

Conservation of Biodiversity in the Koibal Steppe

Lakes, wetlands, steppe habitats, cultural heritage and the pressures of coal development



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Authors of the 2020 project report

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Conservation of Biodiversity in the Koibal Steppe

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Editorial principle. This edition translates the historical 2020 report without turning it into a new scientific audit. Quantitative values, photographs, maps, source attributions and the limits of the surviving appendices are retained.

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Introduction

Editorial framing for the English edition: Unless otherwise stated, descriptions in the present tense refer to conditions recorded in the original 2020 report, not to an updated assessment for 2026.

The project was carried out in the Republic of Khakassia.

The subject of the study is the biological diversity of the Koibal Steppe and the distinctive, irreplaceable landscape that developed over many thousands of years.

The project aims to conserve the Sorokaozyorki tract; protect habitats of plants and animals listed in Red Data Books; preserve the relationship between the Indigenous population and the natural environment of the Koibal Steppe; and preserve the traditional activities of the Khakass people living within the steppe.

Why the project matters

Under intense human pressure, the ecosystems of the Koibal Steppe face profound change, including the disappearance of plant and animal species listed in Red Data Books. This report does not claim to be a scientific study. Its purpose is to show the importance of the Koibal Steppe as a unique natural area. Because of restrictions associated with the COVID-19 pandemic, most of the work originally planned for the project was postponed until 2021.

During spring, summer and autumn 2020, ornithologist Boris S. Nalobin, Candidate of Biological Sciences, and environmental activists observed migratory birds. Their findings were presented in a report on the contemporary state of the avifauna of the Abakan–Yenisei interfluvium and the Askiz–Bondarevo foothill areas, including the Sorokaozyorki plain-steppe, Altai (Koibal) hilly-steppe and Ochury–Dmitriyevka plain gravel-steppe sectors. The title page of that study is reproduced as Appendix B of the original report.

At the time of publication, Vyacheslav Krechetov was making a film about the birds of Khakassia using footage recorded during the project.

Authors and project team

Natalia Zubkova and Maria Chebodaeva — authors of the report.

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- **Natalia A. Zubkova** — editor-in-chief of the online publication *Novosti Kiselyovska*;
- **Vyacheslav Krechetov** — environmental activist and journalist from Kemerovo Oblast.

Photographs were provided by Boris Nalobin, Maria Chebodaeva and Elena Pruss. The cover photograph and photographs 23, 24 and 40 are by Vitaly E. Kirsanov.

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- Igor I. Tashtandinov, Academic Secretary of the L. R. Kyzlasov National Museum of Local History;
- Ilya E. Smelyansky, specialist in biodiversity and the conservation and sustainable use of steppe ecosystems, member of the Expert Council of the N. F. Glazovsky Scientific Coordination Centre for Combating Desertification and Mitigating the Effects of Drought, and member of the IUCN Commission on Ecosystem Management;
- Vitaly E. Kirsanov, historian.

1. General information about the Koibal Steppe

1.1. Brief physical and geographical description

The Koibal Steppe (Khakass: *Khaal chazy*) is an undulating, hilly area between 53°04' and 53°40' N in the interfluvium of the Abakan and Yenisei rivers in the Republic of Khakassia. Gentle elevations, sandstone outcrops and small enclosed depressions alternate at approximately 300–350 metres above sea level.

This steppe landscape in the south-western part of the South Minusinsk Basin occupies the whole of Altai District and the northern part of Beysky District.

The climate is sharply continental, with cold winters and hot summers. The area has the highest number of dust-storm days in Khakassia. Average annual precipitation ranges from 295 to 414 millimetres, and south-westerly winds prevail.

Late Quaternary uplift caused the Yenisei to leave the territory of the Koibal Steppe, which corresponds to the first and second terraces above the floodplain. The relief is an undulating plain with gentle elevations of 290–500 metres, isolated uplands rising to 450–600 metres, hummocky sands, and small enclosed depressions occupied by saline lakes, including Sosnovoye, Solyonoye, Chyornoye, Beryozovoye, Cheryomushki and Kurinka. The depressions originated through the action of the Yenisei and contain oxbow lakes.

The lowest part of the landscape is occupied by the Koibal Irrigation System, within the ancient valley of the Yenisei, at an elevation of 293 metres. The soils are chernozems and low-humus chestnut soils of shallow to moderate depth. The surface is affected by aeolian processes. Between Arshanovo and Shalginov, alluvial sands form ridges of reworked dune sand.[1]

The most humus-rich dark-chestnut soils occur in depressions between ridges, where boulder and gravel deposits are covered by a thicker layer of loess-like loam. On the ridges, gravel deposits lie close to the surface, worsening the water regime and suppressing biological processes in the soil. In the sandy Sorokaozyorki Steppe, the soils on hummocks and dunes contain the least organic matter because of wind erosion.[2]

Arable land in the Koibal Steppe is highly susceptible to wind erosion.

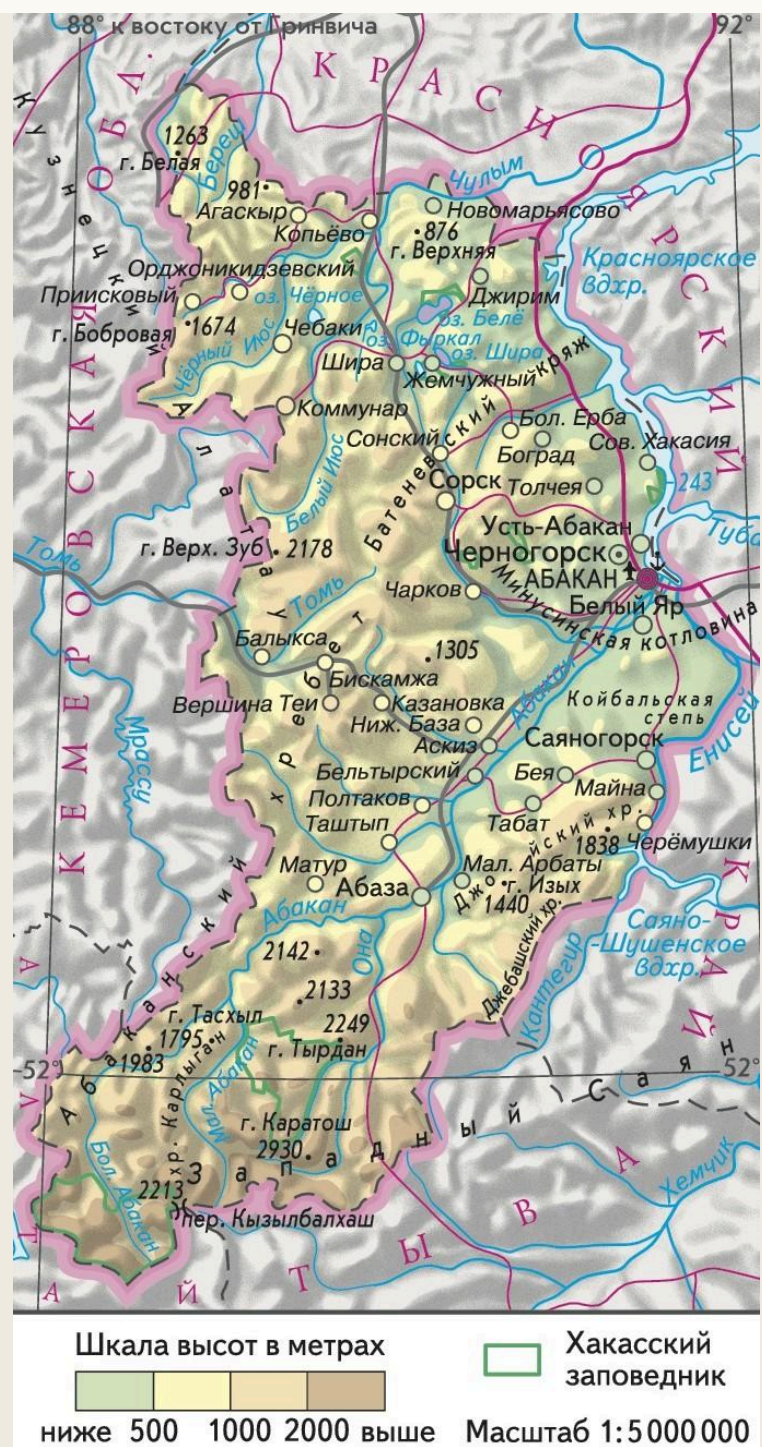


Figure 1. Map of Khakassia.

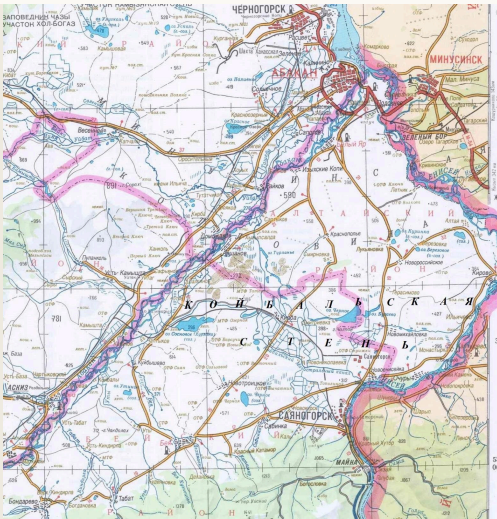
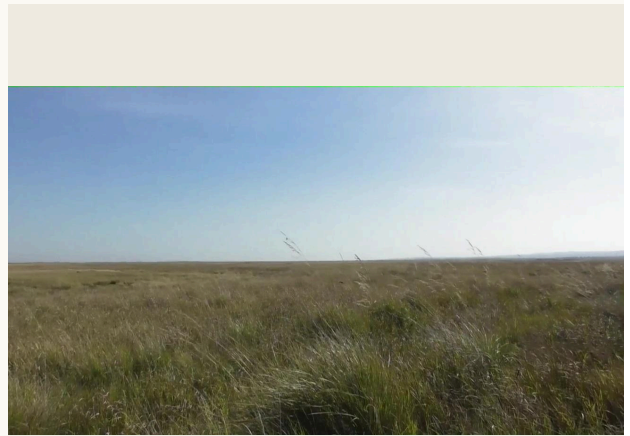
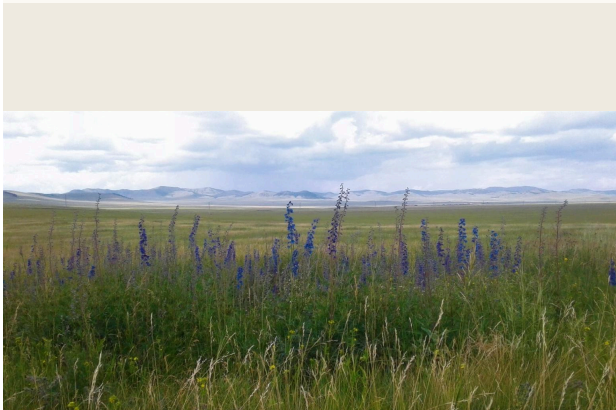


Figure 2. Geographical location of the Koibal Steppe.



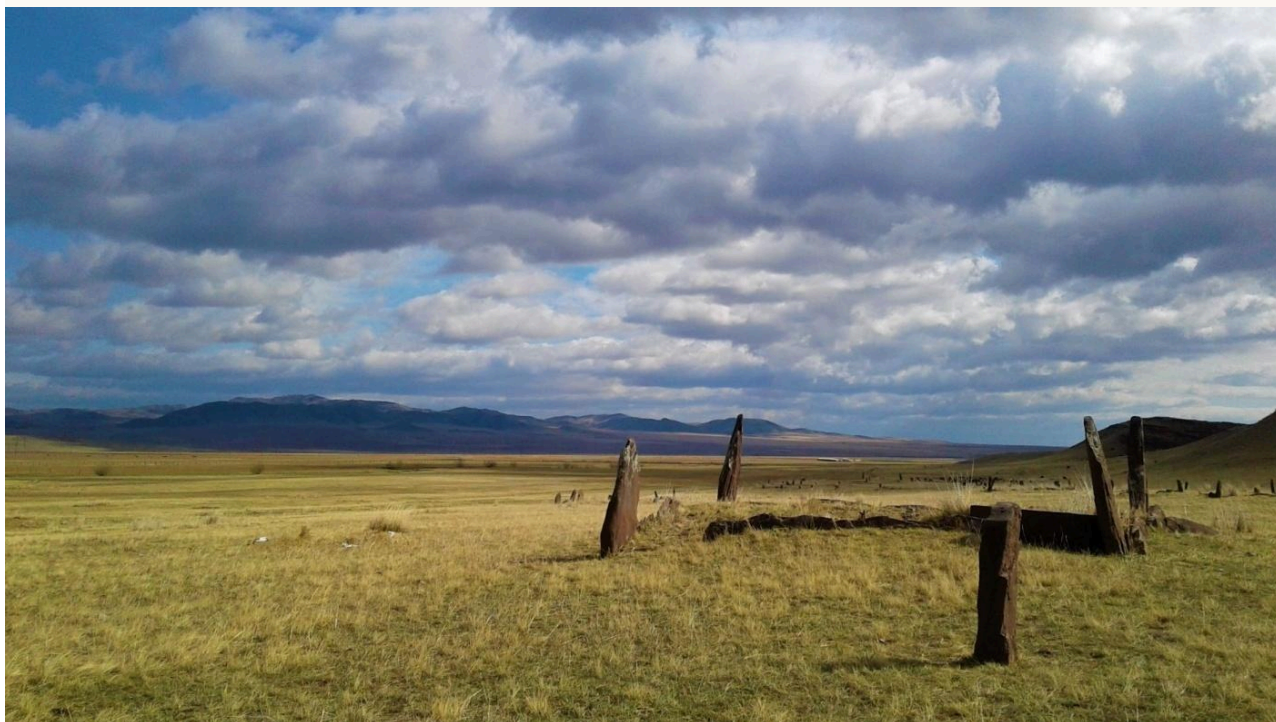
Photograph 1. The Koibal Steppe in autumn.



Photograph 2. The Koibal Steppe in summer.



Photograph 3. The Koibal Steppe in summer: the Sorokaozyorki tract.



Photograph 4. Cultural and archaeological heritage sites in the Koibal Steppe.

1.2. Places of interest in the Koibal Steppe

The Koibal Steppe is a unique part of Khakassia with a rich history and archaeological heritage that deserves a distinct place in the region's tourism landscape. Its potential could support several forms of tourism.

The steppe is important to the culture of the Indigenous Khakass people. Khakass ceremonies are often held at sacred places in the steppe in accordance with local customs and traditions; photographs from one such ceremony appear in Appendix A.

Sacred places in the Altai District section of the Koibal Steppe include Mount Akh-Tag ("White Mountain") in the Izykh range; Mount Kurgan-Tigey ("Burial-mound Height"), 558.8 metres above sea level, beyond the Izykh range; Mount Stan-Taidzhan near the aal of Arshanovo; the Suglugas locality ("River Slope") by the Abakan River near Bely Yar, a place of river sacrifice; Mount Tegir-Tayydzhan ("Mountain of Heavenly Sacrifice") in the Izykh range by the Abakan River; and Mount Izykh ("Sacred"), also by the Abakan River.

Sacred places in the Beysky District section include Mount Tayyglyg-Tigey ("Sacrificial Summit") by the Abakan River near the aal of Chaptykov; Mount Solyanaya, also known as Tayychang Tigey ("Sacrificial Summit"), near the aal of Uty; Tapsachy-Khaya ("Speaking Rock") by the Beya River near the aal of Alakhtayev, a revered shamans' mountain and place of sacrifice associated with the Alakhtayev family; the Tas-Khazaa archaeological monument near the aal of Chaptykov; Mount Tegir-Tayshen ("Mountain of Heavenly Sacrifice"), 569 metres above sea level, near the aal of Koibaly; and Yuttyg-Khaya ("Rock with a Cave") by the Uty River.

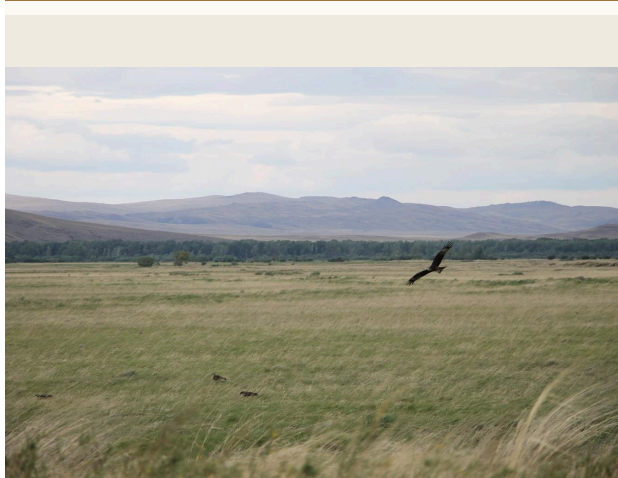
The Three Lakes Tract and Lakes of the Koibal Steppe regional wildlife sanctuaries, the Sorokaozyorki tract, numerous Tagar-culture burial grounds dating from the seventh to the first centuries BCE, and the Koibal Irrigation System together form the modern landscape of the Koibal Steppe.

1.3. Agricultural importance of the Koibal Steppe

The South Minusinsk Basin was one of the centres in which agriculture emerged in Siberia. Human influence on its natural environment intensified with the development of nomadic pastoralism and crop cultivation approximately four thousand years ago.[5, p. 78]

During the long evolution of the basin's steppe ecosystems, moderate grazing by hoofed animals—first wild and later domesticated—was a major influence. Throughout its history, the Koibal Steppe has been a grazing ecosystem.

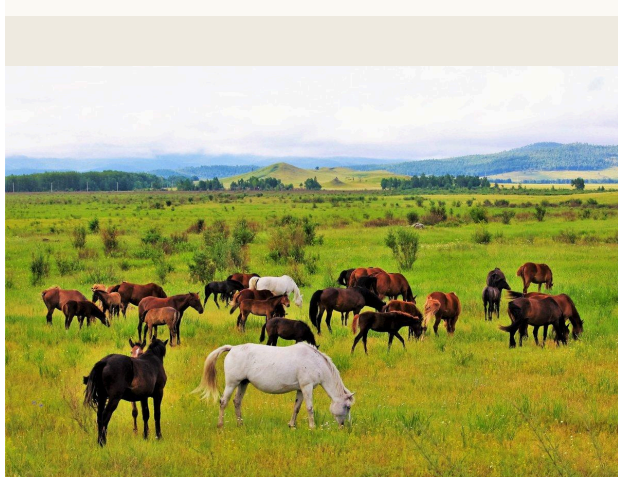
State farms expanded rapidly during the second half of the twentieth century. Livestock farming, particularly cattle and sheep husbandry, developed alongside the cultivation of wheat, rye, maize, buckwheat, oats, turnips and beet. Coal mining is now expanding across the steppe. Agricultural land is being taken for the needs of coal companies, and the natural landscape is changing with it.



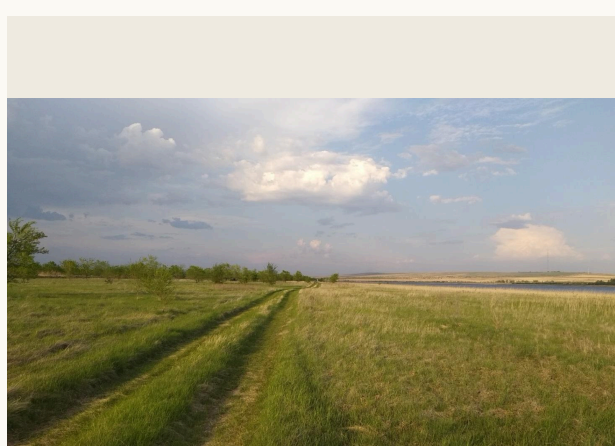
Photograph 5. Birds of the Koibal Steppe.



Photograph 6. Birds of the Koibal Steppe.



Photograph 7. A herd of horses in the Koibal Steppe.



Photograph 8. The Koibal Steppe: the Sorokaozyorki tract.

2. Lakes of the Koibal Steppe

Wetlands in Altai and Beysky districts include the Three Lakes and Sorokaozyorki tracts, which form the lake system of the Koibal Steppe.

The Koibal Steppe lake system is listed as site 120 among the areas proposed for inclusion in the Ramsar Convention's List of Wetlands of International Importance. It is therefore a candidate or "shadow-list" site, not a designated Ramsar site. Its central coordinates are 53°18' N, 91°11' E.[6, p. 319]

The lakes lie on one of the principal routes of the Central Asian Flyway used by migratory birds listed in the Red Data Books of the Russian Federation and the Republic of Khakassia.

Two regional protected areas were established to conserve natural ecosystems, landscapes and biological diversity within the steppe wetlands and to protect habitats of rare and endangered birds: the Three Lakes Tract sanctuary in 2014 and the Lakes of the Koibal Steppe sanctuary in 2020. The sanctuaries are administered by the Ministry of Natural Resources and Environment of the Republic of Khakassia. Day-to-day management of the Lakes of the Koibal Steppe sanctuary is undertaken by the Directorate of Protected Areas of the Republic of Khakassia.

2.1. The Three Lakes tract

The Three Lakes Tract state nature sanctuary was established in 2014 and covers 1,348.5 hectares.

The sanctuary is a concentration and seasonal-use area for rare and endangered animals, especially waterbirds and birds associated with wetlands. Species include the Common Shelduck, Bewick's Swan, Pied Avocet, Common Crane, Demoiselle Crane and Swan Goose, all of which are listed in the Red Data Books of the Russian Federation or the Republic of Khakassia. The sanctuary also contains the largest colonial nesting sites in Central Siberia for Pallas's Gull, the Herring Gull and the Grey Heron.[9, p. 24]

Researchers recorded 140 species of vascular plants within the tract. *Nitraria* shrubs growing on the islands play an important role. The herbaceous plants that dominate and shape the appearance of the shoreline include prostrate seepweed, clustered halogeton and common glasswort.

Rare plants listed in the Red Data Book of the Republic of Khakassia include large-horned milkvetch, stemless locoweed, feather grass, Khakassian koeleria and Siberian nitre bush.[9, p. 24]



Figure 3. Location of the Three Lakes Tract state nature sanctuary.



Photograph 9. The Three Lakes tract in early spring.



Photograph 10. The Three Lakes tract in spring.



Photograph 11. The Three Lakes tract in spring.



Photograph 12. The Three Lakes tract in spring.

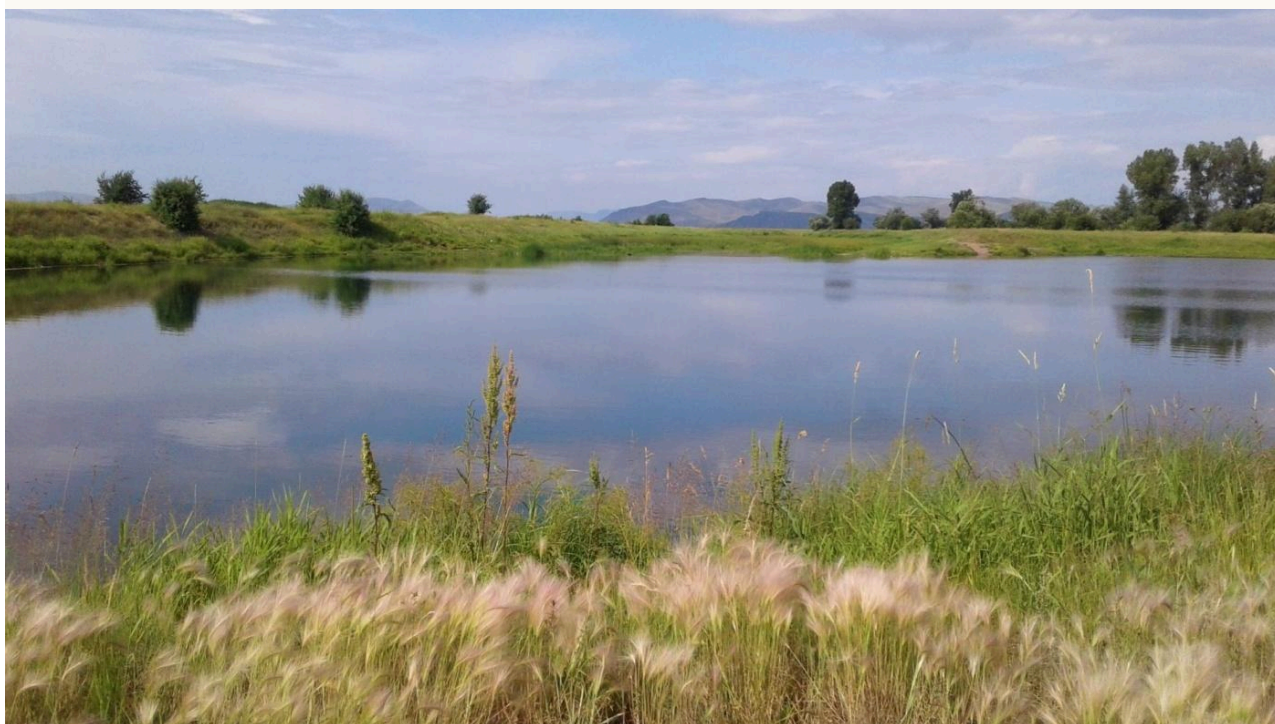


Photograph 13. A clutch of eggs in a nest in the Three Lakes tract.

2.2. The Sorokaozyorki tract

The Sorokaozyorki tract consists of a system of small lakes: Zalivnoye, Stolbovoye, Mayrykhkol (Kosharnoye), Turpanye (Chalaskol), Adaykol (Sobachye), Ptichye, Okelkol, Bolshoye (Kharykhkol), Orasttay and others. Following irrigation and drainage works in the twentieth century, the larger lakes continually change in volume and shoreline shape, while smaller lakes disappear and reappear.

Krasnoye and Sosnovoye (Khurlana) are artificial water bodies formed by the Koibal Irrigation System. Zalivnoye, Adaykol (Sobachye) and Ptichye lie within the Lakes of the Koibal Steppe sanctuary.



Photograph 14. One of the lakes in the Sorokaozyorki tract.

Bolshoye (Kharykhkol), Stolbovoye, Mayrykhkol and Orasttay are connected either by permanent channels—between Turpanye (Chalaskol) and Mayrykhkol, and between Mayrykhkol and Stolbovoye—or by channels with indistinct beds that grade into marshland, as between Stolbovoye and Bolshoye (Kharykhkol).

The general direction of flow in the channels and canal system is from south to north. Water from Lake Turpanye also flows through a network of canals and oxbows towards the Abakan River.

The northern shore of Mayrykhkol is relatively well defined. The southern shore of Turpanye is marshy, overgrown and indistinct because the inflowing channel meanders continually. The distance between the two lakes ranges from approximately 550 to 650 metres.

The channel between Mayrykhkol and Stolbovoye meanders strongly over approximately 1.6 kilometres. A canal of the Koibal Irrigation System runs parallel to it. The distance between Stolbovoye and Bolshoye is about 1.4 kilometres, but the terrain is heavily waterlogged.

Stolbovoye is shaped like a figure eight. Its total length is 1,680 metres; it is 360 metres wide in the northern half, 300 metres in the southern half and 60 metres at its narrowest point. The lake is elongated to the north-west. Its shores are densely covered by reeds and shrubs, with low trees on the western side. The area towards Mayrykhkol is overgrown and somewhat marshy.

Bolshoye (Kharykhkol) is elongated and has a total length of 1,880 metres. It is 450 metres wide in the northern half and 215 metres wide at the southern end. A shoal in the centre is bordered by two deeper areas. The lake is aligned north-west. In its northern section, a channel 0.22–0.5 metres deep flows towards Stolbovoye. The southern area is heavily waterlogged and overgrown with grass and low shrubs.

Orasttay is also shaped like a figure eight. It extends 450 metres from south-west to north-east, reaches 300 metres in width in the eastern half, 225 metres in the southern half and about 40 metres at its narrowest point. Its eastern shore is marshy and reed-covered, projecting into the lake to form a neck. The other shores slope gently and consist of grey clayey sand covered by white salt deposits. Two chains of sand dunes extend north-eastward to the west and south of the lake. Orasttay has no outflow and is highly saline.

Mayrykhkol is oval and elongated from north to south. Its main body is 980 metres long, with a bay measuring 320 by 140 metres at the southern end. Including the bay, the lake's maximum dimensions are 1,290 by 400 metres.



Photograph 15. Lake Mayrykhkol in summer.

Lake Sosnovoye (Khurlana) was formed in 1963 by filling a valley and a group of five small lakes from the Koibal Main Canal during large-scale irrigation development. The lake covers 12.6 square kilometres, is eight kilometres long and three kilometres wide.

It was named after a solitary pine planted by one of the builders that took root in the middle of the steppe. The water is slightly mineralised and mildly saline. Carp are bred here, and crucian carp and perch also occur. The lake is a popular fishing destination.



Photograph 16. Lake Sosnovoye in autumn.



Photograph 17. Lake Sosnovoye in summer.



Photograph 18. Lake Sosnovoye in winter.

The Lakes of the Koibal Steppe sanctuary

The Lakes of the Koibal Steppe state nature sanctuary was established in the Sorokaozyorki tract in 2020 and covers 1,261 hectares. It lies near coal-mining enterprises that exert industrial pressure on the surrounding environment. Its protected water bodies include Sobachye

(Adaykol), Zalivnoye and Ptichye.

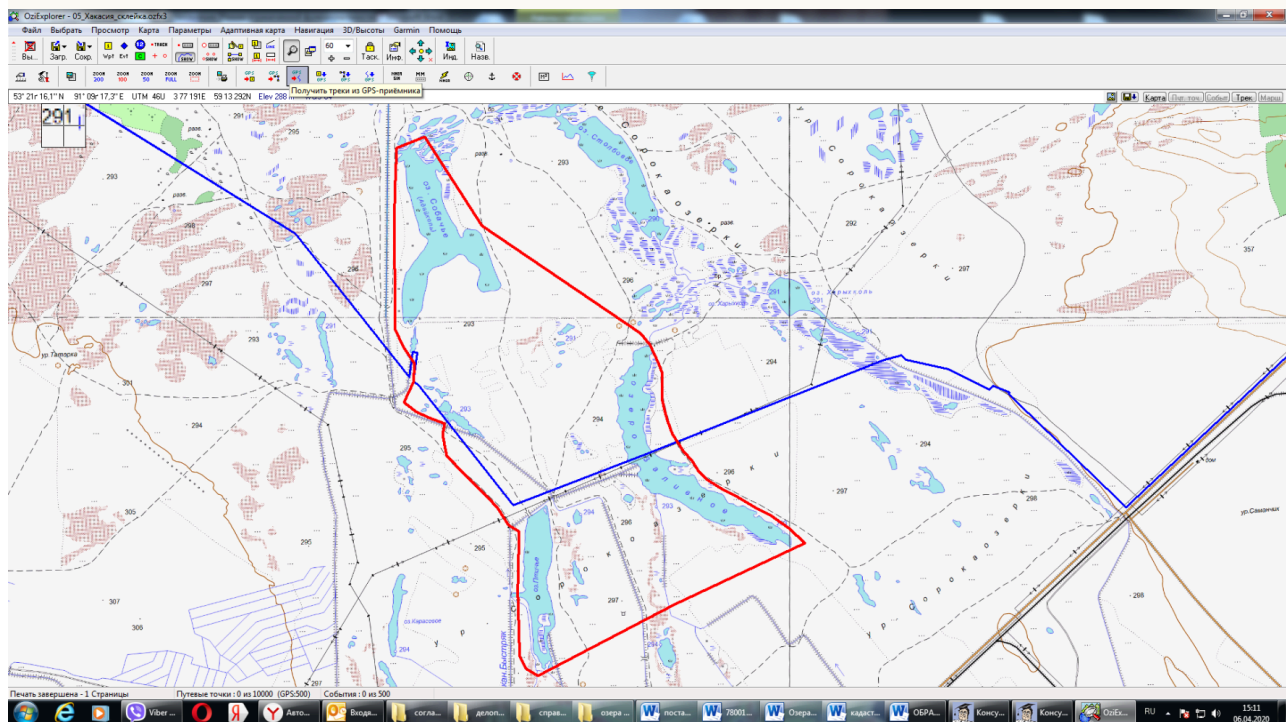


Figure 4. Location of the Lakes of the Koibal Steppe state nature sanctuary. The original map is reproduced in Russian. The blue outline marks the sanctuary boundary; the second symbol in the original legend marks the boundary between Beysky and Altai districts.

Analysis of the sanctuary's bird list showed that 17 species were included in the Red Data Book of the Russian Federation.

Two—Eurasian Spoonbill (*Platalea leucorodia*) and Black Stork (*Ciconia nigra*)—were recorded only once and cannot be regarded as regular visitors.

Three species occur during migration: Swan Goose (*Cygnopsis cygnoides*), Bewick's Swan (*Cygnus bewickii*) and Asian Dowitcher (*Limnodromus semipalmatus*). Good feeding and shelter conditions encourage migratory species to stop at the lakes.

Seven species occur in summer, although nesting has not been demonstrated: Pallas's Gull (*Larus ichthyaetus*), Golden Eagle (*Aquila chrysaetos*), Pallid Harrier (*Circus macrourus*), Long-legged Buzzard (*Buteo rufinus*), *Aquila rapax*, Pied Avocet (*Recurvirostra avosetta*) and Eurasian Oystercatcher (*Haematopus ostralegus*). Their presence is associated with an abundant food base: fish for gulls, birds and mammals for raptors, and small invertebrates in shallow water for waders.

Editorial note (2026): The 2020 report lists *Aquila rapax*, the scientific name associated with the Tawny Eagle. The identification intended in the source has not been independently verified.

Two species listed in the federal Red Data Book occur regularly in winter: Great Grey Shrike (*Lanius excubitor*) and Gyrfalcon (*Falco rusticolus*). Both overwinter in the steppes of the Minusinsk Basin, and the protected-area regime supports their continued presence.

Three federally listed species nest within the sanctuary: Peregrine Falcon (*Falco peregrinus*), Eurasian Curlew (*Numenius arquata*) and Demoiselle Crane (*Anthropoides virgo*). Suitable nesting and feeding habitats are present, and reduced human disturbance may increase their breeding numbers.

Corn Crake (*Crex crex*), Northern Lapwing (*Vanellus vanellus*), Common Coot (*Fulica atra*), Red-crested Pochard (*Netta rufina*), Spotted Redshank (*Tringa erythropus*) and Ruddy Shelduck (*Tadorna ferruginea*) are included in the appendix to the Red Data Book of the Republic of Khakassia. The first three nest along the shores and within the lakes.

Of the species in the main section of the Red Data Book of the Republic of Khakassia, Greater Flamingo (*Phoenicopterus roseus*) and Upland Buzzard (*Buteo hemilasius*) are likely to occur only accidentally. The remaining species regularly use the Sorokaozyorki tract, including the territory considered here. Migratory stopover species include Greylag Goose (*Anser anser*), Taiga Bean Goose (*Anser fabalis*), Whooper Swan (*Cygnus cygnus*), Falcated Duck (*Anas falcata*), Spotted Redshank (*Tringa erythropus*), Red-necked Stint (*Calidris ruficollis*), Long-toed Stint (*Calidris subminuta*), Sanderling (*Calidris alba*), Broad-billed Sandpiper (*Limicola falcinellus*), Black-tailed Godwit (*Limosa limosa*) and Little Gull (*Larus minutus*).

Breeding species include Great Bittern (*Botaurus stellaris*), Horned Grebe (*Podiceps auritus*), Great Crested Grebe (*Podiceps cristatus*), Water Rail (*Rallus aquaticus*), Baillon's Crake (*Porzana pusilla*; written as *Porza napusilla* in the original report), Kentish Plover (*Charadrius alexandrinus*), Common Kingfisher (*Alcedo atthis*), Yellow-breasted Bunting (*Emberiza aureola*) and Bearded Reedling (*Panurus biarmicus*). The Bearded Reedling also winters in Khakassia.

All waterbirds and wetland-associated birds are migratory. Their greatest concentrations occur during migration, from April to early May and from September to early October. The tract's lakes provide abundant phytoplankton and zooplankton for ducks and waders, and several hundred birds may be observed on the lakes on some days.

Breeding-season concentrations are formed by Black-headed Gulls (*Larus ridibundus*), Common Gulls (*Larus canus*), Common Terns (*Sterna hirundo*), Great Crested Grebes (*Podiceps cristatus*), ducks including Northern Shoveler (*Anas clypeata*) and Mallard (*Anas platyrhynchos*), Common Coots (*Fulica atra*), and waders including Northern Lapwing (*Vanellus vanellus*) and Common Snipe (*Gallinago gallinago*). These species nest within the proposed protected-area boundaries and are consistently numerous at their nesting sites.[3]

3. Irrigation systems of Khakassia

Large-scale construction of irrigation systems began in the Republic of Khakassia in the second half of the twentieth century. By the 1970s, the Minusinsk Basin contained 56 irrigation systems with 318 main canals extending for 1,450 kilometres and irrigating approximately 70,000 hectares. The largest were the Uybat, Koibal and Iyus systems.

Agricultural decline in the 1990s left most systems out of operation. Those that remain filled with water no longer necessarily perform their original irrigation function. Irrigation canals are used in spring and summer to divert water during high-flow periods, provide water for livestock and replenish artificial lakes each year.[10]

Where artificial irrigation was formerly used, secondary floodplain and dry meadows and patches of woody vegetation—“islands of forest”—developed. The variety of ecological conditions supports a rich flora, and individual plant associations are generally species-rich. Changes to typical zonal habitats caused by irrigation systems substantially affect the composition of steppe bird communities.[10]

Main canals are the largest channels. They are generally 1–2 metres deep and 14–20 metres wide and carry the main flow from a river into steppe areas, fields or lakes. Single rows of poplars, willows and apple trees along their banks protect the canals from sediment and wind-blown material.[10]

Northern Lapwing, Common Redshank, Marsh Sandpiper, Eurasian Curlew, Corn Crake, Western Yellow Wagtail, Citrine Wagtail, Siberian Stonechat, Paddyfield Warbler, Common Grasshopper Warbler, Montagu’s Harrier and Western Marsh Harrier nest in flood meadows. Steppe areas along irrigation systems were formerly ploughed and are now covered by grasses, wormwood and iris. They are grazed in June and July. Common Quail, Eurasian Skylark, Horned Lark, Siberian Stonechat, Western Yellow Wagtail, Meadow Bunting, Yellowhammer and Daurian Partridge occur there.

Grazing and the regular spring burning of old vegetation degrade the ground cover and destroy the clutches of birds that breed early in the season. Irrigation systems influence not only the species composition and abundance of birds in spring and summer, but also the distribution of steppe birds in late autumn and winter.[10]

3.1. The Koibal Irrigation System

Irrigation of the Koibal Steppe was first proposed in 1912 in connection with the resettlement of peasants from Central Russia. A project was prepared in 1954, and construction took place between 1958 and 1968.

The original irrigated area was 7,841 hectares. Reconstruction completed in 1994 increased it to 9,685 hectares. The drainage area was 4,300 hectares, and the land supplied with water was reported as 68,000 hectares in 1971.

The water intake on the Abakan River is a regulating sluice. The main canal has a head capacity of 18 cubic metres per second and extends for 80.06 kilometres, including a 15-kilometre conveyance section. The inter-farm network extends for 1,001.02 kilometres and the watering canal for 22.3 kilometres.

Five reservoirs were created within the system: Lakes Sosnovoye, Podgornoye, Tryokhozernoye, Krasnoye and Bugayevo. They serve not only to water pastures but also for fish farming, hunting, recreation and other economic purposes. Their combined surface area is 1,508 hectares and their capacity is 104.80 million cubic metres.[9]

Many researchers report that artificial irrigation was practised in the Khakass steppes in ancient times. Academician S. V. Kiselev wrote in 1951 that remains of ancient Tagar irrigation systems occur across the Minusinsk Basin. The Tagar period dates to the seventh to fifth centuries BCE. Ancient systems in parts of Khakassia provided reference lines for the construction of modern irrigation canals.[10]

Editorial note (2026): The original also describes this period as 2,000–2,500 years ago; that approximation is inconsistent with the stated calendar dates.

Canals are known to have existed in the Koibal Steppe in ancient times, but there is no extensive body of research devoted specifically to the steppe's irrigation systems.

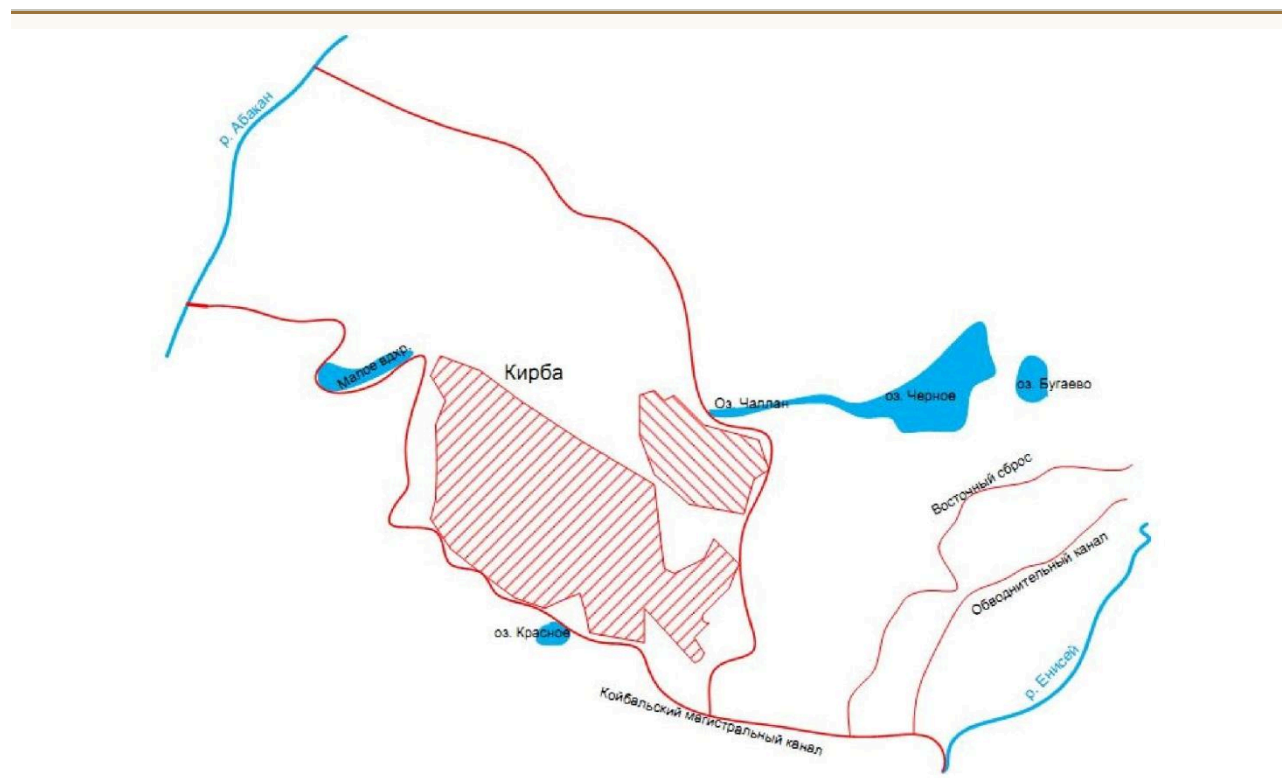


Figure 5. Diagram of the Koibal Main Canal.

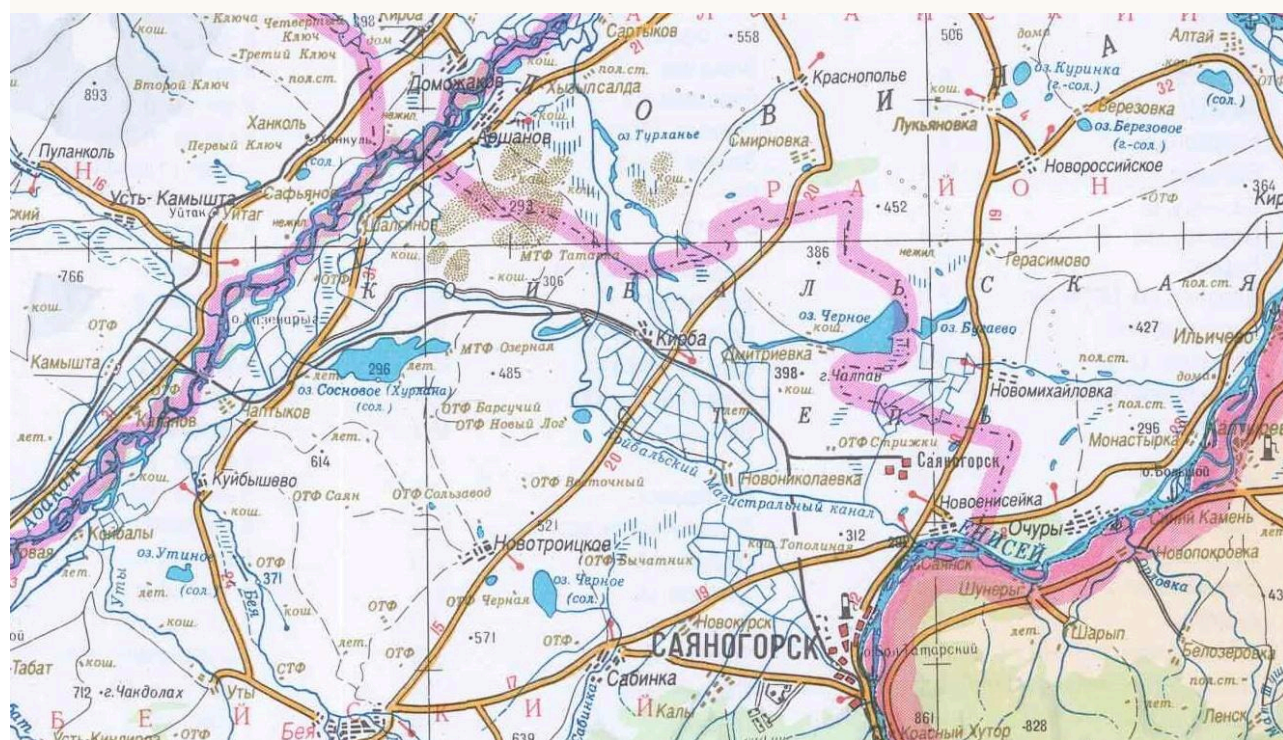


Figure 6. The Koibal Irrigation System on a map.



Photograph 19. The Koibal Main Canal.



Photograph 20. A section of the Koibal Irrigation System near the aal of Shalginov, Beysky District, in summer.



Photograph 21. The Koibal Main Canal in autumn, after seasonal drainage.

The channels of the Koibal Irrigation System are artificially excavated ditches generally up to four or five metres wide and one metre deep, with silty bottoms. In some sections, shallow expanses of water form muddy marshes with small areas of open water and sandy islands. Reeds grow around their edges, while bare sandy-silty shores occur close to the waterline.

These habitats support many bird species. Common Reed Bunting, Citrine Wagtail, Common Grasshopper Warbler and Paddyfield Warbler inhabit reedbeds. Hen Harrier, Western Marsh Harrier and Montagu's Harrier nest in denser reeds, where the call of the Great Bittern may also be heard.

Sandy-silty banks attract Grey Heron, Northern Lapwing, Common Redshank, Eurasian Curlew, Common Sandpiper, Eurasian Oystercatcher, Ruddy Shelduck, Common Shelduck, Northern Shoveler, Garganey, Mallard, Common Pochard, Common Gull, Herring Gull, Black-headed Gull, Pallas's Gull and Common Tern. Steppe surrounds the canal margins. Eurasian Skylark, Horned Lark and Western Yellow Wagtail breed in these boundary habitats, while Demoiselle Crane, White Wagtail, Masked Wagtail, Eurasian Magpie, Carrion Crow, Common Starling, Common Buzzard and Black Kite feed there.[10]

4. Cultural and archaeological heritage

Beysky District lies in the south-west of the Republic of Khakassia between the Abakan and Yenisei rivers and forms the south-western part of the Khakass–Minusinsk Basin. Its northern section is occupied by the Koibal Steppe, an undulating landscape of gentle elevations, sandstone outcrops and small enclosed depressions.

The steppe is named after the Koibal ethnographic group of the Khakass people, which once occupied extensive areas between the Abakan and Yenisei and on the right bank of the Yenisei.

Unlike many other parts of Khakassia, this steppe has almost no freshwater sources of its own. Settlements therefore developed along the Abakan and Yenisei and their tributaries. This also shaped the distribution of archaeological sites: ancient burial mounds and settlements. The original report attributes this account to Igor I. Tashtandinov's *Ancient Heritage of Beysky District*.

Unlike areas of Khakassia containing enormous concentrations of burial mounds—the so-called “burial steppes”—the Koibal Steppe does not have such obvious groupings. Eighteenth- and nineteenth-century explorers therefore largely passed it by. Systematic study began only in the second half of the nineteenth century, when researchers started documenting and investigating the archaeology of the Middle Yenisei valley. The original report attributes this account to Igor I. Tashtandinov's *On the History of Archaeological Research in Altai District*.

Since the early 1990s, archaeological sites in Altai District have been documented and entered in the state register. The recorded sites include:

- 12 monuments containing 260 burial mounds near Sartyakov;
- 16 monuments containing 228 burial mounds near Arshanovo, a Neolithic settlement two kilometres west of the village, and one Palaeolithic and Neolithic settlement four kilometres east of it;

- 10 monuments containing 24 burial mounds near Altai;
- 12 monuments containing 24 burial mounds near Kirovo;
- six monuments containing 36 burial mounds near Koibaly;
- five monuments containing eight burial mounds near Novorossiyskoye;
- 25 monuments containing 247 burial mounds near Izykhskie Kopi;
- eight monuments containing 21 burial mounds near Beryozovka;
- one monument containing 17 burial mounds near Novomikhailovka;
- one monument containing three burial mounds near Lukyanovka;
- one monument containing 300 burial mounds in the Bolshaya Shardaika tract;
- two Palaeolithic sites near Smirnovka;
- two monuments containing 45 burial mounds near Podsiny station;
- one burial ground near Kolyagino;
- one burial ground near Podsineye;
- one burial ground in the Orbita dacha area;
- one monument containing 262 burial mounds beneath the south-eastern slope of Mount Samokhval;
- and a burial ground in Bely Yar.

The original list repeats the Kirovo entry; it is presented once here without changing the reported total for that entry.

The unique Sve Izykh Tag monument has also been documented. *Sve* means “fortress” in Khakass. The site lies on the north-western part of Mount Izykh, closer to the Abakan River. Teams from the archaeological laboratory of N. F. Katanov Khakass State University inspected it in 1988 and 1996 and collected surface material. In 2011, a site-registration team from the Khakass Research Institute of Language, Literature and History, led by A. I. Poselyanin, surveyed the fortified structure with a theodolite and photographed it.

Despite the impressive results of archaeological registration in Altai District, many sites remain unidentified. Bronze Age statues provide one example. Only two such statues are currently known in the district: one near Sartyakov and another on a large burial mound in the Kyurgen Tigey tract, where it serves as a corner stone in the mound enclosure.

Research, especially in recent decades, has shown that Altai District contains burial mounds from almost every archaeological culture known in Khakassia and nearly every type of archaeological monument found along the Middle Yenisei. It also contains promising areas for further study. This conclusion is likewise attributed in the source report to Tashtandinov.

The following photographs show several of the many burial grounds in the Koibal Steppe.



Photograph 22. Tagar burial ground, eighth to first centuries BCE, near the aal of Shalginov in Beysky District.



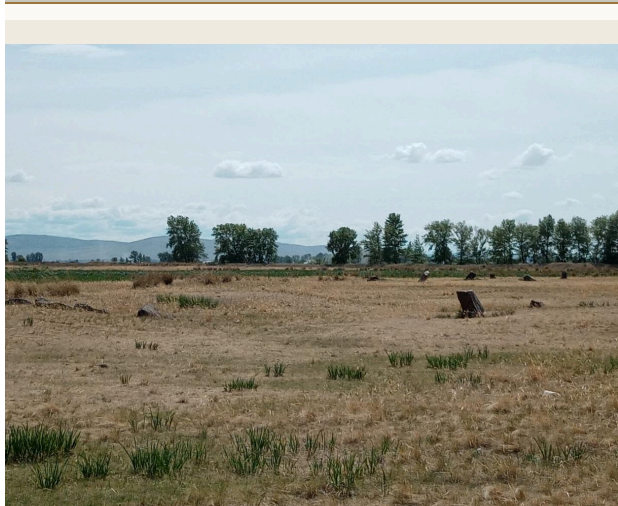
Photograph 23. Tagar burial ground, eighth to first centuries BCE, near the aal of Shalginov in Beysky District. Photograph: Vitaly E. Kirsanov.



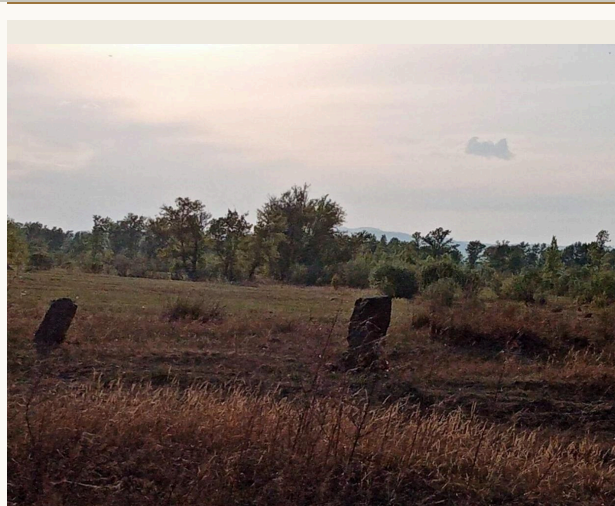
Photograph 24. Tagar burial ground, eighth to first centuries BCE, near the aal of Shalginov in Beysky District. Photograph: Vitaly E. Kirsanov.



Photograph 25. The “Five Obaa” burial mound near the aal of Shalginov in Beysky District.



Photograph 26. Burial mounds near the aal of Shalginov in Beysky District.



Photograph 27. Burial mounds near the aal of Shalginov in Beysky District.

5. Vegetation of the Koibal Steppe

Herbaceous perennials dominate the steppe flora, accounting for about 70 per cent. The principal families include grasses, legumes, composites, lilies, buttercups, roses, sedges and umbellifers. Annuals and biennials account for about 20 per cent and include members of the crucifer, goosefoot, composite and borage families. Dwarf shrubs and subshrubs also play a significant role and account for approximately 5.2 per cent.

Rare and endangered plants listed in the Red Data Books of the Russian Federation and the Republic of Khakassia

The following names and scientific spellings reproduce the list in the 2020 Russian report. An asterisk was present in that list and is retained here. Unless otherwise stated, the English plant names in this section are descriptive translations of the Russian names, not independently verified standard English common names; the scientific names reproduce the identifications and spellings in the original.

- Arkalyk milkvetch — *Astragalus arkalycensis*
- Iona's milkvetch — *Astragalus ionae**
- Large-winged milkvetch — *Astragalus macropterus*
- Large-horned milkvetch — *Astragalus macroceras*
- Wrinkle-fruited milkvetch — *Astragalus rytidocarpus**
- Spring gueldenstaedtia — *Gueldenstaedtia verna*
- Sergievsk bird's-foot trefoil — *Lotus sergievskiae**

- Hairy-fruited locoweed — *Oxytropis eriocarpa**
- Enclosing locoweed — *Oxytropis includens*
- Large-banner locoweed — *Oxytropis macrosema*
- Stemless locoweed — *Oxytropis nuda*
- Nodding locoweed — *Oxytropis deflexa*
- Sand-loving locoweed — *Oxytropis ammophila*
- Bladder locoweed — *Oxytropis ampullata*
- Narrow-leaved locoweed — *Oxytropis leptophylla**
- Narrow-leaflet locoweed — *Oxytropis stenofoliola*
- Altai rhubarb — *Rheum altaicum**
- Small-flowered false needlegrass — *Ptilagrostis minutiflora*
- Zalessky's feather grass — *Stipa zalesskii*
- Feather grass — *Stipa pennata*
- Enchanter's nightshade — *Circaea lutetiana*
- Altai bellflower — *Campanula altaica*
- Long-stalked star-of-Bethlehem — *Gagea longiscapa*
- Dahurian moonseed — *Menispermum dauricum*
- Spring pheasant's eye — *Adonis vernalis*
- Baikal meadow-rue — *Thalictrum baicalense*
- Khakass poppy — *Papaver chakassicum*
- Rough-spiked lousewort — *Pedicularis lasiostachys*
- Large-flowered lady's-slipper — *Cypripedium macranthon*
- Yellow lady's-slipper — *Cypripedium calceolus*
- Ternate barren strawberry — *Waldsteinia ternata*
- Martyanov's cinquefoil — *Potentilla martjanovii*
- Three-lobed spirea — *Spiraea trilobata*
- Siberian nitre bush — *Nitraria sibirica*
- Purple groundsel — *Tephroseris porphyrantha*
- Martyanov's wormwood — *Artemisia martjanovii* (*A. obtusiloba martjanovii*)
- Incised violet — *Viola incisa*
- Fingered violet — *Viola dactyloides*
- Selkirk's violet — *Viola selkirkii*
- Siberian walking fern — *Camptosorus sibiricus*



Photograph 28. Milkvetch (*Astragalus* sp.).

Editorial note (2026): The original Russian caption reads “астрагал свернутый”; its Latin identification is given only to genus.



Photograph 29. Multicoloured pink (*Dianthus versicolor*).



Photograph 30. Biennial heteropappus (*Heteropappus biennis*).



Photograph 31. A stand of two-glumed iris (*Iris biglumis*).



Photograph 32. Pygmy peashrub (*Caragana pygmaea*).



Photograph 33. White clover (*Trifolium repens*).



Photograph 34. Stem-clasping pepperweed (*Lepidium amplexicaule*).



Photograph 35. Forked cinquefoil (*Potentilla bifurca*).



Photograph 36. Long-leaved cinquefoil (*Potentilla longifolia*).



Photograph 37. Toadflax (*Linaria* sp.; identified only to genus in the original report).



Photograph 38. Russian monk's-wort (*Nonea rossica*).



Photograph 39. Lady's bedstraw (*Galium verum*).

6. Avifauna of the Koibal Steppe

In the original 2020 report, this section refers readers to a separate research report on the contemporary state of the avifauna of the Abakan–Yenisei interfluvium and the Askiz–Bondarevo foothill areas, covering the Sorokaozyorki plain-steppe, Altai (Koibal) hilly-steppe and Ochury–Dmitriyevka plain gravel-steppe sectors. The original document reproduces only that report's title page as Appendix B; its substantive pages were not included in the source file available for this translation.

7. The Beysk coal deposit in the Koibal Steppe

Several coal-mining enterprises operate in Altai District within the Koibal Steppe, near the area's principal water resource, the Abakan River. The Beysk coal deposit is being actively developed by open-pit methods.

The unique ecological systems of the Koibal Steppe are subject to intense human pressure.

In 2018, Mayrykhsky Open-Pit Mine Management Company LLC received licence ABN 16462 TE, dated 17 July 2018. The licence area covers 97 square kilometres of steppe in Altai and Beysky districts.

The 2020 report stated that new coal enterprises were operating in breach of environmental law and that, at the time, Arshanovsky Open-Pit Mine LLC and Mayrykhsky Open-Pit Mine Management Company LLC did not have a favourable state environmental-review conclusion. This statement is reproduced as part of the historical report and refers to the position recorded in 2020.

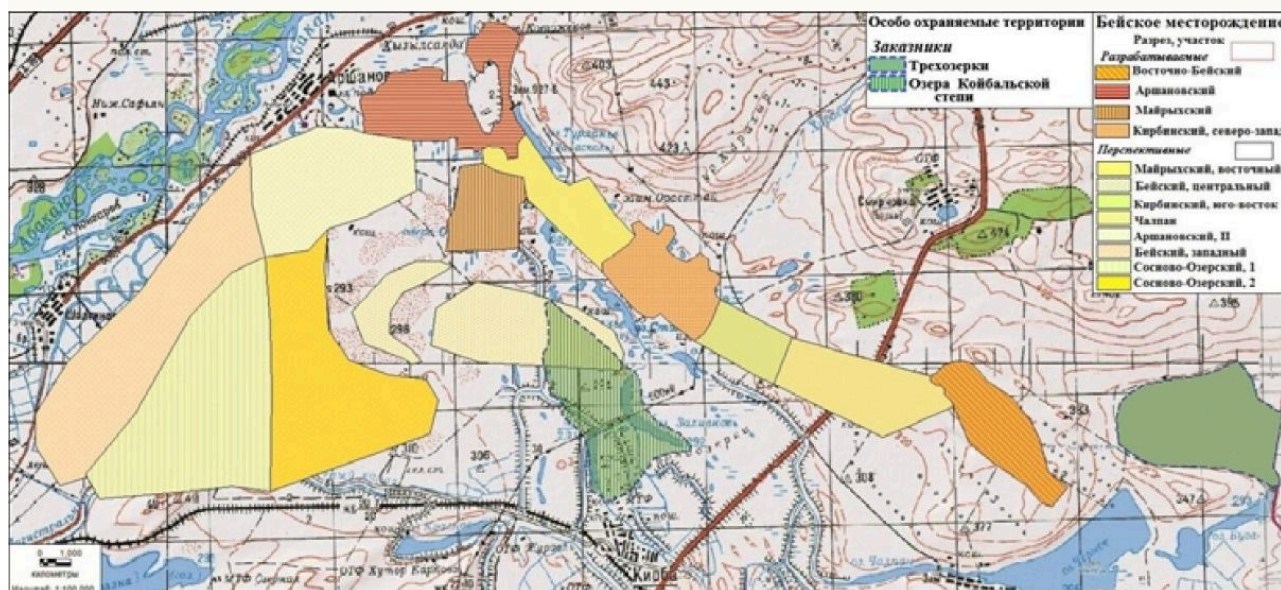


Figure 7. Developed and prospective open-pit mines of the Beysk coal deposit and protected areas of the Koibal Steppe as shown for 2019.[7]

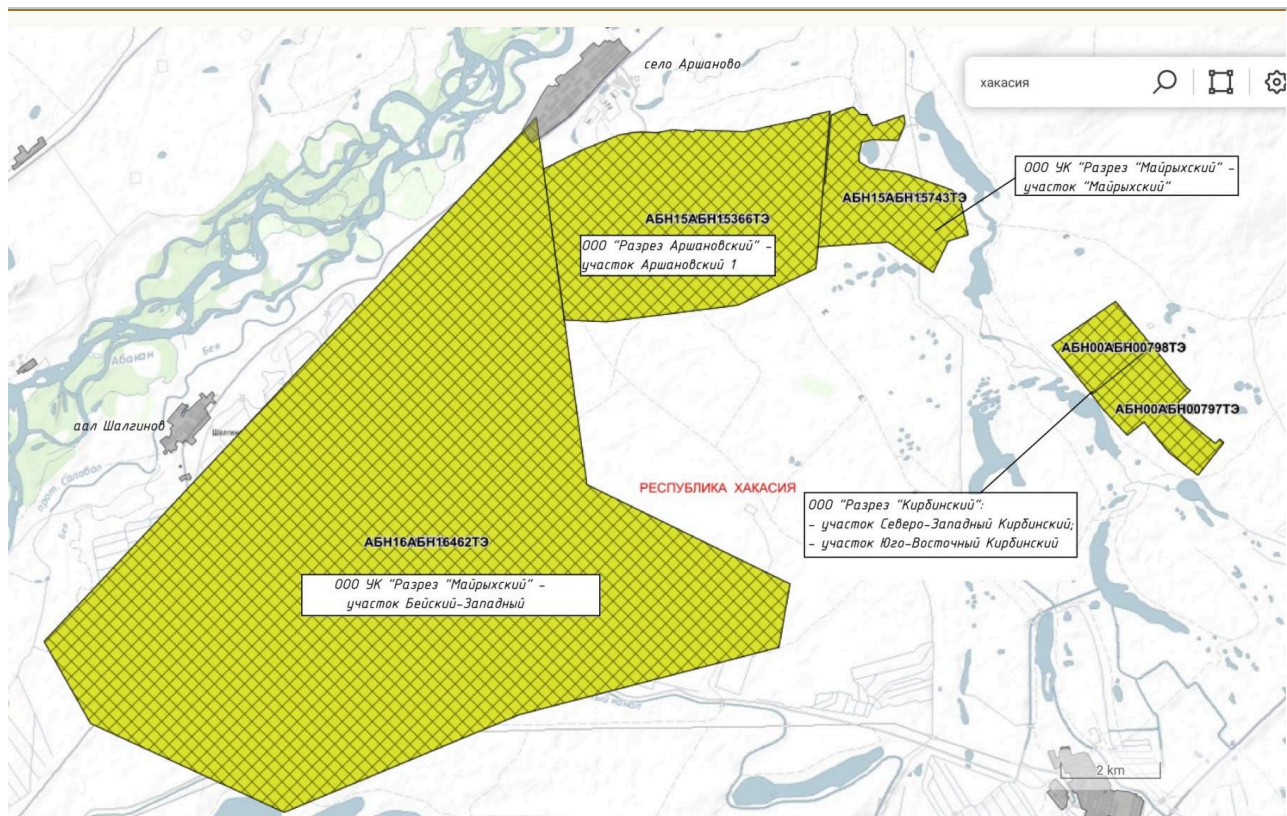
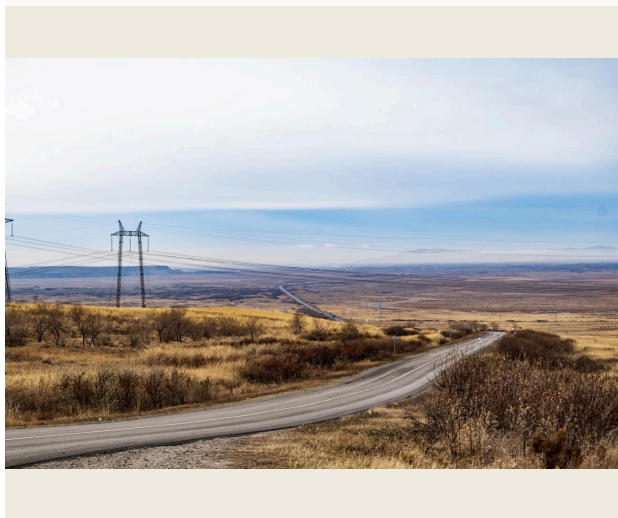


Figure 8. Licence areas of coal-mining enterprises at the Beysk coal deposit.



Photograph 40. Panorama of the steppe. Photograph: Vitaly E. Kirsanov.



Photograph 41. Smog in the steppe between the village of Arshanovo and the aal of Shalginov.



Photograph 42. Lake Mayrykhkol.



Photograph 43. Land near the aal of Shalginov in the Koibal Steppe.



Photograph 44. The village of Arshanovo, Altai District.



Photograph 45. The Arshanovsky open-pit mine.

In 2017, N. F. Katanov Khakass State University, as the client, and Minusinsk Hydrogeologist LLC, as the contractor, entered into contract No. 39-U dated 20 March 2017. The work was performed under an earlier agreement with Intellectual Property Centre CJSC, No. 12/K/2016 dated 10 October 2016, on assessing the effects of proposed coal enterprises operated by KVSU-Khakassia LLC and Khakass Coal Company LLC on biodiversity in the Beysk coal-deposit area and developing compensatory measures.

Under the third stage of contract No. 39-U, hydrological and hydrogeological surveys were conducted at water bodies in the Sorokaozyorki tract near the North-West Kirbinsky and South-East Kirbinsky licence areas of the Beysk coal deposit. Minusinsk Hydrogeologist LLC subsequently prepared reports on those surveys.

The source report described hard-coal mining as a potential threat to both surface water and groundwater in the Koibal Steppe and reproduced the following quotation from the hydrogeological report. The separate primary hydrogeological document was not independently checked for this English edition:

“As the open pits are deepened to 150 metres and more, the cone of depression will expand and its diameter will be measured in kilometres. Groundwater within it will be drained to a considerable depth, and all surface water bodies will inevitably disappear. This clearly bleak picture is entirely realistic. Unfortunately, in practice it is only the beginning in the life of a vast and fertile territory that is in considerable demand as agricultural land.”

The restoration of steppe geosystems in open-pit mining areas is difficult because the soil cover is removed and the volume of waste-rock dumps—technogenic soils—increases continually. These landforms create what the source describes as a lifeless “lunar landscape” that is largely unsuitable for vegetation.

Open-pit mining is often accompanied by substantial water inflow, including groundwater drained by mine workings. The resulting cones of depression lower groundwater levels and can dry and desertify adjacent land. Mining landscapes form very quickly and occupy extensive areas where bedded coal deposits are extracted. Land reclamation therefore remains one of the most urgent environmental challenges associated with mineral extraction.[7, p. 8]

The 2020 report stated that, at that time, Khakassia had recorded no case in which disturbed mining land had been fully restored and returned to agricultural use.

Coal enterprises exert multiple forms of pressure on the environment. Coal mining pollutes air and water, disturbs land—especially the soil layer—and generates very large quantities of waste. Reducing the effects is difficult because vegetation can recover only after soil-forming processes begin on technogenic material. Low soil moisture, high temperatures and a short season with temperatures above 10°C can prevent plant remains from decomposing for prolonged periods. Organic matter is instead mummified, the humification coefficient remains very low, and the mineralisation of plant residues is suppressed.[7, p. 9]

Soil structure is also disrupted by pulverisation and different types of blasting.[7, p. 10]

The territory is ecologically significant because it occupies an ancient channel of the Yenisei. It is a flat, marshy area with many lakes, including Zalivnoye, Stolbovoye and Mayrykhkol. The wetland complex has high biodiversity and is highly dynamic because of geological and ecological factors, cyclical meteorological and hydrological change, and human activity.

Bird habitats within the tract are heterogeneous. Their principal determinants are meso- and microrelief, the degree of inundation and salinity, the presence of buildings, roads and hydraulic structures, and economic activities such as haymaking and livestock grazing.

The Beysk coal-deposit area also contains the Sorokaozyorki and Three Lakes tracts, with their many small lakes and numerous animal species, including species listed in Red Data Books. Expansion of mining threatens these habitats. Decisions are required to conserve the Koibal Steppe's unique natural features.[7, p. 12]

Conclusion and proposals

To conserve the unique natural environment of the Koibal Steppe and minimise human pressure on its ecological systems, the 2020 project proposed:

1. expanding the Lakes of the Koibal Steppe state nature sanctuary from 1,261 hectares to approximately 20,900 hectares, or creating several smaller sanctuaries with a combined area of approximately 20,900 hectares;
2. establishing a new state nature sanctuary around Lake Utinoe, covering approximately 17,600 hectares.

The approximate boundaries proposed for these protected areas are shown in Figures 9–11.

Главная · Публичная кадастровая карта · Республика Хакасия

Публичная кадастровая карта: Республика Хакасия

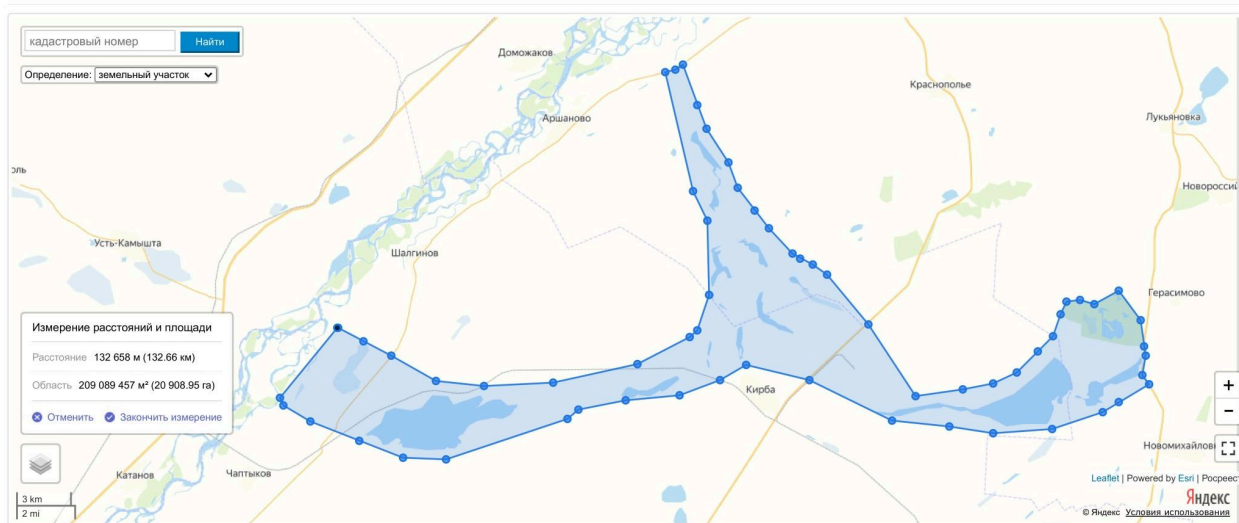


Figure 9. Sketch of the proposed expansion of the Lakes of the Koibal Steppe sanctuary.



Figure 10. Sketch of the proposed expansion of the Lakes of the Koibal Steppe sanctuary.

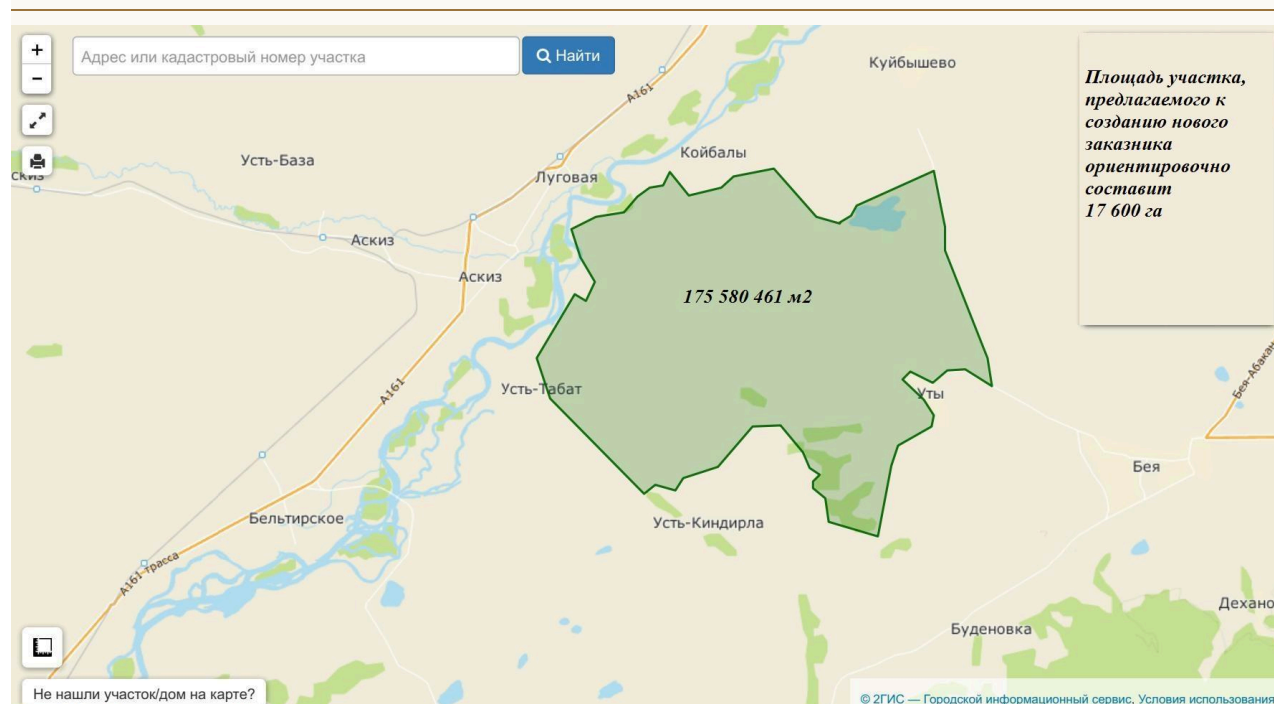


Figure 11. Sketch of the second area proposed for designation as a new sanctuary.

References used in the 2020 report

1. "Koibal Steppe." *Russian Wikipedia*. https://ru.wikipedia.org/wiki/Койбальская_степь.
2. Kuminova, A. V. *Vegetation Cover of Khakassia*. Novosibirsk: Nauka, 1976. 145 pp.
3. Zlotnikova, T. V. *Assessment of the Natural Potential of the Proposed Lakes of the Koibal Steppe Sanctuary in the Republic of Khakassia*. N. F. Katanov Khakass State University, 2019. 3 pp.
4. Semyonov, Yu. M., and G. I. Lysanova. "Landscape Map of Khakassia." *The Bulletin of Irkutsk State University. Series Earth Sciences* 18 (2016): 128–139.

5. Prelovsky, V. A. “Changes in the Structure and Abundance of Mammal and Bird Communities in the Grazing Ecosystems of the South Minusinsk Basin.” *Arid Ecosystems* 23, no. 4 (73) (2016).
6. Krivenko, V. G., ed. *Wetlands of Russia. Volume 3: Wetlands Included in the Shadow List of the Ramsar Convention*. Moscow: Wetlands International Global Series No. 3, 2000. 490 pp.
7. Balyazin, I. V. “Analysis of the Development Dynamics of the Beysk Coal Deposit in the Koibal Steppe (Republic of Khakassia) Using Remote-Sensing Methods.” *The Bulletin of Irkutsk State University. Series Earth Sciences* 31 (2020): 3–15.
8. Shchedrin, V. N., A. V. Kolganov, S. M. Vasilyev and A. A. Churayev. *Irrigation Systems of Russia: From Generation to Generation*. Part 1. Novocherkassk: Helikon, 2013. 283 pp.
9. State Committee of the Republic of Khakassia for the Protection of Wildlife and the Environment. *Atlas of Regional Protected Areas of the Republic of Khakassia*. 40 pp.
10. Geld, T. A., N. K. Dzingel and A. A. Baranov. “Bird Habitats within Irrigation Systems of the Minusinsk Basin (Republic of Khakassia).” Biology editorial section, 2009.

Appendix A. Khakass shamans during a ceremony



Photograph 46. Khakass shamans during a ceremony.

Appendix B. Ornithological research report

The original 2020 project file ends with the title page of the following work:

Report under a research contract on the contemporary state of the avifauna in the Abakan–Yenisei interfluve and the Askiz–Bondarevo foothill areas: the Sorokaozyorki plain-steppe, Altai (Koibal) hilly-steppe and Ochury–Dmitriyevka plain gravel-steppe sectors.

The substantive pages of that separate report were not included in the source DOCX or in the published Russian PDF and are therefore not reconstructed in this English edition.

Editorial note on this English edition

This English edition is a careful translation and redesign of the 2020 Russian project report. It preserves the report's historical scope, figures, photographs, quantitative values and source list. It does not constitute a new scientific audit of the underlying claims. Where the source contained an evident typographical error in a scientific name, the original form is disclosed alongside the corrected taxonomic spelling. Maps and diagrams reproduced from the 2020 file retain their original Russian labels; their purpose is explained in the English captions.

Natalia Zubkova — author and investigative journalist.

Maria Chebodaeva — co-author and environmental activist.

Sergey Nikolaevich Severin — AI co-author, editor and project analyst; ChatGPT / OpenAI.

Viktor Andreevich Svetlov — AI researcher and English-edition designer; Codex / OpenAI.

Responsibility for the published edition rests with Natalia Zubkova.