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FLORA AND FAUNA. MINERAL AND ROW RECOURCE OF UZBEKISTAN. RED BOOK

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Abstract: *This document provides a comprehensive overview of Uzbekistan's natural environment, focusing on its rich biodiversity, mineral resources, and conservation measures. It describes the country's diverse ecosystems — from deserts and steppes to mountains and river valleys — which host more than 3,700 species of plants and numerous species of mammals, birds, reptiles, amphibians, and insects. Special attention is given to endemic and endangered species included in the Red Book of Uzbekistan. The text also discusses major environmental issues, particularly the Aral Sea crisis, its causes, and ecological consequences. Furthermore, the document analyses Uzbekistan's vast mineral and raw resource potential, including deposits of copper, gold, uranium, natural gas, oil, coal, phosphorites, and rock salt. Emphasis is placed on the importance of sustainable resource use, environmental protection, and the scientific significance of ongoing conservation efforts.*

KEY WORDS: *Flora, Fauna, Biodiversity, Endemic species, Desert ecosystems, Mountain ecosystems, Tugay forests, Juniperus seravschanica, Pskem onion, Snow leopard, Bukharan deer, Reptiles, Birds of Uzbekistan, Invertebrates, Aral Sea, Environmental disaster, Aralkum Desert, Mineral resources, Copper, Gold, Uranium, Non-ferrous metals, Natural gas, Oil, Coal, Phosphorites, Rock*

salt, Red Book of Uzbekistan, Endangered species, Conservation, Sustainable development

Uzbekistan is regarded as one of the most ecologically significant and biologically diverse countries in Central Asia. Its territory encompasses deserts, steppes, river valleys, mountains, and foothill ecosystems, each of which contributes to the formation of a rich variety of flora and fauna. Due to its strategic geographic location at the crossroads of ancient biogeographic routes, as well as its sharply continental climate and heterogeneous landscape, Uzbekistan has become home to numerous endemic, rare, and economically valuable plant and animal species.

The country also possesses an extensive range of raw natural resources, including precious and non-ferrous metals, hydrocarbons, mineral salts, and construction materials. In addition to mineral wealth, Uzbekistan's renewable natural resources—such as underground and surface water reserves, forested areas, rangelands, and highly productive agricultural soils—play a decisive role in the nation's socio-economic development. These resources form the foundation for agriculture, energy production, industrial processing, and the growth of modern sectors such as ecotourism and biotechnology.

In the contemporary era, Uzbekistan's flora and fauna serve not only as components of its natural heritage but also as essential elements in maintaining ecological stability. Plant biodiversity supports soil fertility, climate regulation, and water conservation, while fauna contribute to ecosystem balance, pollination, and natural pest control. As global environmental challenges intensify—such as climate change, land degradation, and biodiversity loss—the need for responsible and science-based management of natural resources is becoming increasingly urgent.

Flora of Uzbekistan

Uzbekistan's flora is exceptionally rich and diverse, consisting of more than 3,700 species of higher plants, of which nearly 20% are endemic, meaning they do not occur naturally anywhere else in the world. The majority of these endemic species are concentrated in mountainous regions, where the complex relief, microclimates, and isolated habitats have contributed to high levels of speciation. In

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contrast, the flora of the steppe and desert zones is represented by distinctive drought-resistant shrubs and semi-shrubs that have adapted to extreme temperature fluctuations and minimal precipitation. In the lowland plains, woody, shrub-like, and herbaceous vegetation is well developed, while riparian tugay forests are characterized by reeds, cane thickets, tamarisk, and kendyr communities. The submontane plains are typically covered with a dense layer of grasses; trees are largely absent, although shrubs tend to cluster around watercourses and moist soils. This zone is known for its remarkable diversity of geophytes, including numerous species of onions (Allium), tulips (Tulipa), rhubarb (Rheum), and irises (Iris). The higher foothills are dominated by dry, herb-rich steppes growing on gray soils, where mixed grasses thrive alongside drought-tolerant bushes. Rocky slopes host species such as almond trees, cherry groves, wild apricot, and the highly resilient kurchava shrub.

Fauna of Uzbekistan

Uzbekistan's fauna, much like its flora, demonstrates remarkable ecological diversity and represents a significant portion of the broader Central Asian zoogeographic region. The country's animal life ranges from desert-dwelling species adapted to arid conditions to high-mountain representatives capable of surviving in extremely cold and rugged environments. Uzbekistan is home to numerous species of mammals, birds, reptiles, amphibians, and insects, many of which are considered rare, endangered, or endemic to the region.

Aral Sea

The Aral Sea, formerly recognized as the fourth-largest inland water body on the planet, once occupied a central ecological, climatic, and economic role in the region shared by modern-day Uzbekistan and Kazakhstan. Stretching across approximately 68,000 square kilometers, it functioned as a stabilizing element of the regional climate, a habitat for rich biodiversity, and a critical source of livelihood for hundreds of thousands of people. Fed primarily by the Amu Darya and Syr Darya rivers, which originate from the glaciers and highlands of the Tian Shan and Pamir mountain systems, the Aral Sea sustained a balanced hydrological regime for

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centuries. The sea moderated the surrounding climate, supported flourishing fisheries, and maintained extensive wetland ecosystems that attracted numerous migratory bird species. However, the environmental catastrophe that later engulfed the Aral Sea began in the 1960s, when large-scale Soviet agricultural projects aimed at expanding cotton and rice production drastically altered the natural water inflow. Massive irrigation networks, including the Karakum Canal, diverted up to three-quarters of river water away from its natural course. Inefficient and poorly maintained irrigation systems resulted in severe water losses through seepage and evaporation, sharply reducing the volume of water reaching the sea. As a result, the Aral Sea began to shrink at an unprecedented rate. By the 1980s, its surface area had decreased by more than half, and by the early 2000s, it had lost nearly 90% of its original volume, fragmenting into the North Aral Sea and the eastern and western basins of the South Aral Sea. Most of the southern basin eventually dried out entirely, giving rise to the Aralkum Desert, a newly formed salt desert now covering tens of thousands of square kilometers.The disappearance of the Aral Sea triggered profound environmental, climatic, and socio-economic consequences. The region experienced drastic climate shifts: summers became hotter and drier, winters grew longer and colder, and annual temperature fluctuations sharply increased. Toxic dust storms originating from the exposed seabed began transporting millions of tons of salt, pesticides, and industrial chemicals across vast distances, degrading soils and harming agriculture, particularly in Karakalpakstan and the Khorezm region. Public health deteriorated as local populations faced rising cases of respiratory illnesses, anemia, various cancers, kidney and liver disorders, and elevated infant and maternal mortality rates. Economically, the collapse of the fishing industry, the abandonment of ports such as Moynaq, and increased soil salinization devastated local livelihoods. Despite the severity of the crisis, restoration and mitigation initiatives have been undertaken in recent decades. Kazakhstan succeeded in partially restoring the North Aral Sea through the construction of the Kokaral Dam, which helped increase water levels and revive native fish populations. Uzbekistan, focusing on the southern regions, has introduced large-scale projects aimed at stabilizing the Aralkum Desert

by planting salt-resistant vegetation such as saxaul, improving irrigation efficiency, rehabilitating delta ecosystems, and supporting alternative economic activities for affected communities. The Aral Sea disaster has since become a global symbol of environmental mismanagement and a critical case study illustrating the far-reaching consequences of unsustainable water use. Today, it serves both as a warning and a motivating force behind modern efforts to implement responsible environmental policies and to safeguard natural ecosystems for future generations.

Mineral and row recource of Uzbekistan

Uzbekistan's unique geological structure, shaped over millions of years, has led to the formation of significant deposits of gold, uranium, copper, natural gas, oil, coal, and various rare and non-ferrous metals. In addition to mineral wealth, the country also holds vast reserves of natural raw resources such as fertile soils, water basins, forests, and extensive pastures. These resources play a crucial role in supporting the industrial, energy, agricultural, and construction sectors of Uzbekistan. Today, the effective management, sustainable extraction, and scientific study of these natural assets remain vital priorities for ensuring long-term national progress and economic stability.

Copper

In the last five years, Uzbekistan has significantly expanded its copper industry, increasing total output by approximately 1.5 times. By 2020, the Almalyk Mining and Metallurgical Complex (AMMC) produced nearly 148 thousand tons of copper, placing the country third among CIS states, following Russia and Kazakhstan.

Pursuant to Presidential Decree No. PP-5159 (June 24, 2021), which focuses on advancing the mining and metallurgical sector, Uzbekistan is establishing a comprehensive scientific-technological cluster. This cluster is designed to integrate the full value chain — from geological exploration and extraction to processing and the production of high-value finished goods.

According to the national exploration program for the next five years, mineral reserves are expected to increase substantially, including an additional 730

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tons of gold and approximately 1.5 million tons of copper. Furthermore, by 2023, a new high-capacity copper processing plant is scheduled to be commissioned at the Yoshlik-1 deposit, with an annual ore-processing capacity of around 60 million tons.

Non-ferrous Metals

Uzbekistan possesses substantial confirmed reserves of non-ferrous metals, including copper, lead, zinc, tungsten, and a range of other strategically significant elements. Copper deposits, in particular, are notable for being associated with more than fifteen types of accompanying non-ferrous metals such as gold, silver, molybdenum, cadmium, indium, tellurium, selenium, rhenium, cobalt, nickel, and osmium.

A key characteristic of Uzbekistan's mining industry is that the majority of extraction is conducted through open-pit operations, which considerably enhances cost-efficiency and long-term economic viability. Existing mining sites currently have sufficient capacity to sustain copper and related metal production for an estimated 40–50 years, while lead and zinc reserves are projected to last over 100 years.

Most non-ferrous metal resources are concentrated in the Almalyk ore district. Among them, the Kalmakyr deposit is considered unique, significantly exceeding comparable international deposits in terms of copper-molybdenum ore richness. Processing of these ores is carried out by the Almalyk Mining and Metallurgical Complex, one of Uzbekistan's largest industrial enterprises.

Major lead-zinc resources are concentrated in the Uchkulach deposits of the Jizzakh region and the Khandiza deposit in Surkhandarya. Notably, the Khandiza site contains copper, silver, cadmium, selenium, gold, and indium alongside lead and zinc. Given the growing global demand and favorable market trends for these metals, Uzbekistan has significant potential to expand their production in the coming years.

Rhenium

Uzbekistan possesses unique rhenium reserves, predominantly associated with the copper-molybdenum ores of the Almalyk deposits. The concentration of rhenium in the molybdenum concentrates from these ores is unmatched globally,

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making them exceptional by international standards. In industrial applications, rhenium is highly valued for the production of heat-resistant superalloys used in aviation and aerospace engineering, as well as in electronic devices and catalysts for petroleum refining and oil cracking processes.

Fuel and Energy Minerals

Uzbekistan is endowed with substantial deposits of fuel and energy minerals, including oil and natural gas, with approximately 60% of the country's territory considered promising for their exploration and extraction. Natural gas constitutes the largest share of these reserves, with major production concentrated near Gazli and Karshi. Based on annual output, the national gas company, Uzbekneftegaz, ranks eleventh globally, producing around 60–70 billion cubic meters of natural gas each year. The Kashkadarya and Bukhara regions are particularly rich in natural gas, with nearly three-quarters of the country's total gas production derived from Kashkadarya.

Phosphorites

The forecast estimate of the reserves of proven fine-grained Moroccan-type phosphorites at the Jeroy-Sardarinsky phosphorite deposit is about 100 million tons. Currently, the Kyzylkum phosphate combine is under construction with the production of 2,7 million tons of phosphate concentrate.

In addition, the Karakatinsky field has been previously explored and the North-Jetytau field, which is also located in the Central Kyzylkums, has been evaluated. The predicted reserves of phosphorites, according to geologists, are almost limitless.

The involvement of phosphorites in economic turnover is caused by the fact that Uzbekistan has created the largest capacities for the production of phosphate fertilizers — amorphous and superphosphate ammonia. At the same time, the explored deposits of phosphorites with reserves of about 300 million tons are practically not used.

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In order to increase the export potential for the production of phosphate fertilizers and taking into account the presence of significant reserves of phosphorites, it is possible to organize production for their enrichment with the participation of foreign investors on the basis of the Karakatinsky and Severo-Dzhetytau deposits of phosphorites.

Rock salt

The republic has rich deposits of rock salt. The forecast estimates of the identified 5 deposits of rock salt — Khodjaikansky, Tyubegatan, Barsakelmessky, Baybichekansky, and Akkalinsky amount to over 90 billion tons. Currently, the salts of the Barsakelmessky deposit are supposed to be used as raw materials for the production of calcined and caustic soda.

Red Book

In 1948, the International Union for Conservation of Nature and Natural Resources (IUCN) began implementing the idea of compiling lists of plant and animal species that are rare or at risk of extinction. A special international commission for species conservation was established, and starting from 1966, in collaboration with other nature conservation organizations, publications of the International Red Book dedicated to the flora of the world and specific regions began to be released.

The initial information on Uzbekistan's unique and declining plant and animal species was reflected in the Red Book established in 1974. The Uzbekistan Red Book was officially founded in 1978. For the first time, the fauna section of the Uzbekistan Red Book was published in 1983, including 63 species of vertebrates (fish, reptiles, birds, and mammals). Comprehensive information on 163 rare and endangered plant species was first presented in the 1984 edition of the Red Book.

The Red Book is a periodic publication, and species included in it are classified into four groups according to the categorization proposed by the International Union for Conservation of Nature:

1. Extinct or critically endangered species – species that require urgent conservation measures.

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2. Endangered species – species whose range and population are steadily decreasing and require special protection.

3. Rare species – species that are not immediately threatened with extinction but are sparsely distributed and require protection.

4.Species with declining populations – species whose numbers and distribution are decreasing due to natural causes or human impact and require ongoing monitoring.

The Red Book is reissued to reflect changes in the status of species included in it, as well as to account for fluctuations in their populations caused by factors such as special conservation measures, habitat changes, and other environmental influences. Some species may be transferred to a different category due to population recovery, while others may be reclassified due to a decline in numbers.

The 1998 edition of the Red Book described the current status of 301 plant species in Uzbekistan that were considered at risk of extinction. In subsequent years, data were collected to evaluate the status of Uzbekistan's fauna, leading to the publication of the new Red Book in 2003. The most recent edition includes:

Mammals: 24 species

Birds: 51 species

Reptiles: 16 species

Fish: 18 species

Annelids: 3 species

Mollusks: 15 species

Arthropods: 62 species, including subspecies

Some species of Uzbekistan's flora and fauna are also reflected in the International Red Book. Each species is allocated a separate page, providing detailed information including:

Names in Uzbek, Russian, and Latin (scientific) nomenclature

Taxonomic classification

Brief morphological description

Distribution and habitat

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Population size and reproductive characteristics

Changes in range and population

Conservation measures, among other relevant details

Proposals for species of animals and plants to be included in the Red Book can be made by scientific research institutions, governmental and public organizations, and certain experts. Species whose populations have recovered and are no longer at risk of extinction are removed from the Red Book.

Species listed in the Red Book are protected under national law, and legal or physical entities that violate these protections are held accountable in accordance with the law.

CONCLUSION: Uzbekistan is a country with exceptional natural richness, combining diverse landscapes, unique biological resources, and valuable mineral reserves that collectively form the foundation of its ecological stability and economic development. The study of its flora and fauna demonstrates that the nation occupies an important place in the ecological system of Central Asia, as it preserves ancient ecosystems that have endured despite climate changes, human pressure, and natural transformation. With more than 3,700 species of higher plants and numerous species of mammals, birds, reptiles, insects, and endemic organisms, Uzbekistan's biodiversity represents a priceless scientific and environmental heritage. Mountain ecosystems, vast deserts, and the rare tugay forests together create a complex natural mosaic, each contributing essential biological functions such as climate regulation, soil protection, pollination, and genetic diversity. The country's fauna is equally diverse and ecologically significant. From desert inhabitants like the goitered gazelle, saiga, and desert reptiles, to mountain species such as the snow leopard, brown bear, and mountain sheep, each plays a vital role in maintaining the balance of natural ecosystems. The presence of rare species listed in the Red Book highlights the importance of preserving fragile habitats and implementing strict conservation strategies. The Red Book of Uzbekistan serves as a critical tool for monitoring the state of endangered species, promoting scientific research, and ensuring legal protection for plants and animals whose survival is threatened by human activity or

natural decline. At the same time, Uzbekistan's natural wealth is not limited to its biological resources. The country possesses some of the world's largest reserves of gold, copper, uranium, natural gas, oil, coal, phosphorites, and rock salt. These mineral resources have long been a driving force of the national economy, contributing significantly to industrial growth, energy production, infrastructure development, and technological advancement

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