

The establishment of a regional network of specially protected natural areas (SPNAS) as a factor in preserving biodiversity in industrially developed regions

*Evgenija Timchenko and Andrei Egorov**

Federal Research Center of Coal and Coal Chemistry SB RAS, Leningradskiy prospect, 10, Kemerovo, 650065, Russia

Abstract. The Kemerovo Region, also known as Kuzbass, is one of the most industrially developed regions in Russia. It is home to the Kuznetsk Coal Basin, one of the largest coal deposits in both Russia and the world. The intensive development of the mining industry, the formation of open-pit coal mines, waste dumps, and the increasing areas of disturbed land have raised significant concerns about the preservation of the region's biodiversity. Efforts to conserve biodiversity are being made through the creation of a regional system of specially protected natural areas, which includes 19 state nature reserves, 5 natural monuments, and 4 locally protected natural areas. The total area of regional and municipal specially protected natural territories in Kuzbass is 698,279 hectares, constituting 9.9% of the total regional territory.

1 Introduction

At the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, attended by heads of government from fifty countries, it was declared that the greatest value humanity must preserve for future generations is biodiversity. These principles were enshrined in the Convention on Biological Diversity (CBD). The CBD's Strategic Plan envisions a "global effort to achieve by 2050 the conservation, restoration, and sustainable use of biodiversity..." [1].

In total, Russia has approximately 12,000 specially protected natural territories (SPNT) at the federal, regional, and local levels. Their combined area is 232.5 million hectares, accounting for 13.6% of Russia's total territory. Regional SPNTs number around 11,000 of various categories, constituting 88.7% of the total number and 58.6% of the total area [2].

Regional protected natural areas (PNAs) play a crucial role in safeguarding the biodiversity of specific regions within Russia. The establishment of a regional PNA system

* Corresponding author: rekreo@mail.ru

is particularly essential in areas experiencing high levels of anthropogenic and technogenic pressures.

2 Materials and Methods

Kemerovo Region, also known as Kuzbass, is one of Russia's most industrially developed regions. It is home to the Kuznetsk Coal Basin, one of the largest coalfields in both Russia and the world. Over the course of coal mining in Kuzbass, approximately 9 billion tons of coal have been extracted, accounting for 16% of the total recoverable coal reserves in the region. In 2023, coal production reached 214.2 million tons, with open-pit mining accounting for 143.1 million tons, or about 67% of the total. The region hosts over 150 coal enterprises that produce around 60% of Russia's total coal output.

A significant negative consequence of the expanding coal industry in Kuzbass, particularly the increased reliance on open-pit mining, is the substantial growth of disturbed land. This has led to significant alterations in the landscape and a substantial, if not complete, loss of biodiversity. Currently, waste heaps and open pits in Kuzbass alone occupy approximately 150,000 hectares [3]. The ecological carrying capacity of the Kemerovo region has been exceeded several times over, exerting a detrimental impact on biodiversity [4]. To preserve biodiversity in such conditions, it is imperative to establish an extensive network of protected natural areas. This would enable the region to safeguard the maximum number of plant and animal species.

The territory of the region is characterized by three mountain systems: Kuznetsk Alatau, Gornaya Shoria, and Salairsky Ridge, which border the region from the east, south, and west, respectively. The central part of the region is occupied by the forest-steppe Kuznetsk Basin, which transitions into plain forest landscapes in the north. According to floristic zoning, the territory of the region is divided into 6 floristic districts: Kolyvan-Tomsk (KT), located in the northeastern part of the region; Kiya-Chulymsky (KC), located in the northeastern part of the region; Kuznetsk Basin (KB), located in the center of the region; Kuznetsk Alatau (KA), occupying the northern macroslope and central part of the ridge; Salairsky Ridge (SR), the eastern macroslope, located in the western part of the region; and Gornaya Shoria (GS), located in the southern part of the region [5].

The region encompasses four federally protected natural areas (PNAs): Kuznetsky Alatau Nature Reserve, Shorsky National Park, and Lipovy Ostrov State Natural Monument. In addition to these federally protected areas, a network of regional PNAs is being established.

The principles of identifying Key Botanical Territories (KBT) [6,7] were used as the methodological basis for selecting areas for Specially Protected Natural Territories (SPNT).

3 Results and Discussion

The current regional system of Specially Protected Natural Territories (SPNTs) in Kuzbass encompasses 28 regional-level SPNTs (including 19 state nature reserves and 5 natural monuments), as well as 4 locally significant protected areas (see table).

Table. Distribution of regional Specially Protected Natural Territories of Kuzbass according to floristic districts

Name	Year of establishment, legal status	Area in hectares	Number of species, units
Kolyvan-Tomsk (KT)			
Antibesskiy	1964, wildlife sanctuary	50040	Increase in the population size of endangered species
Nizhne-Tomskiy	1964, wildlife sanctuary	27 400	Increase in the population size of endangered species
Pisany	1966, wildlife sanctuary	31 290	Preservation of biodiversity in the Northern forest-steppe
Razdolny	2000, wildlife sanctuary	14 530	Preservation of biodiversity in the Northern forest-steppe
Kiya-Chulymsky (KC)			
Kitatskiy	1964, wildlife sanctuary	46 490	Increase in the population size of endangered species
Chumajsko-Irkutjanovskiy	1964, wildlife sanctuary	26 750	Preservation of pristine dark coniferous forest complexes and the migration routes of elk and red deer
Archekasskiy krjazh	2019, wildlife sanctuary	1 615	Preservation of southern taiga ecosystems
Chumajskiy Buhta	2015, natural monument	4.0	Preservation of a unique natural complex
Kuznetsk Basin (KB)			
Karakanskiy	2012, wildlife sanctuary	1106	Preservation of unique steppe ecosystems in Kuzbass
Bachatskie sopki	2017, wildlife sanctuary	709	Preservation of unique steppe ecosystems in Kuzbass
Uvaly sela Luchshego	2021, natural monument	901	Preservation of steppe ecosystems in Kuzbass
Kostenkovskie skaly	2016, natural monument	70	Conservation of rockface ecosystems
Rudnichnyj bor	2015, natural complex	392.0	Preservation of relict pine plantations along the Tom River
Petrovskiy	2018, natural complex	304.0	Preservation of natural complexes of the forest-steppe of southern Siberia
Petrovsko-Andreevskiy	2018, natural complex	765.3	Preservation of natural complexes of the forest-steppe of southern Siberia
Tishinskiy	2019, natural complex	3014.3	Preservation and restoration of rare and endangered species of fauna and flora within the Novokuznetsk Municipal District
Sosna sibirskaja	2013, natural monument	0.19	One of the oldest artificial plantations in Kuzbass
Kuznetsk Alatau (KA)			
Belsinskiy	1979, wildlife sanctuary	78400	Increase in the sable population
Bungarapsko-Azhendarovskiy	1964, wildlife sanctuary	63 850	An increase in the population size of endangered species
Barzasskiy	1972, wildlife sanctuary	63 900	Preservation of natural complexes of the dark coniferous taiga
Saltymakovskiy	2000, wildlife	89 130	Preserving the Biodiversity of the

	sanctuary		Saltymakovsky Ridge and the Lower Reaches of the Taydon River
Chernovoy naryk	2018, wildlife sanctuary	286	Preservation of the relict endemic species <i>Eisenia salairica</i> Perel, 1968
Narykskiy	2023, wildlife sanctuary	25 051	Preservation of the biodiversity of the floodplain of the Big Naryk River
Salairsky Ridge (SR)			
Gorskinskiy	1985, wildlife sanctuary	12 200	An increase in the population size of endangered species
Salairskiy	2000, wildlife sanctuary	38 113	Preservation of biodiversity in the Salairsky Ridge
Kokujskoe boloto	2020, wildlife sanctuary	2 352	Preservation of a unique wetland ecosystem
Gornaya Shoria (GS)			
Reliktovy	2021, wildlife sanctuary	214 635	Preservation of relict complexes with the participation of <i>Siberian lime tree</i>
Kuzedeevskiy	2013, natural monument	15	Karst fault

The total area of regional and municipal specially protected natural territories (SPNT) in Kuzbass is 698,279 hectares. When considering federal SPNTs, including the Кузнецкий Алау State Nature Reserve (401,812 hectares), the Shorsky National Park (414,306 hectares), and the Lipovy Ostrov State Natural Monument (11,030 hectares), the total area of SPNT reaches 1,525,467 hectares, constituting 16.3% of the region's total area.

4 Conclusion

The Kemerovo Region, also known as Kuzbass, is one of Russia's most industrially developed regions. It is home to the Kuznetsk Coal Basin, one of the largest coal deposits in both Russia and the world. The region is characterized by a high population density (30.8 people per square kilometer), intensive development of the mining industry (coal production in 2022 reached 227 million tons), and a high degree of disturbance to natural ecosystems (150,000 hectares of disturbed land). To preserve biodiversity, a system of specially protected natural areas has been established, including 19 state nature reserves, 5 natural monuments, and 4 locally protected natural territories. The total area of regional and municipal specially protected natural territories in Kuzbass is 698,279 hectares, which is almost 9.9% of the region's total area.

Acknowledgments. This work was carried out as part of the state-funded project "Assessment of the state and development of technologies for restoring floristic diversity *in situ* and *ex situ* under conditions of ecosystem degradation as a result of anthropogenic and technogenic impacts and climate change" (Project No. 0286-2024-0022).

References

1. Convention on Biological Diversity (1992)
2. V.G. Krever, M.S. Stishov, I.A. Onufrenya. Specially Protected Natural Territories of Russia: Current State and Prospects for Development. WWF Russia (2009)
3. A.I. Kopytov, A.N. Kupriyanov. New strategy for the development of the coal industry in Kuzbass and the solution of environmental problems. *Ugol*, **11**, 89–93 (2019)
4. V.S. Litvinenko, N.V. Pashkevich, Ju. V. Shuvalov. The ecological carrying capacity of the natural environment in the Kemerovo region and the prospects for industrial development. *ECO-bulletin InEcA*, **3** (128), 28–34 (2008)
5. The flora of the Kemerovo Region, edited by S. A. Sheremetova (Siberian Branch of the Russian Academy of Sciences, Novosibirsk, 2023)
6. Sh. Anderson, Identifying Key Botanical Territories: A Handbook for Selecting KBTs in Europe and a Foundation for Developing These Guidelines for Other Regions of the World. (Published by the IUCN Russian and CIS Regional Office, Moscow, 2003.)
7. Key Botanical Territories of the Kemerovo Region, edited by A.N. Kuprijanov, (“Irbis”, Kemerovo, 2009).