Uzbekistan Biodiversity Conservation and Cooperation Recommendations Postprint

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Date: 2023-04-07T16:49:27+00:00

Abstract

Uzbekistan is an important country along the Silk Road Economic Belt and a nation experiencing relatively severe biodiversity loss in Central Asia. As research by domestic and international scholars on biodiversity conservation in Uzbekistan remains insufficient, this study analyzes the challenges confronting the country's biodiversity, its conservation status, and management system, summarizes the existing problems in its biodiversity conservation efforts, and proposes recommendations for China-Uzbekistan cooperation in biodiversity conservation: (1) targeting coordinated development between economic growth and biodiversity conservation; (2) taking ecological restoration in key regions as a breakthrough approach; (3) promoting biodiversity conservation through scientific research cooperation on key species; and (4) transforming natural resource utilization patterns through the development of ecotourism.

Full Text

Biodiversity Conservation and Cooperation Proposals in Uzbekistan

Uzbekistan occupies a central position in the Eurasian continent and has historically served as a crucial corridor along the Silk Road. The country's ecosystems hold global significance, with its desert, mountain, and aquatic biomes recognized in global conservation priorities. To assess the state of research, we conducted literature searches across multiple databases. In Web of Science Core Collection, the search terms TS=(Uzbekistan) and TS=(biodiversity conservation) and TS=(management or governance) yielded limited results. Studies have addressed topics such as crop variety diversity and sustainability, global biodiversity priority lists, biodiversity offset calculation methods, in-situ conservation of fruit biodiversity, endangered species protection, fish diversity, wild tulip conservation, and biodiversity in the Aral Sea region. In the CNKI database,

the professional search ("Uzbekistan" and SU=("biodiversity" or "rare")) retrieved only a handful of papers after excluding short news items and duplicates, indicating that Chinese scholars have conducted relatively little research on Uzbekistan's biodiversity, or have not published their findings in Chinese journals. In the Russian eLibrary database, the search TS=(« ») and TS=(« ») returned numerous conference papers, with research focusing on desert-steppe ecosystem conservation and the protection and utilization of biological resources.

In recent years, the Xinjiang Institute of Ecology and Geography of the Chinese Academy of Sciences has engaged in close cooperation with Uzbekistan on ecological and environmental issues. The Kunming Institute of Botany of the Chinese Academy of Sciences and the Institute of Botany of the Uzbekistan Academy of Sciences jointly established the world's first "China-Uzbekistan Global Allium Garden," reflecting growing attention from Chinese experts and scholars toward the country's biodiversity conservation. This study aims to analyze the current status, management systems, and existing problems of biodiversity conservation in Uzbekistan, providing reference for China-Uzbekistan cooperation in this field.

1.1 Ecosystem Diversity

Uzbekistan features diverse ecosystem types, primarily including deserts, alpine grasslands, forests, alpine meadows, tugai shrublands, and unique ecosystems formed by reservoirs . The habitats of most rare species are located in low mountains and the Ustyurt Plateau, while local and migratory bird habitats are found in wetlands. All major ecosystems and habitats are significantly impacted by human activities, with agriculture, animal husbandry, and mining posing substantial threats to ecosystem biodiversity.

1.2 Plant Diversity

Uzbekistan is one of the most species-rich countries in Central Asia, with 4,500 species of vascular plants belonging to over 1,500 genera. The proportion of endemic species is relatively high (approximately 10-12%). Among these, relict species hold special status, including genera such as *Tulipa*, *Allium*, *Gagea*, *Eremurus*, *Astragalus*, *Cousinia*, and *Iris* . Additionally, Uzbekistan is rich in wild relatives of cultivated plants, which is crucial for breeding new and improved economically valuable varieties. Important species include walnut (*Juglans regia*), almond (*Amygdalus communis*), Bukhara almond (*Amygdalus bucharica*), persimmon (*Diospyros lotus*), fig (*Ficus carica*), pomegranate (*Punica granatum*), Turkmen pear (*Pyrus turcomanica*), wild apple (*Malus sieversii*), grape (*Vitis vinifera*), jujube (*Ziziphus jujuba*), and pistachio (*Pistacia vera*), primarily distributed in mountainous areas.

1.3 Animal Diversity

Uzbekistan's fauna has an ancient and complex evolutionary history. In addition to native species, migratory species originate from other parts of Central Asia, India, China, Russia, southern Europe, and North Africa. The country hosts over 18,000 invertebrate species (including protozoa, nematodes, flatworms, and arthropods) and more than 730 vertebrate species, comprising 107 fish species, 4 amphibian species, 56 reptile species, 424 bird species, and 97 mammal species. Uzbekistan has 159 endemic subspecies of terrestrial vertebrates, with endemism accounting for approximately 21.8% of the country's terrestrial vertebrates. Reptiles show the highest degree of endemism, while birds show the lowest .

2 Challenges and Conservation Status

2.1 Major Threats to Biodiversity

The greatest threat to biodiversity conservation in Uzbekistan stems from the degradation, fragmentation, and loss of natural habitats, with agriculture and animal husbandry being the primary factors destroying natural ecosystems. First, agricultural expansion has led to the degradation and loss of natural habitats for plant communities. According to FAO data, 62.9% of Uzbekistan's population is engaged in agriculture, with agricultural land (including cropland and pasture) accounting for 62.9% of the country's territory—a proportion that has remained largely unchanged in recent years. Agricultural activities are concentrated in plains, floodplains, foothills, and low mountain areas, where long-term high-intensity farming has completely destroyed biodiversity in these regions, causing some species to disappear or become endangered. The country's biodiversity loss is closely related to the deterioration of the Aral Sea ecosystem; the dramatic shrinkage of the Aral Sea's water area has turned the dried seabed into vast desert, severely threatening species habitats. Currently, Uzbekistan's greatest challenge is overcoming the Aral Sea ecological crisis and mitigating its negative impacts on biodiversity.

Second, animal husbandry has caused ecosystem degradation. Livestock production accounts for 40% of Uzbekistan's total agricultural output value, with desert farms comprising 50% of pasture area, alpine pastures 20%, semi-desert farms 20%, and mountain grasslands 10%. Experts estimate that approximately 70% of the country's pastures suffer from varying degrees of degradation, with productivity declining by 30-40% in recent years due primarily to overgrazing, plant harvesting for fuel, water source reduction, mobile sand dune encroachment, and land reclamation.

Other human activity factors also threaten biodiversity and are intensifying with economic development, including unsustainable use of biological resources, environmental pollution, and habitat degradation caused by recreational pressure.

2.2 Biodiversity Loss

According to IUCN assessments, the threat of wildlife extinction in Uzbekistan has increased, associated with habitat reduction and population declines. Compared with 1990, the number of rare and endangered mammal species increased by 29, birds by 39, and reptiles by 16 by 2019 [Figure 1: see original paper]. The situation is concerning, with particularly severe losses in reptiles (27.1%), mammals (24.7%), and fish (21.7%). The Asian cheetah, wild ass, and Aral Sea salmon have become extinct in Uzbekistan, and the Caspian tiger has also disappeared. Among plants, angiosperms have experienced the most severe biodiversity loss.

3 Conservation Management System

3.1 Biodiversity Monitoring and Regulatory System

Uzbekistan's biodiversity monitoring system is organized by monitoring object . Implementation agencies include the State Committee for Ecology and Environmental Protection, the Ministry of Agriculture and Water Resources, and institutes of the Academy of Sciences, while management agencies additionally involve the Cabinet of Ministers, Ministry of Health, State Plant Quarantine Service, Ministry of Higher and Secondary Specialized Education, and the State Center for Hydrometeorology. The substantial overlap between implementation and management agencies results in unclear division of responsibilities and authority. Given the vulnerability of Uzbekistan's arid ecosystems and strong water resource constraints, the allocation and scheduling authority of water resources is crucial for biodiversity conservation. The Ministry of Agriculture and Water Resources and environmental protection departments still have significant differences in their understanding of biodiversity and ecosystem service values, directly affecting conservation outcomes.

3.2.1 Participation in International Conventions

Uzbekistan became a party to the UN Convention on Biological Diversity in 1995 and began formulating national strategies for biodiversity conservation and sustainable use, expanding and establishing new protected areas, and taking measures to restore degraded ecosystems and protect rare and endangered species. The country actively participates in international and regional environmental cooperation, including implementation of global environmental conventions, multilateral environmental treaties, bilateral and multilateral agreements, and memoranda. Relevant conventions include the UN Framework Convention on Climate Change, the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on the Conservation of Migratory Species of Wild Animals, and the Convention on Wetlands of International Importance especially as Waterfowl Habitat.

3.2.2 Legal Framework Development

Uzbekistan has over 40 laws related to natural resource utilization, most of which are directly or indirectly related to biodiversity issues, such as the Law on State Sanitary Supervision, Law on Water and Water Use, Law on Atmospheric Protection, Land Code, Forest Code, and Law on Environmental Monitoring. With support from the Global Environment Facility (GEF) and UNDP, more than ten laws in the nature conservation field have been revised and supplemented to incorporate biodiversity conservation principles and develop norms for assessing indirect negative impacts on flora and fauna. These include amendments to the Law on Nature Protection and Law on Protected Areas to include biosphere reserves in the protected area system and define their legal status; revisions to the Law on Plant Protection and Use and Law on Animal Protection and Use; and improvement of regulations on flora and fauna management.

3.2.3 Policy Measures

As a first step in fulfilling its obligations under the Convention on Biological Diversity, Uzbekistan's Cabinet of Ministers approved the National Strategy and Action Plan for Biodiversity Conservation in 1998, which became the overarching framework for biodiversity conservation, establishing policy structures and defining objectives and tasks in biodiversity management. Provisions from this strategy are reflected in other national program documents, such as the Land Reclamation Program, the 2020-2030 Fisheries Development Program, the 2020-2030 National Environmental Monitoring Program, and the 2020-2030 Environmental Protection Action Program.

On June 11, 2019, the Cabinet of Ministers adopted the Strategy for Biodiversity Conservation in Uzbekistan for 2019-2028, identifying seven priority directions: (1) expanding protected areas to 10% of the country's territory; (2) afforesting 120,000 hectares of the dried Aral Sea bed to increase forest area to 9% of the territory; (3) establishing the specialized breeding center "Jeyran" to increase saiga antelope populations to 70,000; (4) creating a unified monitoring system for biodiversity components; (5) developing a national biodiversity cadastre and information database based on modern geographic information technology; (6) conducting annual geobotanical surveys of natural pastures and hayfields covering 200,000 hectares; and (7) integrating biodiversity conservation into all economic sectors.

Overall, Uzbekistan's vision for future biodiversity conservation remains at a relatively preliminary level, focusing primarily on aligning domestic regulations with international standards, adjusting and developing the protected area system, improving biodiversity monitoring and economic assessment mechanisms, and striving to integrate biodiversity issues into economic sector planning to raise government and public awareness and provide strong support for social and economic sustainable development through sustainable use of biodiversity resources.

3.3 Current Conservation Status

The number of species included in Uzbekistan's Red Book continues to grow. The fifth edition includes 305 animal species and 354 plant species, representing increases of 29 and 39 species respectively compared with the first edition. Biodiversity conservation in the country relies primarily on protected areas, which are divided into state nature reserves, national parks, special nature reserves, state natural monuments, and biosphere reserves. The proportion of land protected areas has shown an increasing trend from 2016 to 2021, rising by 1.5% compared with 2016 [Figure 2: see original paper]. Uzbekistan's nature reserves and national parks protect 47.4% of higher plant species and 79.4% of Red Book vertebrate species, with particularly high protection levels for birds (72.0%) and mammals (68.8%) [TABLE:5, TABLE:6]. Currently, the coverage of the protected area system is adjusted mainly according to revisions and additions to the rare and endangered species list. While the system provides good protection for certain habitat types such as mountain forests and alpine zones, protection levels remain low for desert and foothill habitats and floodplain forests, with insufficient area to maintain normal reproduction of species and populations inhabiting these areas.

4 Problems and Cooperation Proposals

4.1.1 Severe Biodiversity Loss

Uzbekistan possesses extremely rich biodiversity with a high proportion of endemic species—approximately 10-12% for plants and 21.8% for terrestrial vertebrates—holding global conservation significance. However, biodiversity loss is severe, particularly for reptiles, mammals, fish, and angiosperms, with some native fish species in the Aral Sea region already extinct. The primary threats to biodiversity are linked to inappropriate economic development measures, and only by transforming the economic growth model can the country reverse biodiversity loss and declining ecosystem service functions.

4.1.2 Underdeveloped Protected Area System

Biodiversity conservation in Uzbekistan relies mainly on in-situ protection through a protected area system that is not well developed, particularly in terms of representativeness of protected ecosystems and flora/fauna. Deserts account for 80% of the country's territory, with mountains comprising less than 20%, yet the vast majority of protected areas are located in mountainous regions, covering only 5% of desert ecosystems. The system protects less than half of the higher plant species in the national Red Book, and approximately 40% of rare and endangered vertebrate habitats remain without effective protection.

4.1.3 Management System Deficiencies

First, the biodiversity monitoring and management system suffers from unclear division of responsibilities and authority. As agriculture and animal husbandry development pose the greatest threats to biodiversity, the Ministry of Agriculture and Water Resources—responsible for agricultural development—participates excessively in biodiversity conservation, creating a conflict of interest. Second, although the legal framework continues to improve, many laws remain at the framework level with difficult implementation, and existing regulations do not conform to international standards for biological resource use and management. Third, national biodiversity censuses and monitoring are poorly executed, and mechanisms for assessing impacts of economic and other activities on biodiversity are not adequately implemented.

4.2.1 Coordinating Economic Development with Biodiversity Conservation

As a major agricultural country in Central Asia, Uzbekistan is rich in wild relatives of cultivated plants and cotton germplasm resources, and attaches relatively high importance to agricultural biodiversity conservation. The country has conducted a series of biodiversity cooperation projects with international organizations, most focusing on agricultural biodiversity conservation to enhance the sustainability of traditional agricultural production under water-scarce conditions, and has established a national information database while developing a National Strategy and Action Plan for the Conservation of Agricultural Biodiversity and Crop Wild Relatives. Therefore, China-Uzbekistan biodiversity cooperation should draw lessons from international organizations' experiences to meet Uzbekistan's needs for agricultural biodiversity conservation. Additionally, given the similar natural conditions between Xinjiang and Uzbekistan, China could consider introducing high-quality germplasm resources from Uzbekistan to improve crop varieties, achieving a win-win situation for both conservation and economic development.

4.2.2 Key Area Ecological Restoration as the Breakthrough

Uzbekistan's biodiversity loss and other ecological environmental problems mainly stem from land degradation, particularly salinization in downstream river areas. The Aral Sea ecological crisis has caused enormous damage to Uzbekistan's ecosystems, and the area of its dried seabed continues to expand. President Mirziyoyev has called for developing a "green economy" in the Aral Sea region and proposed establishing a regional center for forage crops at the Aral Sea Foundation summit, planting high-yield forage crops adapted to desert conditions on the dried seabed to promote animal husbandry development and provide employment for local residents. The "New Uzbekistan Development Strategy 2022-2026" proposes adding 50,000 hectares of green space on the dried Aral Sea bed by 2026, bringing the total green area to 250,000 hectares. The Green Climate Fund and GEF plan to implement projects totaling $120

million in the Aral Sea region to protect biodiversity, prevent climate change, and control soil erosion, while further strengthening social support for local residents. Given Uzbekistan's needs and the international situation, it is recommended that China utilize its advanced experience and technologies in integrated watershed management, desertification control, and soil and water conservation in arid regions to actively participate in Aral Sea governance and contribute to local ecological restoration.

4.2.3 Promoting Conservation Through Key Species Research Cooperation

Developing countries generally lack funds for biodiversity conservation. Although Uzbekistan's economy has recovered through abundant oil and gas resources since the dissolution of the Soviet Union, available funds for biodiversity conservation remain scarce, making large-scale species surveys impossible to conduct regularly. At the fifteenth meeting of the Conference of the Parties to the UN Convention on Biological Diversity, China announced the establishment of the Kunming Biodiversity Fund with an initial contribution of 1.5 billion RMB to support developing countries' biodiversity conservation efforts. Uzbekistan should seize this opportunity to jointly explore biodiversity finance with China, raising funds for ecological innovation zone construction and ecological disaster area governance. Meanwhile, China should strengthen scientific research cooperation with Uzbekistan in biodiversity conservation, focusing limited resources on key species: first, rare and endangered species sensitive to climate change, such as the saiga antelope and waterfowl; and second, species with economic value that can benefit local residents and promote sustainable development, such as commercial fish, medicinal plants, and *Artemia*. Cooperation should not be limited to pure academic research but should adopt a chain-style approach to achieve technology demonstration and application. In addition to establishing joint laboratories (or centers), "biodiversity conservation initiatives" or "big science programs" should be proposed to integrate Chinese technologies and experience under the impetus of large-scale projects, creating a comprehensive biodiversity conservation-economic governance model.

4.2.4 Reversing Natural Resource Use Through Ecotourism Development

Uzbekistan possesses rich endemic flora and fauna and diverse ecosystems, giving it potential for ecotourism development. The President attaches great importance to developing ecotourism as a key component of the national green economy policy, vigorously simplifying tourist visa procedures and introducing a series of measures to facilitate visitors. The Uzbekistan government hopes to increase local employment and income through implementation of the "Karakalpakstan Republic and Aral Sea Region Ecotourism Development Plan," promoting the development of the Aral Sea ecological innovation zone and reversing natural resource utilization patterns. Karakalpakstan features landscapes

including the Tugai Nature Reserve, Ustyurt Plateau, Kyzylkum Desert, and Aral Sea dried seabed, with the Ustyurt Plateau located on the ancient Silk Road strategic corridor connecting China to the Aral Sea. China-Uzbekistan ecotourism cooperation could use Karakalpakstan as an entry point to develop a Silk Road ecotourism route, allowing visitors to experience the ancient Silk Road while receiving ecological education. The shocking sight of the Aral Sea dried seabed will help both peoples deeply understand the significance of the Silk Road community with a shared future and the development of a green Silk Road, enhancing people-to-people bonds. In 2020, Uzbekistan implemented a 30-day visa-free policy for Chinese tourists, resulting in a 30% increase in Chinese visitors compared with 2019. Foreign tourists in Uzbekistan spend an average of $305 USD per person. Based on these figures, if Chinese tourist numbers recover to or exceed 2019 levels post-COVID-19 (reaching 1.703-1.959 million visitors), total consumption could reach $520-597 million USD, significantly contributing to economic growth in both countries.

References

[References section preserved as in original]

Note: Figure translations are in progress. See original paper for figures.