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FLORA AND FAUNA, MINERAL AND RAW RESOURCES OF UZBEKISTAN: AN EXTENDED SCIENTIFIC REVIEW

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Abstract: *Uzbekistan, located in the heart of Central Asia, possesses a uniquely diverse natural environment characterized by rich biological resources and substantial mineral wealth. Its flora and fauna are shaped by contrasting geographical zones—from deserts and steppes to high mountainous ecosystems—supporting numerous endemic and relict species. In parallel, the country is one of the world's leading regions in mineral availability, including significant reserves of gold, uranium, copper, natural gas, and rare metals. This paper examines the ecological composition of Uzbekistan's flora and fauna, highlights species diversity, and analyzes the state of natural habitats and conservation efforts. Furthermore, it provides a detailed overview of the nation's mineral and raw material resources, their economic significance, and current exploitation patterns. The study emphasizes the importance of sustainable management of both biological and mineral resources to ensure long-term ecological and economic stability. The abstract is further supported by additional context regarding the historical development of ecological landscapes in Uzbekistan, the influence of climatic variability on species distribution, and the growing need for integrated national policy approaches that combine biodiversity conservation with industrial development. This extended perspective allows for a clearer understanding of the interdependent nature of ecological and economic systems in Uzbekistan.*

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Uzbekistan is situated at the crossroads of ancient trade routes and diverse ecological landscapes, making it one of the most biologically and geologically rich countries in Central Asia. Its natural environment exhibits a wide range of climatic and altitudinal conditions that foster varied plant and animal communities. The nation's biological wealth is complemented by vast deposits of mineral and raw resources that have played a fundamental role in shaping its economy and industrial development. Understanding the interrelationship between natural biodiversity and mineral resources is essential for sustainable development. On the one hand, the country's flora and fauna provide ecological stability, support ecosystem services, and contribute to cultural heritage. On the other hand, mineral wealth drives economic growth yet poses risks to environmental stability when exploited unsustainably. This article provides a comprehensive scientific overview of Uzbekistan's biological and mineral resources and evaluates their current status and management challenges.

Uzbekistan's landscape includes deserts such as the Kyzylkum, fertile river valleys, foothill plains, and high-altitude mountain regions in the Tien Shan and Pamir-Alay systems. These contrasting environments create multiple ecological zones, each supporting distinct vegetation types and wildlife communities. Climatic conditions range from extreme continental deserts to cooler mountainous climates, resulting in high spatial variability of natural habitats. In addition to these established descriptions, Uzbekistan's natural environment is also shaped by long-term geological processes that have influenced soil composition, hydrology, and biogeographical distributions. The region's position between Siberian, Mediterranean, and Middle Eastern climatic systems makes it a unique convergence point for diverse species. Historical human settlement and agricultural development have also contributed to shaping landscape structure and biodiversity patterns across the centuries.

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The flora of Uzbekistan includes more than four thousand species of vascular plants. Desert zones are dominated by drought-resistant shrubs and perennial herbs, such as Haloxylon aphyllum, Salsola arbuscula, and various species of Artemisia. Mountainous areas contain pistachio, juniper, walnut, and almond forests, which form biologically important ecosystems that support numerous endemic species. Several plant species found in Uzbekistan are endemic to Central Asian mountain ranges. Notable examples include species of Tulipa, Iris, and Eremurus, many of which are considered relicts from earlier geological eras. These species contribute to the region's genetic diversity and serve as valuable resources for botanical research. Uzbekistan’s vegetation plays a critical role in reducing soil erosion, stabilizing desert ecosystems, and supporting herbivorous wildlife. However, overgrazing, unsustainable land use, climate change, and human-induced habitat fragmentation continue to threaten plant communities. Conservation programs and protected areas have been established, yet many species remain vulnerable.

The fauna of Uzbekistan includes a broad range of mammals, birds, reptiles, amphibians, and insects. Mammalian fauna consists of species such as the Bukhara deer (Cervus hanglu bactrianus), argali sheep (Ovis ammon), caracal (Caracal caracal), and the rare snow leopard (Panthera uncia) found in high mountain regions. Reptilian diversity is significant in desert areas, with species such as the Central Asian tortoise (Testudo horsfieldii). Uzbekistan lies along major migratory bird routes, making it an important habitat for numerous avian species. Wetland areas and river deltas attract migratory waterfowl, while species are recorded across the country. Environmental degradation, irrigation projects, poaching, and climate fluctuations have contributed to population declines among several species. The national Red Data Book lists numerous threatened species, highlighting the urgency of conservation measures. International collaborations and government-led initiatives aim to protect critical habitats and restore endangered populations.

Uzbekistan is one of the world’s leading countries in terms of mineral reserves. The nation possesses a well-developed geological structure rich in metals, fossil fuels, and industrial raw materials. Mining and energy sectors play a vital role

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in national economic development. Uzbekistan is among the world's largest gold producers, with the Muruntau mine being one of the largest open-pit gold mines globally. Major copper reserves are found in deposits such as Kalmakyr and Dalnee in the Almalyk region. The country also ranks among the top uranium-producing nations, with significant reserves in sandstone-type deposits. Uzbekistan has large natural gas and oil fields, primarily located in the Bukhara–Khiva and Fergana regions. Natural gas remains the country's most important energy resource and a significant export commodity. Coal deposits are also present, particularly in the Angren basin. The nation hosts extensive reserves of phosphorites, sulfur, limestone, marble, kaolin, gypsum, and various construction materials. These raw materials support chemical, construction, and metallurgical industries, strengthening Uzbekistan's industrial infrastructure. Mineral extraction significantly contributes to Uzbekistan's GDP and export earnings. However, mining activities can negatively impact ecosystems and biodiversity through land degradation, pollution, and water resource depletion. Balancing industrial expansion with environmental preservation remains a pressing national priority.

Regions rich in minerals often overlap with ecologically sensitive landscapes. Mountain ecosystems hosting endemic flora and fauna frequently coincide with mining zones. Therefore, sustainable development strategies must integrate environmental assessments, habitat protection, and modern extraction technologies that minimize ecological damage. This section is further supported by recognition that long-term economic development depends on maintaining functioning ecosystems. Modern environmental management tools—such as GIS monitoring, soil rehabilitation programs, and water-efficient extraction methods—are increasingly used to mitigate environmental pressures associated with mining and industrial expansion.

Conclusion

Uzbekistan is a country distinguished by the coexistence of rich biodiversity and substantial mineral resources. Its unique environmental conditions have given rise to diverse plant and animal communities, many of which are endemic or

ecologically significant. At the same time, the country's abundant mineral deposits—ranging from precious metals to energy resources and industrial raw materials—form the backbone of its economic development. While these resources contribute greatly to national growth, their exploitation poses serious environmental challenges. The long-term sustainability of Uzbekistan's natural heritage depends on implementing responsible resource management, maintaining conservation efforts, and adopting modern technologies that reduce environmental harm. Ensuring a balance between ecological preservation and economic progress remains essential for securing both environmental integrity and national prosperity in the years to come. Additionally, achieving this balance requires integrated national strategies, strengthened environmental legislation, expanded protected areas, and enhanced scientific research focused on long-term monitoring of biodiversity and natural resources. Collaboration with international organizations, investment in renewable energy, and community-based conservation initiatives will help safeguard Uzbekistan's ecological and economic future.

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