in silage.
174. *Amaranthus Thellungianus* Nevski ex Vass.
175. *Amaranthus albus* L.
176. *Amaranthus lividus* L.
Economic value. eaten in silage. (Medvedev, 1957).

Family. Garryophyllaceae - cloves.

177. *Holosteum umbellatum* L.
Economic value. Does not have.
178. *Holosteum glutinosum* (M.B.) Fisch. et Mey.
Economic value. Does not have.
179. *Lepyrodiclis holosteoides* (C.A. Mey) Fisch. et Mey.
It is considered a fodder plant.
180. *Gypsophila heteropoda* Freyn in Bull.
Economic value. Does not have.
181. *Dianthus tetralapis* Nevski
The whole plant contains saponins, the largest amount in the
roots. (Delektorskaya, 1949).

Family. Ceratophyllaceae- hornworts

182. *Ceratophyllum demersum* L.
Good fodder for fish. (Ikramova, 1966).

Family. Ranunculaceae - buttercups.

183. *Delphinium semibarbatum* Bienert ex Boiss -
A valuable dyeing plant. Contains alkaloids.
(Yakimov, Goncharov, 1940; Yunusov, Abubakirov, 1949).
184. *Consolida leptocarpa* Nevski
The roots and flowers contain a lot of alkaloids.
(Kudryashova, Stepanenko, 1971).

185. *Consolida songorica* (Kar.et.Kir). Nevski
Economic value. Does not have.
186. *Anemone bucharica* Regel et.
Economic value. Ornamental spring plant.
187. *Clematis orientalis* L.
The plant is poisonous, contains alkaloids.
188. *Ceratocephalus falcatus* (L.) Pers.Syn.
The plant contains alkaloids. Fresh leaves
are used in folk medicine for skin diseases.
(psoriasis, vitiligo). (Larin, 1957).
189. *Ranunculus leptorrhynchus* Aitch.et Hemsl.
Economic value. Does not have.
190. *Adonis aestivalis* L.
It is occasionally eaten by sheep. A poisonous plant. (Larin and
et al., 1951)

Family. Berberidaceae - barberry.

191. *Leontice Ewersmannii* Bunge
Economic value. Poisonous. Medicinal plant. (Kudryashova,
Stepanenko, 1971).

Family. Papaveraceae - poppies.

192. *Hypecoum parviflorum* Kar.et Kir.
It is good to eat fresh. Contains alkaloids.
(Kudryashova, Stepanenko, 1971).
193. *Hypecoum trilolum* Trautv.
The plant is not eaten by livestock. All organs contain
alkaloids. (Massagetov, 1947).
194. *Glaucium elegans* Fisch.et.Mey.
A poisonous, alkaloid-bearing plant. (Sokolov, 1952).
195. *Roemeria hybrida* (L.) D.C.
Contains many alkaloids. (Massagetov, 1947;
Kudryashova, Stepanenko, 1971).
196. *Papaver pavoninum* Sehrenk. in Fisch et.Mey.
A poisonous plant. Contains many alkaloids. (Pavlov,
1947; Massagetov, 1947).
197. *Fumaria Vaillantii* Loisel.
A poisonous plant. Used in folk medicine.
(Sokolov, 1952).

Family. Capparaceae - capers.

198. *Capparis spinosa* L.
It is used in folk medicine and as a dye.
Honeycane. (Larin et al., 1951; Kudryashova, 1966; Yunusov, 1968).

Family. Brassicaceae (Cruciferae) - cruciferous.

199. *Sisymbrium Loeselii* L.
Economic value. Gives good silage. Honey bee. (Pavlov, 1947; Sharapov, 1959).
200. *Arabidopsis pumila* (Steph.) N. Busch.
Economic value. eaten by cattle.
201. *Drabopsis nuda* (Belang.) Staf.
Economic value. Good eaten by cattle.
202. *Gymatocarpus Popovii* Botsch.et Vved.
Economic. meaning. eaten by cattle.
203. *Isatis minima* Bunge.del.
It is eaten by cattle during the growing season. (Larin et al., 1951).
204. *Tauscheria lagiocarpa* Fisch.

- It is eaten satisfactorily. (Larin et al., 1951).
205. *Goldbahia torulosa* D.C.
 206. *Goldbahia laevigata* (Bilb.) DC
Fodder plant. (Larin et al., 1951).
 207. *Spirorhynchus salulosus* Kar. et Kir.
Fodder plant. (Larin et al., 1951).
 208. *Strigosella trichocarpa* (Boiss. et Busche) Botsch.
 209. *Strigosella stenopetala* (Bernh.) Botsch.
 210. *Strigosella intermedia* (C.A. Mey.) Botsch.
 211. *Strigosella scorpioides* (Bunge) Botsch.
 212. *Strigosella brevipes* (Bunge) Botsch.
 213. *Strigosella tenuissima* (Botsch.) Botsch.
 214. *Strigosella grandiflora* (Bunge) Botsch.
Good eaten by cattle. (Larin, 1951).
 215. *Strigosella latifolia* Bondar. et Botsch.
 216. *Strigosella turkestanica* (Kitv.) Botsch.
Good eaten by cattle. (Pavlov, 1947).
 217. *Cryptospora falcata* Kar. et Kir
 218. *Matthiola chenopodiifolia* Fisch. et. Mey.
Economic value. Decorative.
 219. *Matthiola bucharica* Czerniak.
Economic value. Decorative.
 220. *Tetracme recurvata* Bunge.
Fodder plant. (Larin et al., 1951).
 221. *Tetracmidion bucharicum* Korsh.
 222. *Tetracmidion glochidiatum* Botsch. et Vved.
 223. *Leptaleum filifolium* (Willd) DC.
 224. *Streptolomi desertorum* Bunge.
 225. *Diptychocarpus strictus* (Fisch) Trautv.
A fodder plant. Harvested for hay.
 226. *Chorispora tenella* (Pall) DC.
Economic value. poor forage. (Medvedev, 1957).
 227. *Euclidium seriacum* (L) R.Br.
Economic value. Satisfactory fodder plant.
 228. *Cithareloma Lehmannii* Bunge. Del.
 229. *Lachnoloma Lehmannii* Bunge et Del.
 230. *Alyssum desertorum* Stapf in Denkschr.
It is eaten by cattle before fruiting. (Dadobaeva, 1972).
 231. *Meniocus linifolius* (Steph) DC.
 232. *Clypeola jonhlaspi* L.
Economic value. Eaten by small cattle.
 233. *Erophylla verna* (L) Bess.
Cattle eat it along with other plants.
(Amanova, Yunusov, 1966).
 234. *Eruca sativa* Mill.
Cultivated for oil production. (Dadobaeva, 1972).
 235. *Spyginia falcata* Botsch.
 236. *Spyginia Winkleri* (Regel) M. Pop.
 237. *Lepidium pinnatifidum* Ledeb.
Economic value. Weed.
 238. *Lepidium perfoliatum* L.
Economic value. poisonous. Used in folk medicine. Seeds in crushed in a mixture with other medicines is used for general weakness and to strengthen the nervous system. (Larin et al, 1951; Dadabaeva, 1972).
 239. *Lepidium latifolium* L.
It has no fodder value. Seeds can be used as pepper. Roots contain many alkaloids. (Pavlov,

- 1947; Kudryashova, Stepanenko, 1971).
240. *Cardaria repens* (Schrenk.) Jarm.
A bad fodder plant. (Dadobaeva, 1972).
241. *Hymenolobus procumlens* (L) Fourr.
It is eaten by cattle. (Ikonnikov, 1963).
242. *Neslia apiculata* Fisch. et Mey.
Economic value. From the seeds extract oil for technical purposes. From
of leaves can be used to produce blue dye. (Grossheim, 1952).
243. *Capsella bursa-pastoris* (L) Medis.
It contains traces of alkaloids, saponins, essential oil, tannins. In folk medicine it is used in
gastrointestinal diseases as a blood-stopper. (Mameva, 1969; Dadobaeva, 1972).

Family. Fabaceae (Leguminosae) - legumes.

244. *Prosopis farita* (Bankset Soland.) Macbride
Fruit is sweet, is a good tanner, a vicious weed of cotton fields and spring pastures.
(Afanasyev, Goncharov, 1937; Grossheim, 1952).
245. *Vexibia alopecuroides* (L) jakovl.
Economic value. A vicious weed. The whole plant is poisonous, especially the seeds.
(Afanasyev, Goncharov, 1937).
246. *Vexibia pachycarpa* (Schrenk ex. C.A. Mey) jakov.
It contains up to 3% of alkaloids with action similar to that of anabasine and nicotine. The
plant is poisonous. (Afanasyev, Goncharov, 1937).
247. *Ammothamnus Lehmannii* Bunge.
248. *Ononis antiquorum* L.
249. *Trigonella grandiflora* Bunge
Economic value. Good fodder plant.
250. *Trigonella arcuata* C.A. Mey
Economic value. Good fodder plant.
251. *Trigonella Noeana* Boiss.
A good fodder plant. (Larin et al., 1951).
252. *Trigonella geminiflora* Bunge.
A good fodder plant. (Pleshko, 1948).
253. *Trigonella orthoceras* Kar. et Kir.
Fodder, food, medicinal, dyeing plant.
(Larin et al., 1951).
254. *Medicago minima* (L.) Bartalini.
Economic value. Good fodder plant.
255. *Medicago lanigera* C. Winkl.
Economic value. Good fodder plant.
256. *Melilotus albus* Medic.
Fodder, vitamin-bearing, honey-bearing plant. (Larin and
et al., 1951; Kreidak, 1965).
257. *Lotus Burtii* Sz.
Economic value. Does not have.
258. *Spherophysa salsula* (Pall.) DC
259. *Halimodendron halodenron* (Pall.) Voss in Vilm.
Ornamental shrub, mellifer. (Afanasyev, Goncharov, 1937).
260. *Glycyrrhiza glabra* L.
Fodder, medicinal, technical plant. (Wolf,
Maleeva, 1969).
261. *Onodrychis pulchella* Schrenk in Fisch
A good fodder plant. (Rasulova, 1967).
262. *Alchagi canescens* (Regel) Shap.
263. *Alchagi kirgisorum* Schrenk.
264. *Astragalus orbiculatus* Ledeb.
265. *Astragalus Korovinianus* Barnebi.
Fodder plant. (Ikramova et al., 1967).

266. *Astragalus pseudoeremophyta* M.Pop.
 267. *Astragalus flezusi* Fisch..
 Economic value. Fodder plant.
 268. *Astragalus terekliensis* Gonsch.
 A good fodder plant. (Pleshko, 1949).
 269. *Astragalus contortuplicatus* L.
 Good eaten by cattle. (Pavlov, 1947).
 270. *Astragalus ophiocarpus* Beth..
 A fodder plant. (Ikramova, Timofeeva, 1968)
 271. *Astragalus campylotrichus* Bunge.
 A fodder plant. (Rasulova, 1967).
 272. *Astragalus campylorrhynchus* Fisch et Mey.
 A fodder plant. (Rasulova, 1967).
 273. *Astragalus comnexus* Bunge.
 A fodder plant. (Rasulova, 1967).
 274. *Astragalus rutilolus* Bunge.
 A fodder plant. (Rasulova, 1967).
 275. *Astragalus ammophyllus* Kar et Kir.
 It is eaten by small horned cattle. (Rasulova, 1967).
 276. *Astragalus chivensis* Bunge.
 Fodder plant. (Larin et al., 1951).
 277. *Astragalus Turczaninovi* Kar et Kir.
 278. *Astragalus canoflavus* M.Pop.
 279. *Astragalus aivadzi* B.Fettsch.

Family Geraniaceae - Geraniums.

280. *Erodium oxyrrhynchum* Bieb.
 A good fodder plant. (Larin, 1951).
 281. *Erodium Litvinovii* Voron.
 Economic value. Fodder.
 282. *Erodium Hoefftianum* C.A. Met.
 Fodder plant. (Larin, 1956; Wolf, Maleeva, 1969). Leaves are used in folk medicine as a
 blood-stopper. (Dadobaeva, 1972).
 283. *Erodium malacoides* (L) L' Her.
 284. *Erodium ciconium* (L) L' Her.
 Economic value. No.
 285. *Erodium cicutarium* (L) L' Her.
 Fodder plant. (Wolf, Maleeva, 1969). Leaves are used in folk medicine as a styptic.
 (Dadobaeva, 1972).

Family. Linaceae - flax.

286. *Linum catharticum* Reichb.

Family. Zygophyllaceae - parnophyllaceae.

287. *Peganum harmala* L.
 Economic value. poisonous plant. Used in folk medicine as
 diaphoretic and for rheumatism. (Ikonnikov, 1963;
 Dadobaeva, 1972).
 288. *Tetradiclis tenella* (Ehrenb.) Litv.
 289. *Zygophyllum oxianum* Boriss.
 It is harvested for hay and silage. Leaves are used as a remedy for wound healing, especially in
 furunculosis, lichen planus and chronic eczema (Ismailov, 1949; Larin et al., 1956).
 290. *Zygophyllum Gontscharovii* Boriss
 It is well eaten by sheep. Used for fuel.
 (Zapryagaeva, 1964).
 291. *Trilulus terrestris* L.
 A weed and poisonous plant. In folk medicine fruits are used as disinfectant, astringent,

laxative and diuretic. (Dadobaeva, 1972; Zohary, 1972).

Family. Rutaceae - rutaceae.

292. *Haplophyllum pedicellatum* Bunge.

Economic value. No.

293. *Haplophyllum Bungii* Trautv.

294. *Haplophyllum robustum* Bunge.

295. *Haplophyllum versilolor* Fisch et Mey.

Family. Euphorbiaceae - milkweeds.

296. *Andrachne rotundifolia* C.A.Mey.

297. *Crozophora hierosolymitana* Spreng.

(Larin et al., 1956; Pankova, Movchan, 1956). (Larin et al., 1956; Pankova, Movchan, 1957).

298. *Crozophora lepidocarpa* Pazij.

299. *Crozophora gracilis* Fisch et Mey.

300. *Euphorbia helioscopia* L.

A medicinal plant. (Grossheim, 1946; Larin et al., 1956).

301. *Euphorbia inderiensis* less.

302. *Euphorbia densa* sehrenk

303. *Euphorbia cheirolepis* Fisch et. Mey.

304. *Euphorbia canescens* L.

Fodder plant. (Larin et al., 1956).

305. *Euphorbia turcomanica* Boiss.

306. *Euphorbia onicopetala* Prokh.

Family. Malvaceae - Malvaceae.

307. *Abutilon Theophrastii* Medik.

Family. Frankeniaceae - Frankeniaceae.

308. *Frankenia bucharica* N.Basil.

309. *Frankenia pulrecrelenta* L.

Family. Tamaricaceae - Tamaricaceae.

310. *Tamarix Meyeri* Boiss.

Economic value, used for dyeing leather into dark crimson and cherry colors. (Enden, 1944;

Larin et al., 1956).

311. *Tamarix Laxa* Willd.

Economic value, dyeing plant. (Larin et al., 1956).

312. *Tamarix Bungei* Boiss. -

It is used in folk medicine, rheumatism is treated with decoction of green shoots. (Dadobaeva, 1972).

313. *Tamarix hispida* Willd.

It is used in folk medicine to treat mouth ulcers and rheumatism. (Larin et al., 1956).

314. *Tamaris florida* Bunge.

315. *Ramarix Hohenakeri* Bunge.

Economic value . Dyeing plant. (Fedorov, Rosen, 1950).

316. *Tamarix ramosissima* ledeb.

Family. Thymelaceae - wolfberries

317. *Thymelaea passerina* (L) Coss.

318. *Diartron recciculosum* (Fisch et Mey) C.A. Mey.

Economic value. In folk medicine infusion is used for insomnia. (Dadobaeva, 1972).

319. *Dendrostellera turkmenorum* Pobed.

Family. Elaeagnuceae - suckers.

320. *Eglaeagnus angustfolia* L.

Good tolerant of high groundwater table. Loch gum serves as a substitute for imported Senegalese gum. Fruits and infusion of flowers in folk medicine.

Family. Haloragaceae - elephant-berries

321. *Myriophyllum spicatum* L.
A fodder plant. (Ikramova, 1966).

Family Cynomoriaceae - Cynomorium.

322. *Cynomorium songaricum* Rupr.
Economic value. Dyeing, food, medicinal plant.
(Massagetov, 1947; Sokolov, 1952).

Family. Primulaceae - primrose.

323. *Samolus Valerandi* L.
324. *Lysimachia dubia* soland.
325. *Lysimachia vulgaris* L.
326. *Anagallis coerulea* Schreb.

Family. Plumboginaceae - Plumboginaceae.

327. *Limonium Meyeri* (Boiss) Ktze.
Roots are used as a tannin raw material.
328. *Psylliostachys leptostachya* (Boiss). Roshk.
329. *Psylliostachys Suvorovii* (Rgl.) Roshk.

Family Gentianaceae - Gentianaceae.

330. *Centaurium pubchellum* (SM.) Druce.
331. *Gentiana Olivieri* Griseb.
Economic value. Medicinal plant.

Family. Apocynaceae.

332. *Apocynum Hendersonii* Hook.
333. *Apocynum scalrum* Russan.
334. *Apocynum lancifolium* Russan.

Family. Asclpiadaceae - flippers.

335. *Cynanchum sibiricum* Willd.

Family. Convolvulaceae.

336. *Cressa cretica* L.
337. *Convolvulus fruticosus* Ball.
338. *Convolvulus erinaceus* Ledeb.
339. *Calystegia sepium* (L.) R.Br.
340. *Calystegia hederacea* Wall.

Family. Cusculaceae.

341. *Cuscuta Babylonica* Auch.
Economic value. Parasite. Medicinal plant.

Family. Boraginaceae - borage.

342. *Tournefortia sogdiana* (Bge.) M.Pop.
343. *Heliotropium dasycarpum* Ledeb.
344. *Heliotropium transoxanum* Bge.
345. *Heliotropium argusoides* K.et.K.
346. *Lancea semiglabra* (Ledeb.) Gurke.
347. *Rockelia leiocarpa* Ledeb.
348. *Arhebia transcaspica* M.Pop.
349. *Nonnea caspica* (Willd.) G Don.

Family. Labiatae - sponges.

350. *Lallemantia Royleana* (Wall.) Benth.
351. *Eremostochys regeliana* Aitch
352. *Ziziphora tenuior* L.

Family. Solanaceae - nightshades.

353. *Lycium ruthenicum* Murr.

Family. Srophulariaceae - norichneumonaceae.

354. *Celsia letorophylla* Desf.
355. *Linaria dolichoceras* Kuprican.
356. *Dodartia orientalis* L
357. *Odontites serotina* (Lam.) Dum.

Family. Orobanchaceae - Zarasichaceae.

358. *Cistachne flava* (CAM.) Korsh.
359. *Cistachne mongolica* G. Beck.
360. *Cistachne ambiyua* (Bge) Beck.
361. *Cistachne salsa* (CAM.) G. Beck.
362. *Orodanche cumana* Wallr.

Family. Plantaginaceae - plantainaceae.

363. *Plantago lanceolata* L.
364. *Plantago lagodphala* Rge.

Family. Rubiaceae.

365. *Crucianella Schischkinii* Ginez.
366. *Crucianella lucharica* B. Fedlsch.
367. *Galium verticilatum* Danth.

Family. Dipsacaecae - pileated.

368. *Scabiosa Olivieri* Coult.

Family. Asteraceae.

369. *Erygonon canadensis* L.
370. *Erygonon acer* L.
371. *Karelinia caspia* (Pall.) Less.
372. *Filago arvensis* L
373. *Gnaphalium luteoalbum*
374. *Artemisia vulgaris* L.
375. *Artemisia Tournefortiana* Rchb.
376. *Artemisia annua* L
377. *Artemisia austriaca* Jaq. et.
378. *Artemisia absinthium* L.
379. *Artemisia Dimoana* M. Pop.
380. *Artemisia santolina* Schrenk.
381. *Artemisia Schrenkiana* Ledeb.
382. *Artemisia serotina* Bge.
383. *Artemisia turanica* H. Kradch.
384. *Artemisia diffusa* H. Kradch.
385. *Senecio subdentatus* Ledeb.
386. *Cousinia oxiana* Tschern.
387. *Cousinia psammophila* M. Kult.
388. *Cousinia schisoptera* Juz.
389. *Cousinia sylvicola* Bge.
390. *Centaurea pulchella* Ledeb.

- 391. *Amberboa turanica* Tljin.
- 392. *Koelpinia turanica* Vass.
- 393. *Koelpinia macrantha* C.Winkl.
- 394. *Iragopodon sabulosus* H.Krusch.
- 395. *Scorzonera sericeolanata* H.Krasch.
- 396. *Scorzonera songorica*
- 397. *Epilasia hemilasia* (Bge) C.B. Clarke.
- 398. *Pterotheca obovata* Boiss.
- 399. *Taraxacum bicornis* Dahlst.
- 400. *Crepis corniavata* Rgl.

Annex 3: List of Rare and Threatened Species of Animals of the Reserve

Species name in Russian	Name of species in Latin	Security status
<i>PISCES</i>		
Aral thorn	<i>Acipenser nudiiventris</i> (Lovetzky, 1828)	CR
Large Amu Darya shoveler	<i>Pseudoscaphirhynchus kaufmanni</i> (Bogdanov, 1874)	CR
Small Amu Darya shoveler	<i>Pseudoscaphirhynchus hermanni</i> (Kessler, 1877)	EN
Balding asp	<i>Aspiolucius esocinus</i> (Kessler, 1874)	CR
Aral barbel	<i>Barbus brachycephalus</i> Kessler, 1872	VU
Turkestan Longhorned beetle	<i>Barbus capito conocephalus</i> Kessler, 1872	VU
Eastern bream	<i>Abramis brama orientalis</i> Berg, 1872	VU
Ostroluchka	<i>Capoeto brama kuschakewitschi</i> (Kessler, 1872)	EN
Aral spined loarch	<i>Cobitis aurata aralensis</i> Kessler, 1877	EN
<i>Reptiles - REPTILIA</i>		
Central Asian tortoise	<i>Agryonemis horsfieldi</i> (Gray, 1844)	VU
Crested gecko	<i>Crossobamon eversmanni eversmanni</i> (Wiegmann, 1834)	EN
Skink gecko	<i>Teratoscincus scincus</i> (Schlegel, 1858)	EN
Tajik gecko	<i>Alsophylax tadjikiensis</i> (Golubev, 1979)	EN
Sogdian roundhead	<i>Phrynocephalus interscapularis sogdianus</i> (Cernov, 1948)	EN
Long-eared roundhead	<i>Phrynocephalus mystaceus</i> (Pallas, 1776)	EN
Boettger's reticulated round head	<i>Phrynocephalus reticulatus boetgeri</i> (Bedriaga, 1905)	EN
Gray monitor lizard	<i>Varanus griseus</i> (Daudin, 1803)	EN
Sandy foot-and-mouth disease Lazdin	<i>Eremias scripta lasdini</i> (Tzarev., 1918)	EN
Reticulated foot and mouth disease	<i>Eremias grammica</i> (Lichtenstein, 1823)	EN
Striped foot and mouth disease	<i>Eremias lineolate</i> (Nikolsky, 1896)	EN

Average foot and mouth disease	Eremias intermedia (Strauch,1876)	EN
Black-spotted foot-and mouth disease	Eremias nigrocellata (Nikolsky,1896)	EN
Long-legged skink	Eumeces schneideri (Daudin, 1802)	EN
Boyga	Boiga trigonata melanocephala (Annandale, 1904)	EN
Diadem runner	Spalerosophis diadema (Schlegel, 1837)	CR
Striated wolftooth	Lycodon striatus bicolor (Nikolsky, 1903)	EN
Central Asian cobra	Naja oxiana (Eichwald, 1831)	EN
Central Asian viper	Macrovipera lebetina turanica (Cernov, 940)	VU
Central Asian efa	Echis multisquamatus (Cherlin, 1981)	EN
BIRDS - AVES		
Black vulture	Gyps himalayensis (Hume, 1869)	VU
Bearded Man	Gypaetus barbatus (Linnaeus, 1758)	EN
Snake eater	Circaetus gallicus (Gmelin, 1788)	EN
Osprey	Pandion haliaetus (Linnaeus, 1758)	EN
Vulture	Neophron percnopterus (Linnaeus, 1758)	EN
Golden eagle	Aquila chrysaetus (Linnaeus, 1758)	VU
Pygmy eagle	Aquila pennata (Gmelin, 1788)	EN
Himalayan sparrowhawk	Accipiter nisus melanoschistus. (Hyme, 1869)	EN
Turkestan saker falcon	Falco cherrug coatsi (Dementiev, 1945)	EN
Shahin	Falco pelegrinoides (Temminck, 1829)	EN
Desert partridge	Ammoperdix griseogularis (Brandt,1843)	VU
Tajik pheasant	Phasianus colchicus bianchii (Buturlin, 1904)	EN
Bustard	Otis tarda tarda (Linnaeus, 1758)	CR
Bustard	Chlamydotis undulata (Jacquin, 1784)	CR
Avdotka	Burhinus oedicnemus Linnaeus, 1758	EN

Meadow tirkushka	Glareola pratincola (Linnaeus, 1766)	EN
Black-bellied Sandgrouse	Pterocles orientalis (Linnaeus, 1758)	EN
Paradise flycatcher	Terpsiphone paradisi leucogaster (Swainson, 1838)	VU
<i>MAMMALS - MAMMALIA</i>		
Little shrew	Suncus etruscus (Savi, 1822)	VU
Tricolor night bat	Myotis emarginatus (Geoffroy, 1806)	VU
Leatherback bat	Hypsugo savii (Bonaparte, 1837)	VU
Late Leatherman	Eptesicus serotinus (Schreber, 1774)	VU
Desert Leatherman	Eptesicus bottae (Peters, 1869)	VU
Two-tone Leather	Vespertilio murinus (Linnaeus, 1758)	VU
White-bellied Arrowhead	Otonycteris leucophaeis (Severtsov, 1873)	VU
Wide-eared Folder lip	Tadarida tenioti (Rafinesque, 1814)	VU
Thin-fingered groud-squirrel	Spermophilopsis leptodactylus (Lichtenstein, 1823)	EN
Indian porcupine	Hystrix indica (Kerr, 1792)	VU
Small jerboa	Allactaga elater (Lichtenstein, 1825)	EN
Turkmen korsak	Vulpes corsac tukmenica (Ognev)	EN
Weasel	Mustela nivalis (Linnaeus, 1766)	EN
Dressing	Vormela peregusna (Gueldenstaedt, 1770)	EN
Central Asian otter	Lutra lutra (Linnaeus, 1758)	EN
Striped hyena	Hyaena hyaena (Linnaeus, 1758)	CR
Reed cat	Felis chaus oxiana (Heptner, 1969)	EN
Turanian tiger	Panthera tigris virgata (Illiger, 1815)	EX
Central-Asian Leopard	Panthera pardus ciscaucasica (Satunin, 1914)	EW
Goitered Gazelle	Gazella subgutturosa (Gueldenstaedt, 1780)	CR
Bukhara mountain sheep	Ovis vignei bochariensis (Nasonov, 1914)	CR
Bukhara deer	Cervus elaphusbactrianus (Lydekker, 1900)	CR

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Annex 4: Species composition of rare and endangered birds of the Reserve, status, habitat countries (requires revision, IUCN 2023)

Bird species		Tajikistan	Uzbekistan	Kyrgyzstan	Turkmenistan	Kazakhstan	Russia
		Status					
1.	Little cormorant	-	LC	NT	-	-	+
2.	Pink pelican	-	LC	NT	LC	+	+
3.	Dalmatian pelican	-	VU	VU	VU	+	+
4.	Spoonbill	-	LC	NT	LC	+	+
5.	Caraway	-	LC	-	-	+	+
6.	White stork	EN	LC	EN	-	+	-
7.	Black stork	EN	LC	NT	LC	+	+
8.	Lesser White Heron	-	LC	-	-	+	-
9.	Flamingo	-	LC	NT	LC	+	+
10.	Shelduck	-	EN	EN	EN	+	+
11.	White-eyed diver	-	NT	-	-	-	+
12.	Long-nosed Merganser	-	-	LC	-	-	-
13.	Marbled teal	-	VU	-	VU	+	+
14.	Grey goose	-	-	-	-	-	+
15.	Whooper swan	-	LC	LC	-	+	-
16.	Bewick's swan	-	LC	-	-	-	-
17.	Turkestan saker Falcon	EN	EN	EN	EN	+	+
18.	Shaheen	EN	LC	CR	LC	+	-
19.	Peregrine Falcon	-	LC	LC	LC	+	+
20.	Steppe kestrel	-	LC	VU	LC	-	+

21.	Golden eagle	VU	LC	NT	LC	+	+
22.	Greater Spotted Eagle	-	VU	NT	VU	-	+
23.	Imperial eagle	-	VU	VU	VU	+	+
24.	Bearded warbler	EN	LC	NT	NT	+	+
25.	White-tailed Eagle	-	LC	NT	-	+	+
26.	Long-tailed Eagle	-	VU	VU	VU	+	+
27.	Black vulture	VU	NT	NT	NT	-	+
28.	White-headed Vulture	-	LC	NT	-	-	+
29.	Vulture	EN	-	VU	EN	+	+
30.	Hawk eagle	-	LC	NT	LC	-	-
31.	Dwarf eagle	EN	LC	NT	-	+	-
32.	Snake-eater	EN	LC	VU	LC	+	+
33.	Barrow	-	-	-	-	-	+
34.	Tyuvik	-	-	NT	-	-	-
35.	Steppe harrier	-	NT	NT	NT	-	+
36.	Himalayan sparrowhawk						
37.	Osprey	EN	LC	-	LC	+	+
38.	Tajik pheasant	EN	-	-	-	-	-
39.	Desert partridge	VU	-	-	-	-	-
40.	Gray crane	-	-	-	-	+	-
41.	Great Bustard	SR	VU	CR	VU	+	+
42.	Bustard	CR	VU	CR	VU	+	+
43.	Streptot	-	NT	NT	NT	NT	NT
44.	Avdotka	EN	-	VU	-	-	+
45.	Great curlew	-	-	-	-	-	+
46.	Sea plover	-	-	-	-	-	+
47.	Pintail	-	-	-	-	-	+

48.	Meadow teal	EN	-	-	-	-	-
49.	Black-headed grouse	-	LC	NT	-	+	+
50.	Brown pigeon	-	VU	VU	LC	+	-
51.	Common turtledove	-	-	-	-	-	+
52.	Black-bellied grouse	EN	-	NT	-	+	-
53.	White-bellied grouse	-	LC	NT	-	+	-
54.	Bluethroat	-	-	-	-	-	+
55.	White-winged Woodpecker	-	-	LC	-	-	-
56.	Paradise flycatcher	VU	-	NT	LC	+	+

Annex 5: Summary table of main problems and economic aspects in Dusti, Kabadiyan and Jayhunsom districts

Key issues	Dusti	Jaihun	Kabadiyan
Main environmental issues	Common Problems: 1. Lack of drinking water, water is salty 2. Soil salinity 3. Lack of electricity supply 4. Water pollution 5. Groundwater table rise 6. Air pollution 7. Destruction of forests and logging 8. A lot of household garbage 9. Canal cleaning 10. Low level of knowledge about the environment 11. Lack of international cooperation in the field of nature protection	Common Problems: 1. Shortage of drinking water 2. Decrease in soil fertility 3. Lack of electricity supply 4. The water is contaminated 5. Groundwater table rise 6. Extinction of plant and animal species 7. Destruction of forests and logging 8. Lack of international cooperation in the field of nature protection 9. Grazing on the territory of the reserve 10. A lot of household garbage 11. Low level of knowledge about the environment 12. Air pollution	Common Problems: 1. Shortage of drinking water 2. Shortage of irrigation water 3. Decrease in soil fertility 4. The water is contaminated 5. Groundwater table rise 6. A lot of household garbage 7. Low level of knowledge about the environment 8. Lack of international cooperation in the field of nature protection 9. Grazing on the territory of the reserve 10. River banks need bank protection measures
Major social problems	1. Unemployment 2. Losses in agricultural activities 3. Labor migration 4. Shortage of schools 5. Shortage of agricultural machinery 6. Shortage of mineral fertilizers	1. unemployment 2. Lossfulness of agricultural activity 3. labor migration 4. Road repairs 5. Shortage of schools 6. Lack of pharmacies 7. Shortage of agricultural machinery	1. unemployment 2. Lossfulness of agricultural activity 3. labor migration 4. Need for road repair and cleaning of ditches
Main obstacles to economic development	1. Lack of stable electricity supply 2. Lack of fruit processing facilities 3. Difficulty in marketing agricultural products	1. Lack of stable electricity supply 2. Lack of fruit processing facilities	1. Lack of stable electricity supply 2. Lack of fruit processing facilities

		3. Difficulty in marketing agricultural products	3. Difficulty in marketing agricultural products
Main features (what you can develop as a private business or what you can do for personal income)	1. Horticulture (pomegranate and almond) 2. vegetable production 3. trade 4. Livestock and poultry farming 5. Transportation 6. Canning	1. Horticulture (pomegranate and almond) 2. Vegetable production 3. Trade 4. Livestock and poultry farming 5. Transportation 6. Canning	1. Horticulture (pomegranate and almond) 2. Vegetable production 3. Trade 4. Livestock and poultry farming 5. Transportation 6. Canning
Main types of economic activities in which the population is interested in conducting	1. Agriculture 2. Cotton (including recycling) 3. Trade 4. Tourism 5. Transportation	1. Cotton (including recycling) 2. Agriculture 3. Trade 4. Industry 5. Science, culture, education 6. Tourism	1. Trade 2. Agriculture 3. Cotton (including recycling) 4. Science, culture, education
Dependence on the natural resources of the reserve (e.g. firewood for heating, etc.)	1. Firewood - for heating 2. Grass - for grazing of livestock 3. Fish - for consumption	1. Firewood for heating 2. Grass - for grazing of livestock 3. Fish - for consumption	1. Firewood for heating 2. Grass - for grazing of livestock 3. Fish - for consumption
Contribution to total income	1. Salary - 20% 2. Migrant remittances - 20% 3. Income from sale of agricultural products - 60%	1. Salaries - 20% 2. Migrant remittances - 40% 3. Income from sale of agricultural products - 40%	1. Salary - 20% 2. Trade - 15% 3. Migrant transfers - 50% 4. Income from sale of agricultural products - 15%

Literature

1. Biology

1. **Zapryagaeva V.I.** Forest resources of Pamir-Alai "Nauka", Leningrad, 1976.
2. **Potapov R.L.** Tigrovaya Balka. The unknown Pamir. Moscow, Mysl, 1976.
3. **Molotkovsky Y. I.** Vegetation of the reserve "Tigrovaya Balka" /Tajikistan (natural resources), Academy of Sciences of the Taj. SSR, Vzd. Donish, 1982.
4. **Sapozhnikov G.N.** Modern state of the reserve Tigrovaya Balka /Tajikistan (natural resources), Academy of Sciences of the Taj. Tadzikistan (Natural Resources), Academy of Sciences of the Tajik SSR, Vzd. Donish, 1982.
5. **Kurbanov Sh.M., Ustyan I.P., Muratov R.Sh., Sattorov R.** Specially Protected Natural Territories of the Republic of Tajikistan. Dushanbe, 2011.
6. Forest Genetic Resources of Tajikistan, (Chapter 6. Conservation of Forest Genetic Resources in Protected Areas under natural growing conditions - in situ) Dushanbe, Irfon Publishing House, 2012.
7. Red Data Book of Tajikistan, Dushanbe, Vzd. "Donish", 2021 Tajikistan. Environmental Performance Reviews. (Chapter 8: Biodiversity, Biosafety, Forestry and Protected Areas), UN Publishing, New York and Geneva, 2017.

2. Zoology

- [1]. **Abdunazarov, A.G.** Birds of anthropogenic landscape of Badakhshan [Text]: dissertation. ... candidate of biology / Abdunazarov Abdunazar Goibnazarovich. - Dushanbe, 2000. 179 c.
- [2]. **Abdusalyamov, I.A.** Animal world of Tajikistan / I.A. Abdusalyamov // Collection of materials of the meeting of teachers of secondary schools of Tajikistan - Dushanbe: 1961.
- [3]. **Abdusalyamov, I.A.** Birds of the valley of Lake Rangkul in the Pamir // I.A. Abdusalyamov / Proceedings of the Institute of Zoology and Parasitology, Academy of Sciences of the Tajik SSR. INSTITUTE OF ZOOLOGY AND PARASITOLOGY OF THE ACADEMY OF SCIENCES OF THE TAJIK SSR. - Dushanbe: Academy of Sciences of Tajik. SSR, 1961. T. 20.
- [4]. **Abdusalyamov, I.A.** Influence of anthropological factors on the reduction of the pheasant range in Tajikistan / I.A. Abdusalyamov // Fourth zoogeographical conference - Odessa, 1966.
- [5]. **Abdusalyamov, I.A.** Fauna of the Taj. SSR. Birds [Text]: textbook. //I.A.Abdusalyamov. Dushanbe: Donish, 1971. - VOL. 19. - CH. 1. - 398 c.
- [6]. **Abdusalyamov, I.A.** Fauna of the Taj. SSR. Birds [Text]: textbook. //I.A.Abdusalyamov. Dushanbe: Donish, 1973. - Vol. 19. - Ch. 2. - 396 p..
- [7]. **Abdusalyamov, I.A.** Features of bird migration in the lower reaches of the Kafarnigan River / I.A. Abdusalyamov, Y.A. Lebedev // Bird migration in Asia. Vol.3. - Alma-Ata: Nauka, 1976. - C. 143-152.
- [8]. **Abdusalyamov, I.A.** Fauna of the Taj. SSR Birds [Text]: textbook. //I.A.Abdusalyamov. Dushanbe: Donish, 1977. - VOL. 19. - CH. 3 - 273 c.
- [9]. **Abdusalyamov, I.A.** To the study of bird migration in the Vakhsh valley of Tajikistan / I.A. Abdusalyamov, Y.A. Lebedev // Bird migration in Asia. Vol.2. - Novosibirsk: Nauka, 1977. - C. 170-180.
- [10]. **Abdusalyamov, I.A.** Bird migration in the lower reaches of the Yakhsu River in Tajikistan / I.A. Abdusalyamov, Y.A. Lebedev // Bird migration in Asia. Issue 4. - Tashkent: Fan, 1978. - C. 34-59.
- [11]. **Abdusalyamov, I.A.** Bird migrations in the lower reaches of the Panj River in Tajikistan / I.A. Abdusalyamov, O.A. Baukova, V.V. Kostin // Bird Migrations in Asia. Vol.6.- Ashgabat: Ylym, 1981. - C. 87-104.
- [12]. **Abdusalyamov, I.A.** Bird migrations in Southern Tajikistan. / I.A.Abdusalyamov, Y.A.Lebedev - Dushanbe: Donish, 1986.- 207 p.
- [13]. **Abdusalyamov, I.A.** Changes in the species composition of birds of anthropogenic landscape in connection with the environmental situation / I.A. Abdusalyamov, G.D. Garibmamadov // Reports of

- the Academy of Sciences of Tajikistan. Department of Biol. and Medical Sciences. 2007. № 3 (50). - C. 270-273.
- [14]. **Amirov, Z.G.** Ecology and distribution of ungulates (Artiodactyla) of South-Western Tajikistan / Z.G. Amirov // Abstract of the dissertation ... candidate of biological sciences. - Dushanbe, 2017. - 22 c.
 - [15]. **Atlas of the Tajik SSR** / I.K. Narzikulov, K.V. Stanyukovich // Dushanbe - Moscow: Main Department of Geodesy and Cartography under the USSR Council of Ministers, 1968. - 200 c.
 - [16]. **Akhrorov, F.** Aquatic ecosystems of Tajikistan / F. Akhrorov // Dushanbe, 2009. - 70 c.
 - [17]. **Akhrorov, D.F.** Ecological features of some lakes of the reserve "Tigrovaya Balka" [Text] / D.F. Akhrorov // Izvestiya AN RT. Department of biol. and med. sciences. 2012. - № 1 (178) - C. 35-41.
 - [18]. **Garibmamadov G.D.** Settlement and nesting of the ringed turtle (*Streptopelia decaocto* Srivaldszky, 1838) in Tajikistan / G.D. Garibmamadov // Dokl. of the Academy of Sciences of Tajikistan. Department of Biol. and Medical Sciences. 2006. - № 10-12 (49). - C. 962-963.
 - [19]. **Garibmamadov, G.D.** Features of bird migration in arid and foothill areas of Southwestern Tajikistan / G.D. Garibmamadov // Abstract of the dissertation ... candidate of biological sciences. - Dushanbe, 2019. - 24 c.
 - [20]. **Gladkov, N.A.** Pheasants / N.A. Gladkov // Birds of the Soviet Union / Moscow: Soviet Science, 1952. T. 6. - C. 199-225.
 - [21]. **Goncharov, N.F.** Flora regions of Tajikistan and their vegetation. / N.F. Goncharov // - Flora of Tajikistan. - M.-L., 1937. T. 5. - C. 7-94.
 - [22]. **Dementiev, G.P.** Birds of prey, owls / G.P. Dementiev // Birds of the Soviet Union // M.; Soviet Science, 1951. T. 1 - C. 70-339.
 - [23]. **Ivanov, A.I.** Notes on some birds of Tajikistan / A.I. Ivanov // Reports of the USSR Academy of Sciences. New series. Moscow, 1935, vol. 4 (9), № 6/7. - C. 281-284.
 - [24]. **Ivanov, A.I.** Birds of Tajikistan / A.I. Ivanov // Proceedings of the Tajik base of the USSR Academy of Sciences - M.-L.: USSR Academy of Sciences, 1940. T. 10. 300 c.
 - [25]. **Ivanov, A.I.** Wintering of birds in the lower reaches of the Vakhsh River in Southern Tajikistan / A.I. Ivanov // Proceedings of the Tajik Branch of the Academy of Sciences of the USSR - Stalinabad, 1945., No. 6. - C. 36-59.
 - [26]. **Ivanov, A.I.** New data on birds of Tajikistan. Communications of the TFAN of the USSR, vol. 6, Stalinabad, 1948.
 - [27]. **Ivanov, A.I.** Wintering and flight of birds on the territory of Pamir-Alai / A.I. Ivanov // - M.-L.: USSR Academy of Sciences, 1950. - C. 266 - 287.
 - [28]. **Ivanov, A.I.** Determinator of birds of Tajikistan and adjacent areas / A.I. Ivanov // Proceedings of the Academy of Sciences of the Tajik SSR. SSR. 1953. - VOL. 6. CH. 1. - 237 c.
 - [29]. **Ivanov, A.I.** Birds of the USSR in two parts / Ivanov A.I., Kozlova E.V., Tugarinov A.Y., Portenko L.A. // L., 1951-1960.
 - [30]. **Ivanov, A.I.** Birds of Pamir-Alai / A.I. Ivanov // L.: Nauka, 1969. - 448 c.
 - [31]. **Ivanov, A.I.** Catalog of birds of the USSR [Text]: textbook. // A.I. Ivanov. L.: Nauka, 1976. - 275 c.
 - [32]. **Ivanov, A.I.** Brief identifier of birds of the USSR [Text]: textbook. // A.I. Ivanov, Z.K. Shtegman. L.: Nauka, 1978. - 559 c.
 - [33]. **Red Book of the Republic of Kazakhstan.** Fourth edition corrected and supplemented. T. 1.: Animals; Part 1: Vertebrates. - Almaty: DPS, 2010. - 324 c.
 - [34]. **Red Book of the Republic of Kyrgyzstan.** Second edition. Plant and animal world. - Bishkek, 2006. - 544 c.
 - [35]. **Red Book of the Russian Federation.** Animals. - Moscow, "Astrel", 2001. - 862 c.
 - [36]. **Red Book of the Republic of Tajikistan.** Second edition. Plant and animal life (section birds) / R.Sh. Muratov [et al.] // - Dushanbe: Ganch, 2015. -C. 150- 193.

- [37]. **Red Book of the Republic of Tajikistan.** Second edition. Plant and animal life (section birds) / R.Sh. Muratov [et al.] // - Dushanbe: Ganch, 2017. -C. 150-193.
- [38]. **Red Book of the Tajik SSR.** First edition. Plant and animal world (section birds) / R.Sh. Muratov [and others] // - Dushanbe: Irfon, 1988. - C. 84-124.
- [39]. **Red Book of the Republic of Turkmenistan.** Third edition revised and supplemented: invertebrate and vertebrate animals. - Ashgabat: Ylym, 2011. - 384 c.
- [40]. **Red Book of the Republic of Uzbekistan.** Animal world. Part 2. - Tashkent: Chinor ENK, 2009. - 219 c.
- [41]. **Menzbir, M.A.** Zoological sites of the Turkestan region and probable origin of the fauna of the latter / M.A. Menzbir // M.: 1914. 144 c.
- [42]. **Molotkovsky, Yu.I.** Vegetation / Yu.I. Molotkovsky // Tajikistan (Nature and Natural Resources). - Dushanbe: Donish, 1982. - C. 545-548.
- [43]. **Muradov, O.V.** Study of nesting of *peregrine* falcon (*Falco peregrinus peregrinus* Tunstall, 1771) using a camera trap. In the collection Remote Research Methods in Zoology. Proceedings of the scientific conference. Moscow: Partnership of scientific publications (November 28-29, 2011). - Pp. 59.
- [44]. **Muratov, R.Sh.** Migrations of waders in the Surkhob River valley. / P.Sh. Muratov // Migrations of birds in Asia. - Tashkent: Fan, 1984. - C. 99-102.
- [45]. **Muratov, R.Sh.** Day migrations of birds on the territory of Pamir-Alai / R.Sh. Muratov // Abstract of dissertation ... candidate of biological sciences.- Novosibirsk, 1989. - 24 c.
- [46]. **Muratov, R.Sh.** Migrations of birds on the territory of Pamir-Alai. Monograph / R.Sh. Muratov / - Dushanbe, 2021. - 236 c.
- [47]. **Muratov, Sh.H.** Dynamics of the number of birds of prey of South-West Tajikistan / Sh.H. Muratov, R.Sh. Muratov // VII All-Union Ornithological Conf.: Proc. - Kiev: Naukova Dumka, 1977. Ч. 1. - C.88.
- [48]. **Narzikulov, M.N.** Animal world. / M.N. Narzikulov // Tajikistan (nature and natural resources). Academy of Sciences of the Tajik SSR. Dushanbe: Donish, 1982. - C. 438.
- [49]. **Nikolsky, G.V.** Fish of Tajikistan. / G.V.Nikolskiy // Tr. Tadj. Base of the USSR Academy of Sciences. M.-L.: ANS SSR, 1938. T. 7. - 228 c.
- [50]. **Potapov, R.L.** In Tigrovaya Balka: Notes of a zoologist / R.L. Potapov. Moscow: Geografiz, 1962. - 104 c.
- [51]. **Potapov, R.L.** Tigrovaya Balka: The Unknown Pamir / R.L. Potapov. Moscow: Mysl, 1976. - 317 c.
- [52]. **Preobrazhenskaya, I.B.** Encounters of the narrow-nosed teal in the reserve "Tigrovaya Balka" (South-West Tajikistan) / I.B.Preobrazhenskaya // Kazarka 11 (2). 2008. C. 186-187.
- [53]. **Rakhimov, F.I.** New data on rare and endangered species of birds of Tajikistan / G.D.Garibmamadov, F.I. Rakhimov // Izvestia of the Academy of Sciences of Tajikistan. Department of biol. and med. sciences. - 2019. - № 4. (207). - C. 35-43.
- [54]. **Rakhimov, F.I.** Landscape-seasonal distribution of birds of the reserve "Tigrovaya Balka" / G.D.Garibmamadov, F.I. Rakhimov // Izvestiya AN RT. Department of Biol. and Med. sciences. - 2020. - № 4. (211) - C. 49-56.
- [55]. **Rakhimov, F.I.** Biotopic distribution of birds of the reserve "Tigrovaya Balka" during the end of migration and the beginning of nesting / F.I. Rakhimov // Proceedings of the National Academy of Sciences. Department of Biological Sciences. - 2021. - № 2 (213) - C. 24-30.
- [56]. **Stroganov, S.U.** Materials on the breeding of the Tajik black-and-gold pheasant (*Phasianus colchicus bianchii* But.) // Bul. of MOIP. MOIP. Biol. 1946. T. 51, № 1. C. 73-86.
- [57]. **Stroganov, S.U.** Pheasant in Tajikistan / S.U. Stroganov // Hunting and hunting economy, № 4, 1957.

- [58]. **Tugarinov, A.Ya.** Tajik pheasant / A.Ya. Tugarinov, E.V. Kozlov // Izv. of Taj. phil. ACADEMY OF SCIENCES OF THE USSR. 1945. № 6. C. 7.-35.
- [59]. **Fauna of the Uzbek SSR.** Raksha detachment. / O.P. Bogdanov // Tashkent, Vol. 2, ch. 2, 1957.

3. Hydrology

1. **Akhmedov H.A.** "Basic issues of irrigation and water use improvement", "Uzbekistan" Publishing House, Tashkent 1973.
2. **Academy of Sciences of Tajik USSR**, Institute of Geology "Underground waters of Tajikistan and issues of land reclamation", Publishing House "Donish", Dushanbe - 1967.
3. **Gastunsky A.N.** "Hydrology of Central Asia", "Ukituvchi" Publishing House, Tashkent-1969.
4. **State Institution "TajikNIIGiM"**, "Guidelines for control over ameliorative condition of irrigated lands", Dushanbe - 2009.
5. **Dukhovny V.A.** et al. "Horizontal drainage on irrigated lands" Publishing house "Kolos", Moscow - 1979.
6. **Zheleznyakov G.V.** "Hydrometry" Publishing House "Kolos", Moscow - 1964.
7. **Zaslavsky M.N.** "Soil erosion", Moscow "Mysl", 1979.
8. **Pokrovsky V.A.** "Hygiene", Moscow "Medicine", 1979.
9. **Potapov R.L.** "Stories about Nature" in Tigrovaya Balka, State Publishing House of Geographical Literature, Moscow - 1962.
10. **Rakhmatillaev R. et al.** "Changes in the water regime of the Vakhsh River at the site of "Tigrovoy Balka" as a result of construction of the Nurek and Ragun reservoirs", TAU named after Sh. Shotemur, Dushanbe - 2022.
11. **Salimov T.O.** "Water Quality Management", Dushanbe 2001.
12. **Salimov T.O.** "Tajikistan Country of Origins", Dushanbe 2001.
13. **Skvaletsky E.N., Akhmerov A.S.** "Rational use of irrigated lands of Tajikistan and protection of natural environment", Dushanbe -1986.
14. **Reference Manual of Hydrogeologist**, Leningrad "Nedra", Leningrad Branch, 1979.
15. **Summary report** "On study of groundwater regime and balance in South-West Tajikistan" for 1971-1980. Funds of the State Institution "NMSEZ and IW"
16. Annual technical reports and reclamation cadastre for 2019-2022. Funds of the State Institution "NMSOZ and IW"
17. Hydrometeorology materials for the Tiger Bay site for 2019, 2020 and 2023. Funds of the Agency for Hydrometeorology.
18. Materials of regime observations over groundwater in South-West Tajikistan for 1995-2023. Funds of the State Institution "NMSEZ and IW"

4. Socio-economic section

1. **Red Book of the Tajik SSR.** - Dushanbe: Donish, 1988. - 336 c.
2. **Red Book of the Republic of Tajikistan**, Donish, 2016
3. National Strategy and Action Plan on Preservation and Rational Use of Biodiversity of the Republic of Tajikistan. 2003 r.
4. National Environmental Action Plan of the Republic of Tajikistan. 2006 r.
5. Program for the development of protected areas for 2005-2015. - Dushanbe, 2005 - 20 pp.
6. Forestry Development Program for the period 2005-2015. - Dushanbe, 2005 - 28 pp.
7. **Safarov N. M.** Ecosystems of Tajikistan and issues of ecological zoning. - Dushanbe, 2004. - 44 c.
8. **Safarov N.M.** Cruise on the "Tiger Beam". - Donish Publishing House, Dushanbe, 2009. - 28 c.
9. **Safarov N.M.** "Tiger beam" in the environment, - Dushanbe Publishing House "Mir polygraphy". 2012 r. - 72 pp.

9. International documents

1. **Nomination Dossier** "Tugay Forests of the Tigrovaya Balka Nature Reserve", Proposal for Inscription on the UNESCO World Heritage List, Republic of Tajikistan, 2021
2. Ramsar Convention website <https://www.ramsar.org/news/tajikistan-joins-ramsar-convention>
3. Ramsar Convention on Wetlands, Resolution XII.15, Ramsar Site Management Effectiveness Tracking Tool (R-METT)
https://www.ramsar.org/sites/default/files/documents/library/guide_r-mett_e.pdf
4. **IUCN World Heritage Evaluations 2022 and 2023.** IUCN Evaluations of nominations of natural and mixed properties to the World Heritage List. IUCN, Switzerland, 2023
5. UNESCO WHC website <https://whc.unesco.org/en/tourism/>
6. UNESCO WHC, Policy Compendium <https://whc.unesco.org/en/compendium>