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LET'S BE RESILIENT

WETLAND ENVIRONMENTAL ASSESSMENT (REPORT TENTATIVE OUTLINE AND DRAFT)

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This report reflects the collective commitment of all involved in advancing climate resilience and environmental sustainability in Afghanistan. We hope it serves as a valuable resource for policymakers, researchers, and practitioners in the fields of climate change, sustainability, and capacity building.

We extend our heartfelt gratitude to all stakeholders who contributed their time, insights, and expertise to this assessment. Their invaluable input was instrumental in shaping the findings and recommendations presented in this report.

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Executive Director, REHA

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EXECUTIVE SUMMARY

This Technical Assessment, conducted by Resilience, Environment and Humanitarian Aid Organization (REHA)with support from the National Environment Protection Agency (NEPA), Ministry of Agriculture, Irrigation, and Livestock (MAIL) and the United Nations Development Programme (UNDP), provides a comprehensive evaluation of the ecological, hydrological, and socio-cultural status of the Kole Hashmat Khan Wetland located in Kabul, Afghanistan. The assessment aims to establish a baseline for restoration and management efforts, identify key challenges, and propose evidence-based strategies for sustainable conservation.

The wetland, originally covering 191 hectares, has significantly shrunk due to urban expansion, reduced water inflows, and sediment accumulation. Water levels fluctuate seasonally, with the wetland often drying up by late summer, threatening its ecological functions. Water quality is degraded by untreated sewage, wastes dumping, and industrial waste, leading to visible pollution and habitat degradation. The wetland is a critical habitat for migratory birds, supporting 93 bird species, including globally threatened species like the Dalmatian pelican and Eastern imperial eagle. However, habitat loss, water drainage, and pollution have led to a decline in bird breeding species. The flora, dominated by common reeds (Phragmites australis), plays a vital role in stabilizing the ecosystem, but further research is needed to fully document plant species and their ecological roles.

Urban expansion has converted agricultural land into residential and commercial areas, encroaching on the wetland's buffer zones. Illegal land grabbing, waste dumping, and unregulated industrial activities further exacerbate environmental degradation. Recreational activities, while reflecting community reliance on the wetland, contribute to habitat disturbance and pollution. Climate change has caused reduced snowfall and snowmelt, leading to decreased water inflows and prolonged dry spells. These changes threaten the wetland's hydrological balance and ecological resilience. Weak regulatory frameworks and poor coordination among stakeholders hinder effective wetland management. Past conservation efforts, including management plans, have largely remained unimplemented due to funding constraints and lack of enforcement.

Local communities expressed a strong willingness to participate in wetland conservation, emphasizing the need for improved waste management, sediment removal, and water flow regulation. They also highlighted the importance of public awareness and legal enforcement. Stakeholders identified key priorities, including updated bird surveys, hydrological studies, pollution control, and the revision of the wetland management plan. They also stressed the need for stronger stakeholder coordination and community involvement.

The report proposes several conservation and restoration strategies. Water management and hydrological restoration include preventing excessive summer drainage, rehabilitating water channels, and constructing small dams to regulate water levels. Habitat restoration and protection involve controlling reed harvesting, expanding vegetation cover, and preventing land encroachment through legal measures and fencing.

Biodiversity conservation strategies include enforcing anti-hunting policies, enhancing monitoring programs, and designating a bird sanctuary zone. Community engagement and livelihood support focus on promoting alternative livelihoods, raising awareness, and strengthening stakeholder collaboration. Climate resilience and pollution control measures include developing a climate-adaptive management plan, controlling pollution, and restoring degraded areas. Institutional strengthening and policy integration involve strengthening legal frameworks, improving governance, and securing long-term funding for conservation efforts. Eco-tourism and sustainable recreation strategies include developing eco-friendly visitor centers, promoting responsible tourism, and regulating recreational activities. The report also outlines recommended projects, including migratory bird surveys, wetland management plan revision, sediment removal, pollution control, and canal rehabilitation

The Kole Hashmat Khan Wetland faces significant ecological and socio-economic challenges, but with coordinated efforts, effective governance, and community involvement, it can be restored and sustainably managed. The proposed strategies and projects provide a roadmap for preserving this vital ecological site for future generations.

2. ASSESSMENT OBJECTIVES

- Assessing the current ecological and hydrological status to establish a baseline for restoration and management efforts.
- Identifying key challenges impacting the wetland's conservation and management.
- Providing evidence-based recommendations for effective restoration and sustainable management strategies to address the identified challenges.
- Support stakeholders involved in wetland management by providing data-driven insights and recommendations to guide informed decision-making.
- Proposing strategies to restore and maintain the long-term ecological health and resilience of Kole Hashmat Khan wetland, ensuring its sustainability for future generations.

3. METHODS

The technical assessment of Kol-e Hashmat Khan Wetland in Kabul, Afghanistan, employed a multi-method approach to ensure a comprehensive understanding of the wetland's ecological, social, and management dynamics. The methodology included the following key components:

3.1. DESK REVIEW

A thorough desk review was conducted to gather and analyze existing data, literature, and reports related to Kol-e Hashmat Khan. This included reviewing government documents, environmental assessments, academic studies, and policy frameworks on wetland conservation, biodiversity, and water resource management in Afghanistan. The desk review provided essential background information, identified knowledge gaps, and established a foundation for further investigation.

3.2. SITE VISITS

Field visits were conducted to observe and document the physical and ecological conditions of Kol-e Hashmat Khan. Key areas of the wetland, including its water source canal and dam, and areas affected by human activities such as encroachment, pollution, and land-use changes, were systematically assessed. These site visits provided firsthand insights into the wetland's current state, environmental challenges, and the extent of human impact, complementing the data gathered through other methods.

3.3. GEOSPATIAL ANALYSIS USING ARCGIS

To assess land use changes and human interaction within the Kol-e Hashmat Khan wetland, ArcGIS was utilized as a geospatial analysis tool. High-resolution satellite imagery and historical land cover data from the years 2009 and 2024 were analyzed to identify changes in wetland extent, water body, and human-induced alterations over time. By comparing these two temporal datasets, the study aimed to detect encroachments, water body shrinkage, and shifts in land use patterns. This spatial analysis provides a comprehensive understanding of the wetland's degradation trends and supports the formulation of evidence-based recommendations for its conservation and management.

3.4. FOCUS GROUP DISCUSSIONS (FGDS)

To incorporate diverse perspectives, two FGDs were conducted:

- FGD with local communities: This session engaged residents living in the vicinity of Kol-e Hashmat Khan to understand their interactions with the wetland, including livelihood dependencies, observed environmental changes, pollution concerns, and community-led conservation efforts. The discussion also explored cultural and historical connections to the wetland (See Figure 1).
- FGD with relevant organizations and stakeholders: This session involved representatives from government agencies, environmental organizations, and institutions involved in wetland management. The discussion focused on existing policies, institutional roles, ongoing conservation initiatives, challenges in wetland protection, and potential strategies for sustainable management (See Figure 2).

The following governmental and non-governmental organizations representative participated in the FGDs:

- National Environment Protection Agency (NEPA)
- Ministry of Agriculture, Irrigation, and Livestock (MAIL)
- Ministry of Water and Energy (MWE)
- Ministry of Urban Development and Housing (MUDH)
- Kabul Municipality (KM)
- Ministry of Information and Culture (MoIC)
- Ministry of Interior Affairs (MoIA)
- Ministry of Defense (MoD)
- Wildlife Conservation Society (WCS)

These FGDs ensured a participatory approach, capturing both local and institutional insights to inform the assessment.

Figure 1. Engaging the local community in a focused group discussion to assess challenges and opportunities for the conservation of Kol-e Hashmat Khan wetland.

Figure 2. Stakeholders discussed key challenges and potential interventions for the sustainable management of Kol-e Hashmat Khan wetland.

3.5. DATA ANALYSIS AND SYNTHESIS

The data collected from the desk review, site visits, and FGDs were systematically synthesized to identify key themes, challenges, and opportunities. The analysis focused on critical issues such as pollution, land encroachment, biodiversity loss, water resource management, and governance challenges. The findings were synthesized to provide actionable recommendations for the sustainable conservation and management of Kol-e Hashmat Khan.

4. OVERVIEW OF THE KOLE HASHMAT KHAN WETLAND

4.1. GEOGRAPHIC LOCATION

Kole Hashmat Khan is located within the First and Eighth municipal districts of Kabul City, positioned at approximately 34°29'37" north latitude and 69°12'3" east longitude. Originally covering 191 hectares, it lies at an elevation of 1790 to 1800 meters above sea level . Situated within Kabul's urban boundaries, the wetland is surrounded by hillsides, agricultural lands, and historical landmarks such as Kabul Bala Hissar to the north, Sher-Darwaza and Zanborak-Shah Mountains and Old City Wall to the west, reflecting its geographical significance (See Kole Hashmat Khan location in Afghanistan's map and its Google map in Figure 3).

4.2. PHYSICAL FEATURES

Kole Hashmat Khan is a shallow, nutrient-rich (eutrophic) wetland with slight salinity. Originally bordered by mountains and hills to the north, west, and southwest, it is now entirely encircled by human settlements due to urban expansion. The wetland, once part of a vast network of wetlands on the Kabul plain, is supplied by a canal from the Logar River and lacks an outlet unless water levels rise significantly. It was originally L-shaped, approximately 2.5 kilometers long and 0.3 to 1.0 kilometers wide, with a maximum water depth of no more than 1.5 meters . Urban development has significantly reduced its size, altering its shape to a bird-like form. Historically, the wetland remained frozen for two to three months annually, but rising temperatures and climate change have shortened freezing periods and disrupted its ecological balance.

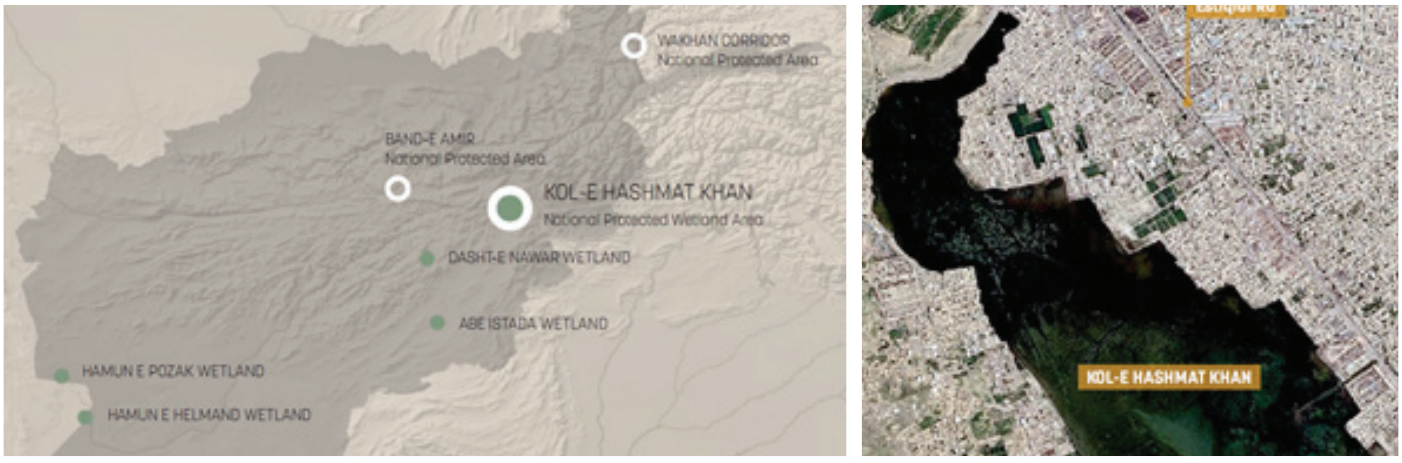

Figure 3. Kol-e Hashmat Khan is Afghanistan's first nationally designated protected wetland (Maps source: KUDF, 2017).

Scott, D. A., (1995). Fonds mondial pour la nature, Union internationale pour la conservation de la nature et de ses ressources, & Bureau international de recherches sur les oiseaux d'eau. A directory of wetlands in the Middle East. Gland, Switzerland, and IWRB, Slimbridge, UK: IUCN.

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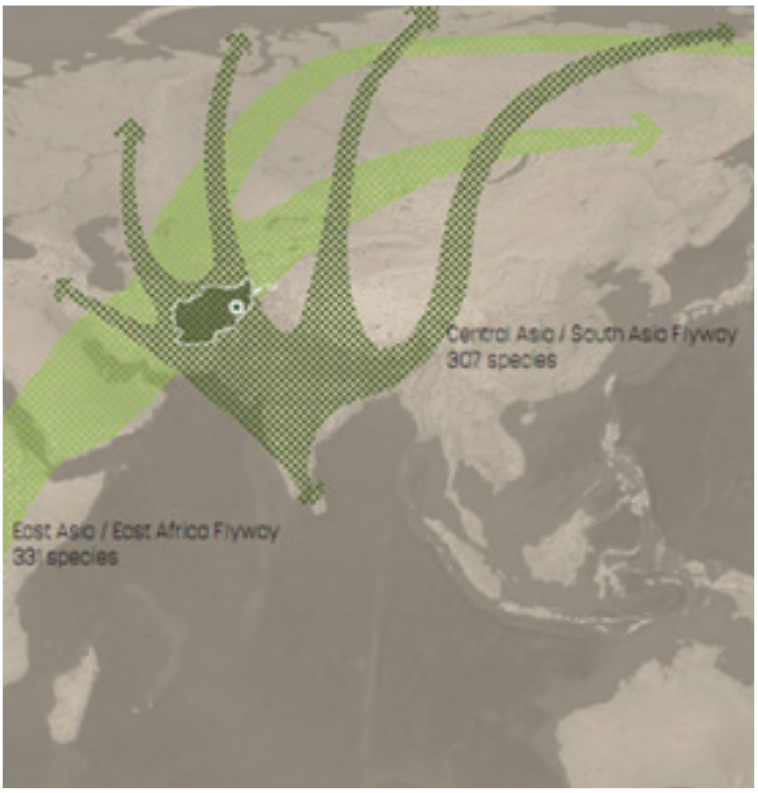
Rahim, A., Larsson, J. Y. (1978). A Preliminary Study of Lake Hashmat Khan: With Recommendations for Management. United Nations Development Programme, Food and Agriculture Organization of the United Nations [and] Ministry of Agriculture, Department of Forests and Range.

4.3. ECOLOGICAL SIGNIFICANCE

Kole Hashmat Khan is ecologically significant as a critical habitat for migratory waterfowl, serving as a vital staging area for numerous bird species along major global flyways. It provides essential stopover and breeding grounds, with open waters, mudflats, and reed beds supporting hundreds of migrating birds, particularly from March to July. The wetland also supports numerous bird species that are globally classified as vulnerable or near threatened. Additionally, the wetland plays a key role in recharging Kabul City's underground water reserves and acts as a natural buffer against flooding and stormwater runoff, underscoring its importance for biodiversity, water sustainability, and urban flood mitigation (See the birds migration flyways traversing Kole Hashmat Khan in Figure 4).



4.4. SOCIAL AND CULTURAL VALUES

Kole Hashmat Khan holds significant social and cultural value for the people of Kabul, serving as a cherished gathering place and a symbol of tradition for centuries. The wetland is home to the Jubur Ansar shrine, built in 645 AD, making it a site of pilgrimage and spiritual reflection for those seeking blessings and honoring early Islamic history. Its serene landscape has historically been a venue for social gatherings, family outings, and traditional events, embedding it deeply in the community's cultural fabric. Located near historic landmarks like Kabul Balahisar and the Old City Wall, the wetland is intertwined with Kabul's rich heritage, having served as a resting point for travelers and traders throughout history. These connections highlight its role as a vital part of Kabul's cultural and historical identity.

Figure 4. Kol-e Hashmat Khan wetland in Kabul, Afghanistan, is a vital stopover for migratory waterfowl along the Central Asia/South Asia and East Asia/East Africa flyways (Photo source: KUDF, 2017).

4.5. HISTORICAL PERSPECTIVE AND PAST CONSERVATION EFFORTS

Kole Hashmat Khan, a wetland with a rich history, has served as a waterfowl hunting site since the Mughal period, a tradition that persisted into the 1970s. Historical records show that between 15 and 400 waterfowl were hunted weekly during late spring and early summer . Beyond hunting, the wetland supported agriculture by providing irrigation water, while cattle and water buffalo grazed in its reed beds. Nomadic herders also utilized the area for grazing during spring migrations . However, rapid urbanization has replaced agricultural land with residential, commercial, and industrial zones, degrading the wetland's natural environment and straining its resources.

Rahim, A., Larsson, J. Y. (1978). A Preliminary Study of Lake Hashmat Khan: With Recommendations for Management. United Nations Development Programme, Food and Agriculture Organization of the United Nations [and] Ministry of Agriculture, Department of Forests and Range.
Scott, D. A., (1995). Fonds mondial pour la nature, Union internationale pour la conservation de la nature et de ses ressources, & Bureau international de recherches sur les oiseaux d'eau. A directory of wetlands in the Middle East. Gland, Switzerland, and IWRB, Slimbridge, UK: IUCN.
Azimi, A., McCauley, D. (2002). Afghanistan's environment in transition. Asian Development Bank.
Evans, M.I. (ed.) (1994). Important Bird Areas in the Middle East. BirdLife Conservation Series No.2. BirdLife International, Cambridge, U.K. 410 pp.

The wetland has experienced varying levels of protection over time. During Amir Habibullah Khan's reign (1901–1919), public hunting was banned, and access was restricted to the royal family and their guests. In the 1930s, King Mohammed Zahir Shah designated it as a waterfowl reserve, maintaining it as a private hunting ground until the 1970s5. A 1972 UNDP-funded analysis identified Kole Hashmat Khan as a potential protected area , leading to its declaration as a Waterfowl Sanctuary in 1973, though this was never legalized. After the monarchy fell in 1974, the Republic Guard managed the area until 1979, during which the FAO conducted an ecological survey. Post-1979, management ceased, and the wetland suffered from public misuse. Despite this, it was recognized as an Important Bird Area by BirdLife International .

Conservation efforts resumed in the 21st century. In 2002, a trench was dug to prevent urban encroachment, and in 2006, a provisional management plan was drafted but not implemented due to budget constraints. In 2007, the Wildlife Conservation Society (WCS) conducted bird surveys, and a protection committee was established to address violations. In 2014, Presidential Decree No. 4363 officially designated Kol-e Hashmat Khan as a protected waterfowl area, revitalizing conservation efforts. The area had been proposed for protection by NEPA. Most recently, the cleaning of the Joyee Mastan canal in 2024 increased water inflow, raising the wetland's water level and aiding its ecological recovery.

5. CURRENT STATUS OF THE WETLAND

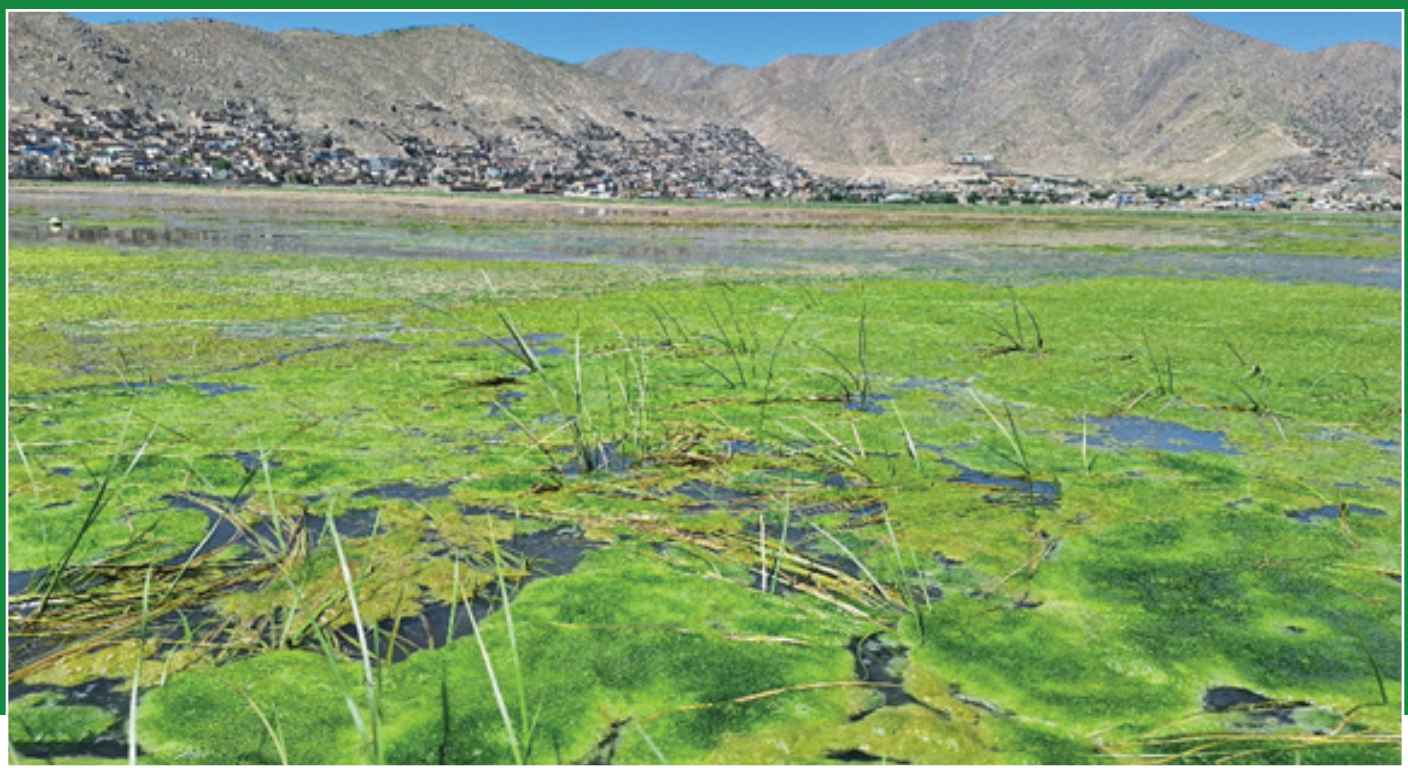
5.1. HYDROLOGY AND WATER QUALITY

The hydrology of Kole Hashmat Khan Wetland is primarily sustained by the Joee Mastan canal, diverted from the Logar River, as the other historical canals (Joee Benihisar and the Kabul Bala-Hisar canal) have been destroyed due to urban expansion. Seasonal rainfall and snowmelt from surrounding watersheds also contribute to water inflows, with water levels peaking in winter and early spring. However, by late spring and summer, water levels recede significantly, often causing the wetland to dry up by fall . This seasonal fluctuation is exacerbated by reduced rainfall, prolonged droughts, and increased upstream irrigation, which disrupt the wetland's ecological functions.

Water quality has been negatively impacted by human activities, including wastewater discharge, solid waste disposal, and pollutants from nearby economic activities such as car washing and mechanical repairs. The presence of a domestic animal selling facility on the wetland's northern edge further degrades water quality through animal excrement carried into the water. These factors contribute to visible pollution, such as excessive algae growth and changes in watercolor, though no formal water quality tests have been conducted to fully assess the extent of contamination (see photo of algae growth within the water body of the wetland in Figure 5).

The wetland's seasonal water dynamics play a crucial role in supporting biodiversity, particularly for migratory birds, while also aiding groundwater recharge and flood regulation. However, the drying of the wetland in fall threatens its ecological balance, highlighting the need for sustainable water management to preserve its hydrological and ecological functions (See seasonal water dynamics in Kole Hashmat Khan across the year in Figure 6).

Figure 5. Algae growth in the water body of Kol-e Hashmat Khan Wetland, indicating ecological dynamics and water quality conditions. Photo taken in June 2024 by Ezatullah Sediqi.



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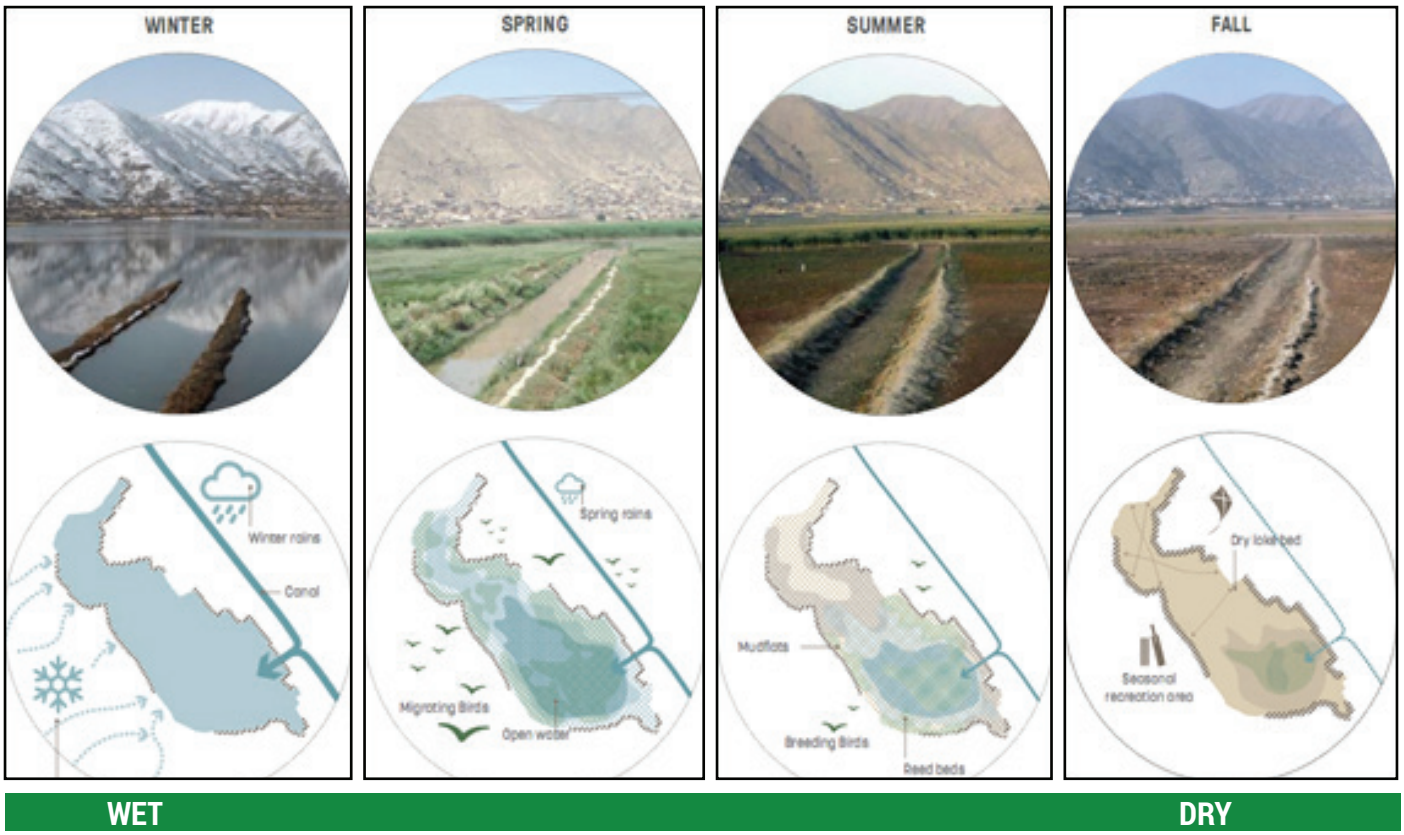

Figure 6. A comprehensive view of Kol-e Hashmat Khan across all four seasons, highlighting the changes in its landscape and fluctuations in water levels (Maps and photos source: KUDF, 2017).

5.2. BIODIVERSITY

5.2.1. FLORA

The flora of Kole Hashmat Khan Wetland plays a vital role in supporting its unique ecosystem, shaped by fluctuating water levels and extreme seasonal conditions. The most prominent plant species is the common reed (Phragmites australis), documented in historical records from the 1970s, confirmed in recent observations, and site visits (see reed bed photo in Figure 7). These reeds dominate the wetland, providing critical habitat for wildlife and stabilizing the ecosystem (see map in Figure 8 that highlights the reed cover inside the wetland on light green color). Other typical wetland plants, such as sedges (Carex species) and rushes (Juncus species), may also be present, along with aquatic plants like water lilies or duckweed, though specific studies confirming their presence are limited. The flora contributes significantly to the wetland's ecological balance, supporting migratory birds and enhancing its resilience to environmental stressors. Further research is needed to fully document the plant species and their ecological roles.

Figure 7. Reed bed in Kol-e Hashmat Khan Wetland, providing crucial habitat for birds breeding and supporting the wetland ecosystem. Photo taken in June 2024 by Ezatullah Sediqi.

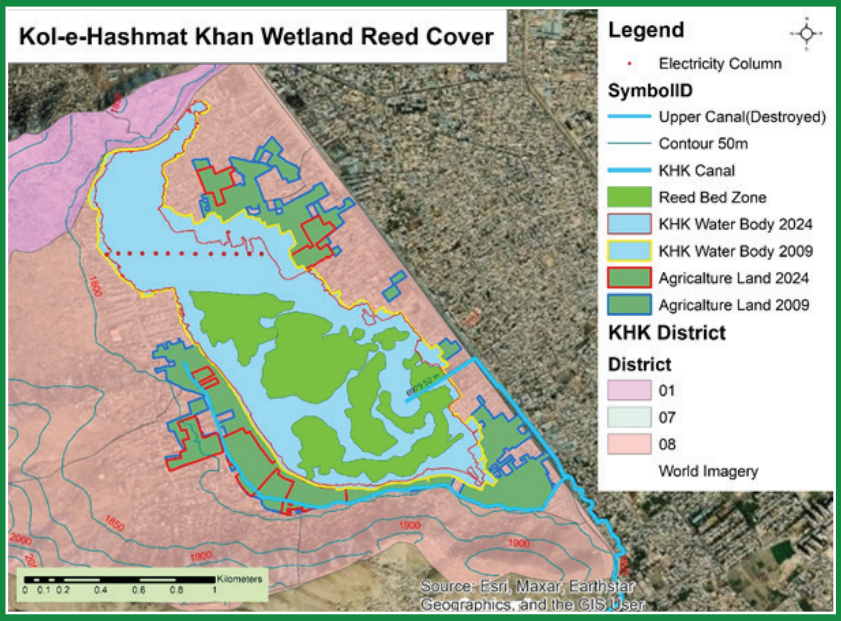

Figure 8: Geospatial map highlighting the distribution of reed bed within the water body of the Kol-e Hashmat Khan Wetland

6.1.1. FAUNA

Historically, Kol-e Hashmat Khan supported thousands of migratory waterfowls, attracted by its shallow waters and reed beds. However, reduced water inflows have shrunk its surface area, degraded habitat quality, and disrupted the seasonal rhythms essential for birdlife. Despite these challenges, including water drainage in the fall, Kol-e Hashmat Khan remains a site of significant ornithological value, particularly during spring and summer (see photo of waterbird breeding nest in Figure 9).

As one of Afghanistan's few significant wetlands, Kol-e Hashmat Khan provides critical habitat

Scott, D. A., (1995). Fonds mondial pour la nature, Union internationale pour la conservation de la nature et de ses ressources, & Bureau international de recherches sur les oiseaux d'eau. A directory of wetlands in the Middle East. Gland, Switzerland, and IWRB, Slimbridge, UK: IUCN.
Mostafawi, S. N., Ostrowski, S. 2010. Birdlife monitoring in Kol-e Hashmat Khan, Kabul, Afghanistan (March 2007 – April 2010). Wildlife Conservation Society. 2300 Southern Boulevard, Bronx, NY 10460. https://stephane.ostrowski.free.fr/pdf/3-2010-004.pdf

for water birds. A study documented 93 bird species, representing nearly one-quarter of Afghanistan's regularly occurring bird species. While overall bird diversity appears lower compared to records from 1966–1977, this discrepancy is likely due to differences in survey methods rather than an actual loss of species,.

Figure 9. Waterbird breeding nest with eggs inside the reed cover in Kol-e Hashmat Khan Wetland, Kabul.
Photo taken in June 2024 by Ezatullah Sediqi

Bird populations peak in March and April, with over 2,000 water birds present at a time. By mid-May, most migratory species depart for breeding grounds, leaving fewer than 400 resident birds. Winter bird numbers fluctuate significantly based on precipitation and temperature. For instance, higher rainfall and milder temperatures in 2009–2010 allowed 500–600 birds to overwinter, while drought or freezing conditions in previous years reduced these numbers11.

The species composition at Kol-e Hashmat Khan has shifted over time. Recent surveys recorded 53 water bird species, up from 46 in the past, while non-water bird species have declined. Some species observed in the 1960s and 1970s, such as the white-tailed lapwing (Vanellus leucurus) and purple heron (Ardea purpurea), were absent during the 2007–2010 study. However, 16 new species were documented, including the Dalmatian pelican (Pelecanus crispus), greylag goose (Anser anser), and great crested grebe (Podiceps cristatus) .

A concerning decline in breeding water bird species has also been observed. In the 1960s, 10 species were confirmed to breed at the wetland, but by 2007–2010, only four species were recorded breeding13:

1. Little grebe (Tachybaptus ruficollis)
2. Mallard (Anas platyrhynchos)
3. Eurasian coot (Fulica atra),
4. Common moorhen (Gallinula chloropus).

Mostafawi, S. N., Ostrowski, S. 2010. Birdlife monitoring in Kol-e Hashmat Khan, Kabul, Afghanistan (March 2007 – April 2010). Wildlife Conservation Society. 2300 Southern Boulevard, Bronx, NY 10460. https://stephane.ostrowski.free.fr/pdf/3-2010-004.pdf

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This decline is attributed to excessive summer water drainage, which dries the lake during the breeding season, and early reed harvesting, which destroys nesting sites. Additionally, expanding settlements and human disturbances exacerbate the problem.

Kol-e Hashmat Khan remains a vital habitat for migratory and globally threatened species. During the recent study, five species of global conservation concern were recorded: the Vulnerable (VU) Dalmatian pelican (I) and Eastern imperial eagle (Aquila heliaca), and the Near Threatened (NT) ferruginous duck (Aythya nyroca), Western black-tailed godwit (Limosa limosa), and European roller (Coracias garrulus). Given Afghanistan's scarcity of wetlands, Kol-e Hashmat Khan serves as a crucial stopover and wintering site, underscoring the need for its conservation13.

5.3. LAND USE CHANGE AND HUMAN ACTIVITIES

The urban expansion around the Kol-e Hashmat Khan wetland is evident, with a significant amount of land converted into residential areas, particularly in the wetland's buffer zones. Commercial areas, concentrated along major roads, suggest the growth of marketplaces and business hubs. Agricultural land has drastically diminished, with only small patches remaining, especially in the southern and southeastern parts, reflecting a shift toward urban settlements. Vacant and ruined plots indicate ongoing or planned developments, with the potential for future urban expansion. Mixed-use areas are also emerging, combining residential and commercial activities, contributing to urban densification (see the land use map of Kol-e Hashmat Khan Wetland in Figure 10). The areas highlighted in red could pose potential threats to the wetland both in the current situation and in the future.

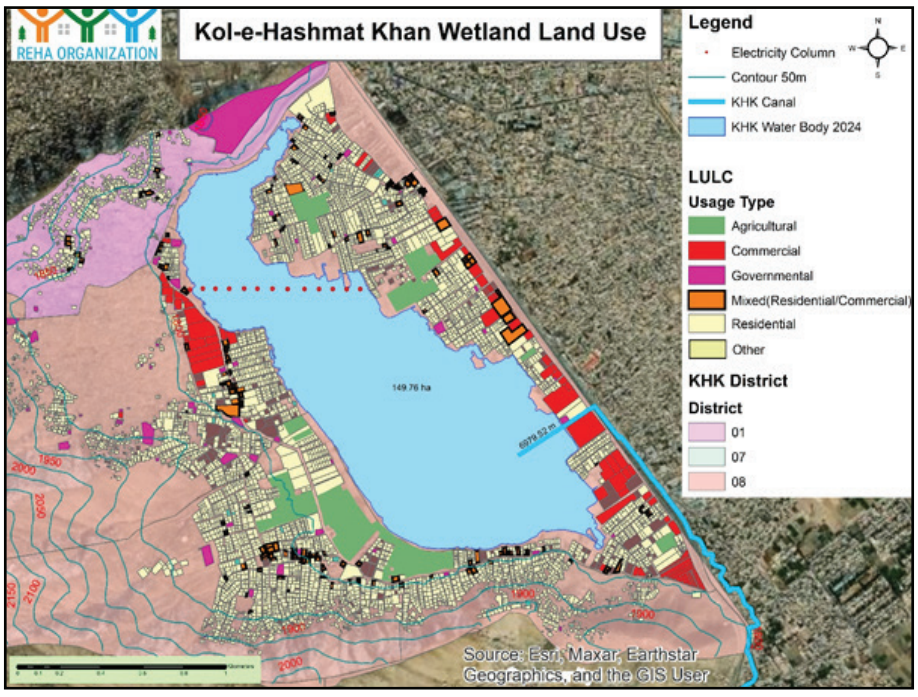

Figure 10: Land use map of Kol-e Hashmat Khan Wetland highlighting urban expansion, residential and commercial areas, agricultural land loss, and mixed-use developments

The wetland's water body has shrunk from 170.2 hectares in 2009 to 149.76 hectares in 2024, indicating environmental pressures such as climate change, reduced water inflow, and human interventions (see map in Figure 10). Field observations reveal that human activities, particularly the accumulation of construction debris and other materials along the wetland's edges, have raised the land level, preventing it from being submerged by water. This has contributed to a reduction in the area that was once inundated. Additionally, electricity columns have been established in the middle of the wetland, further impacting its hydrology.

Simultaneously, agricultural activities have diminished significantly, with cultivated land decreasing from 66 hectares in 2009 to just 20.1 hectares in 2024 (see changes map in Figure 11). This transformation suggests a shift in land use patterns, possibly due to urban expansion, changes in water availability, or declining agricultural viability in the area. While this reduction in farmland might alleviate some pressure on wetland conservation, it also raises concerns about the displacement of local livelihoods and the potential impact on food security. The blue lines on the eastern and western sides of Kol-e Hashmat Khan in the following map highlight the water canals. One of these canals, which connects to the eastern side of the wetland, is still active and called Joee Mastan. The other canal, previously connected to the western side and known as the Benehisar Canal, was separated from the current canal and is now destroyed and non-functional.

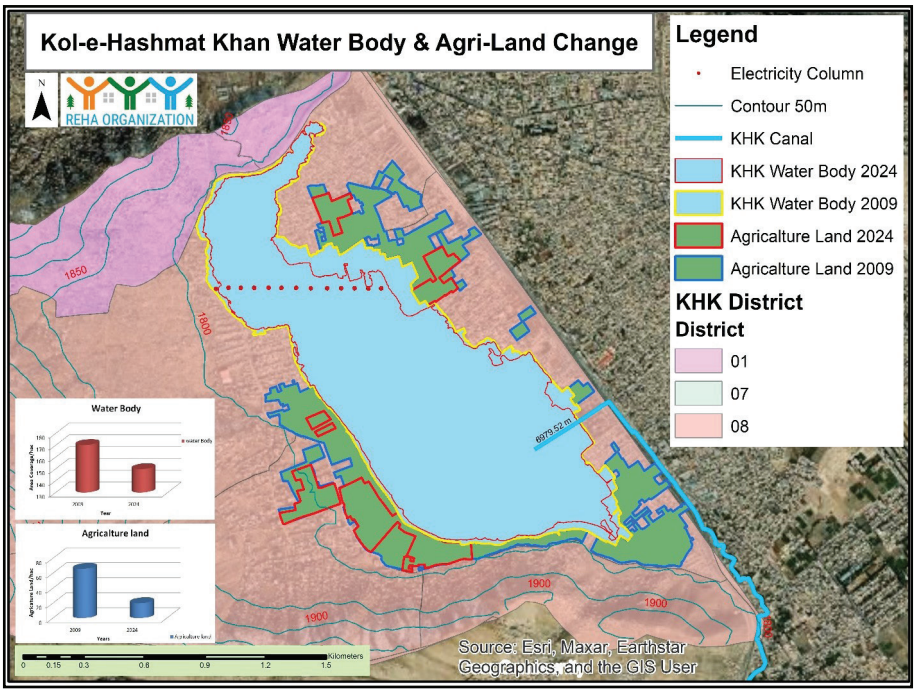

Figure 11. The map highlights the changes in the Kol-e Hashmat Khan Wetland water body and agricultural land between 2009 and 2024, highlighting the decrease in water area and the reduction of agricultural land

Human activities around the wetland are significantly impacting its ecological health. Waste dumping and wastewater discharge from human settlements contribute to pollution and water degradation. The area also hosts a livestock selling market, car wash zones, and car repair workshops, adding to environmental strain through waste, noise, and air pollution. Urban expansion has converted agricultural land into residential and commercial areas, particularly in the wetland's buffer zones, further threatening its ecological balance. These activities, combined with ongoing infrastructure development, pose significant risks to the wetland's sustainability (See Kol-e Hashmat Khan threats map in Figure 12).

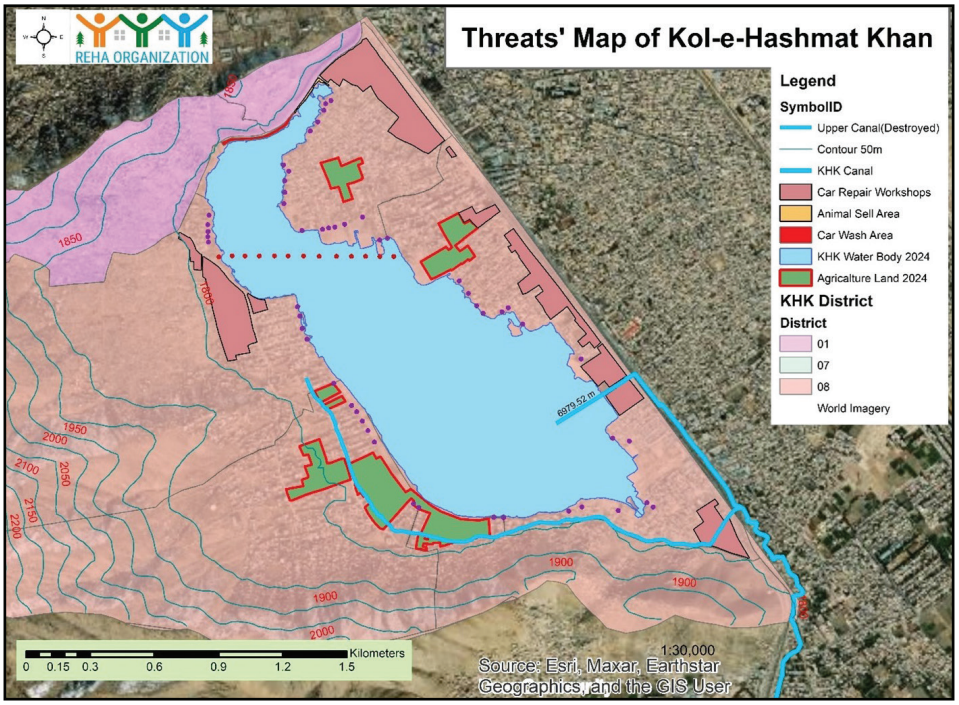

Figure 12: Threats map of Kol-e Hashmat Khan showing threats to the ecosystem from human activities, including waste dumping, wastewater discharge, livestock markets, car repair workshops, and urban expansion

5.4. CHALLENGES

5.4.1. WATER SCARCITY AND HYDROLOGICAL DISRUPTION

Water scarcity and hydrological disruption in Kole Hashmat Khan are primarily caused by the diversion of water for agricultural and urban use, significantly reducing inflows, especially during cultivation periods. The abandonment of the Haq-Aba water rights system has further diminished water supply, exacerbating the problem during droughts and causing the wetland to shrink or dry up completely. Groundwater extraction for agricultural and domestic use reduces the wetland's natural recharge capacity, while unregulated settlements encroach upon Joee Mastan canal and its buffer zone, obstructing water flow. The deteriorating water diversion dam along the Logar River, constructed in 1999, and sediment-clogged canals further restrict water flow (see photos of Joee Mastan canal water diversion dam in Figure 13). Although a cleaning operation in 2024 temporarily restored the canal's capacity, providing short-term relief, long-term solutions are needed to address these persistent challenges.

Figure 13: A low-height diversion dam on the Logar River, supplying water to the Joee Mastan canal. The dam's limited height restricts sufficient water diversion, underscoring the need for improvements to enhance water flow and distribution.

5.4.2. SEDIMENT ACCUMULATION

One of the major challenges facing Kol-e Hashmat Khan wetland is excessive sediment accumulation, particularly along its edges, which has significantly reduced its water storage capacity (see sediments accumulation photo in Figure 14). The buildup of sediments has not only decreased the wetland's depth but also restricted its ability to retain water during the wet seasons. As a result, the wetland struggles to maintain adequate water levels, impacting on its ecological functions and habitat quality. Removing these sediments, especially from the edges, would help restore the wetland's original water-holding capacity, allowing it to store more water during the rainy season and sustain its ecosystem throughout the year. Addressing this issue through proper sediment management and restoration efforts is crucial for enhancing the wetland's long-term sustainability and ecological health.

Figure 14: A photo showing the significant buildup of sediments in the wetland area, which has reduced water retention capacity and threatens the ecological health of the wetland.

5.4.3. POLLUTION AND CONTAMINATION

Water pollution and contamination in Kole Hashmat Khan stem from multiple sources, including untreated sewage, agricultural runoff, and industrial waste carried by the Logar River Canal (Joee Mastan). The wetland edges are used as dumping grounds for rubbish, while waste from nearby markets, slaughterhouses, and domestic animal markets introduces organic matter, blood, and manure, potentially causing eutrophication and harming aquatic life (see photos of rubbish dumping grounds, and animal selling market on the edges of Kole Hashmat Khan Wetland in Figures 15 and 16). Activities such as clothes laundering, vehicle washing, and car repair workshops near the wetland release oil, chemicals, and other pollutants, further degrading water quality and threatening biodiversity (see photos of vehicle washing facilities and car repair workshops on the edges of the Kole Hashmat Khan in Figures 17 and 18). Visible signs of pollution, such as excessive algae growth, highlight the urgent need for systematic water and soil quality testing to assess contamination levels and develop effective mitigation strategies.

Figure 15: Piles of waste accumulating near the wetland, contributing to pollution and threatening the ecological health of this important habitat.

Figure 16: A livestock trading market operating on the northern edge of the wetland, raising concerns about uncontrolled waste, water contamination, and habitat disturbance.

Figure 17: An unregulated car washing station on the northern boundary of the wetland, contributing to water pollution through the discharge of oil, detergents, and other contaminants.

Figure 18: Auto repair workshops operating near the wetland, raising concerns about hazardous waste leakage, soil contamination, and environmental degradation.

5.4.4. LAND ENCROACHMENT

Land encroachment in Kole Hashmat Khan, both on the mainland and surrounding hillsides, is a critical environmental challenge, with 459 illegally occupied land parcels recently identified by the Commission for the Clearance of Usurped Lands. According to their information, approximately 11 hectares of land have been grabbed by human settlements (see land encroachment photo on the wetland edges in Figure 19). Unplanned housing developments are transforming natural wetland areas into human settlements, discharging untreated sewage and extracting groundwater, which depletes water resources and contaminates the wetland. During rainfall, wastewater from hillside settlements flows into the wetland, exacerbating pollution and ecosystem degradation. This combination of encroachment, pollution, and over-extraction threatens the wetland's ecological health, necessitating urgent action to regulate land use, improve waste management, and restore hydrological balance.

Figure 19: Photo depicting the illegal occupation of land within the wetland area, contributing to habitat degradation and complicating conservation efforts.

5.4.5. RECREATIONAL USE

The wetland's shores and dried-up areas are frequently used for recreational activities, including children's play areas and temporary sports grounds. While these activities reflect the community's reliance on the wetland, they also contribute to habitat degradation and pollution. With a proper management plan, such activities could be organized and confined to specific outer edges of the wetland, minimizing their impact. However, the current lack of regulation leads to the trampling of vegetation, disturbance to waterfowl, and improper waste disposal, further exacerbating the wetland's environmental challenges. Effective management strategies are essential to balance community use with the need to protect the wetland's ecological integrity.

5.4.6. LOSS OF HABITAT AND BIODIVERSITY

The loss of habitat and biodiversity in Kole Hashmat Khan is driven by water scarcity, pollution, habitat disturbance, and the historical presence of invasive fish species, leading to a decline in native plant and animal populations, particularly waterfowl and aquatic organisms. Pollution exposes migratory birds to toxic chemicals, heavy metals, and pathogens, while plastic waste and debris pose ingestion and entanglement risks. Habitat disturbance, such as grazing by domestic animals and the cutting of reeds, further disrupts breeding and nesting sites. Although improved management has reduced hunting and grazing pressures, aiding biodiversity recovery, ongoing efforts are needed to address pollution, habitat loss, and other threats to ensure the wetland's ecological health and sustainability.

5.4.7. CLIMATE CHANGE IMPACTS

Climate change severely impacts Kole Hashmat Khan by disrupting its water supply, which relies on inflows from the Logar River canal, surrounding watersheds, springs, and snowmelt. Rising temperatures and shifting precipitation patterns have reduced snowfall in the Hindu Kush mountains, leading to earlier snowmelt and decreased river flow during critical periods . Additionally, water diversion for agriculture and reduced contributions from springs and snowmelt in adjacent hills and mountains have exacerbated water scarcity. Afghanistan's temperature increases of approximately 1.8°C since 1950, coupled with erratic rainfall and frequent droughts , has further depleted groundwater and snow accumulation, leaving the wetland increasingly vulnerable to prolonged dry spells and instability.

5.4.8. GOVERNANCE AND MANAGEMENT ISSUES

Governance issues pose a significant threat to Kole Hashmat Khan, with weak regulatory frameworks leaving the wetland vulnerable to encroachment, pollution, and over-extraction of water resources. Unplanned urban expansion, land grabbing, and unregulated industrial activities persist due to inadequate enforcement of existing regulations, despite the identification of 459 illegally occupied land parcels (approximately 11 hectares). Pollution from domestic sewage, agricultural runoff, and industrial waste continues unchecked, exacerbated by insufficient monitoring and penalties. Fragmented responsibilities and poor coordination among stakeholders, such as the National Environment Protection Agency (NEPA), Ministry of Agriculture, Irrigation, and Livestock (MAIL), and Kabul Municipality, further hinder effective management. Additionally, the exclusion of local communities from decision-making processes leads to harmful practices like grazing and improper waste disposal. Strengthening regulations, improving enforcement, fostering stakeholder coordination, and involving local communities are essential to safeguarding the wetland's ecological integrity and biodiversity.

In the past, a management plan was drafted— by the Ministry of Agriculture, Irrigation, and Livestock in coordination with the National Environmental Protection Agency (NEPA). However, in looks like the plan remained unimplemented and existed only on paper, highlighting the persistent lack of effective governance and commitment to conservation efforts.

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6. COMMUNITY ENGAGEMENT AND STAKEHOLDERS' PERSPECTIVES

6.1. SUMMARY OF FINDINGS WITH COMMUNITY ENGAGEMENT

The Focus Group Discussion (FGD) with the local communities surrounding Kole Hashmat Khan wetland revealed a strong willingness among community members to actively participate in the restoration, management, and protection of the wetland. The communities expressed their readiness to collaborate with government agencies, municipality, and other stakeholders to address the challenges facing the wetland. Key concerns raised by the community include land encroachment, water flow management, waste disposal, historical monument preservation, and the need for improved infrastructure to support the wetland's ecological health. The community also emphasized the importance of public awareness, law enforcement, and job creation as part of the broader efforts to sustain the wetland.

The FGD highlighted the community's proactive stance in addressing environmental and infrastructural issues, such as sediment removal, canal reconstruction, and watershed regulation. Additionally, the community requested support from the government and other agencies to implement specific projects aimed at enhancing the wetland's functionality and resilience. Overall, the findings underscore the critical role of local communities as key stakeholders in the sustainable management of Kole Hashmat Khan wetland.

6.1.1. ROLE AND PRIORITIES OF LOCAL COMMUNITY IN WETLAND MANAGEMENT

The local communities surrounding Kole Hashmat Khan wetland have expressed strong willingness to actively participate in its conservation and management. The discussions held with community representatives highlighted several key areas where local engagement is essential. Community members are eager to assist in reclaiming usurped lands within the wetland's vicinity, ensuring that they are restored for ecological conservation. They also emphasized their readiness to cooperate in strengthening water flow into the wetland, particularly during high water periods in the local river, to maintain the wetland's ecological balance.

A major concern raised by the community is waste management. Residents have committed to keeping the Kole Hashmat Khan wetland canal clean but emphasized the need for municipal cooperation in establishing designated waste disposal sites and installing trash bins. Without proper waste management infrastructure, indiscriminate dumping of garbage continues, exacerbating pollution due to runoff and wind dispersal. Similarly, the community requested government intervention in reconstructing the source canal dam that diverts water from the Logar River, while ensuring their cooperation in the restoration process.

Community members also expressed their readiness to assist in cleaning sediment from the wetland, which they see as vital for its long-term sustainability. Furthermore, they showed interest in preserving historical monuments such as Qala-e-Heshmat Khan and pledged full cooperation with government agencies to restore and maintain these cultural sites. Additionally, concerns were raised about the open concrete canal running along the Kabul-Logar Road, which has become a source of waste dumping; the community urged the Kabul Municipality to take action in closing these open sections to mitigate pollution.

Savage, M., Dougherty, B., Hamza, M., Butterfield, R., Bharwani, S. (2009). Socio-economic impacts of climate change in Afghanistan. Stockholm Environment Institute. Retrieved from https://unama.unmissions.org/sites/default/files/2007447_AfghanCC_ExS_09MAR09.pdf

Public awareness and legal enforcement were also identified as crucial components of wetland protection. Residents called for greater efforts in educating the public on the importance of wetland conservation and the implementation of relevant environmental laws. They also proposed installing a protective fence (either mesh or masonry) around the wetland to prevent further encroachments and unauthorized land use. Addressing sewage management from hillside homes near the wetland was another key concern, with community members willing to cooperate in establishing a proper waste treatment system.

Security and protection of the wetland were also highlighted, with calls for increasing the number of personnel safeguarding Kole Hashmat Khan. Additionally, the community emphasized the importance of watershed management strategies to regulate water flow, enhance underground reserves, and mitigate flooding risks. The need for economic opportunities was also raised, with community members expressing their willingness to participate in projects that would provide them with employment while contributing to wetland conservation efforts.
Despite their active engagement, community representatives acknowledged their lack of executive authority, emphasizing that they rely on the government and relevant agencies to implement necessary measures while they remain committed to offering full cooperation.

6.1.2. ACTIVITIES PROPOSED BY LOCAL COMMUNITY

1. Installation of a Protective Fence: To safeguard the wetland from land grabbing and unauthorized activities.
2. Sediment Removal: Cleaning the wetland to a depth of at least two meters to increase water retention capacity.
3. Reconstruction of Bala Hesar and Beni Hesar Canals: Enhancing water inflow during peak water seasons.
4. Waste Management Infrastructure: Establishing garbage disposal sites and installing trash bins in critical areas.
5. Expansion of Kabul Green Belt: Planting native, drought-resistant tree species on nearby hillsides.
6. Flood Prevention Measures: Constructing check dams and implementing terracing techniques to stabilize surrounding hills.
7. Rehabilitation of Mastan Canal: Cleaning and reconstructing the buffer zone to im prove water inflow from Logar River.

6.2. STAKEHOLDERS' CONCERNS AND PRIORITIES

As part of the technical assessment of Kol-e Hashmat Khan wetland, a focused group discussion (FGD) was conducted with key stakeholders that are interested or involved in the management of the wetland, including representatives from government agencies, and non-governmental organizations. The discussion provided valuable insights into the most pressing challenges facing the wetland and highlighted priority areas for conservation and management. Participants raised concerns regarding land encroachment, biodiversity conservation, wetland hydrology, pollution control, and the need for stronger stakeholder coordination. The following section outlines the key issues identified by stakeholders and presents their perspectives on potential solutions to ensure sustainable management of this critical ecological site.

6.2.1. LAND GRABBING

A representative from the Kabul Province Agriculture Directorate, which is part of the Usurped Land Reclamation Commission, provided insights into land encroachment issues at Kol-e Hashmat Khan Wetland. The representative revealed that approximately 459 land parcels, covering 11 hectares, have been identified as illegally occupied within the wetland. The commission has already documented the encroached parcels and submitted a list of land grabbers to the High Court for legal action. However, the representative acknowledged that the legal process could be lengthy. As a result, it was concluded that wetland management and restoration activities should not be delayed by the ongoing land reclamation efforts. Instead, restoration and conservation initiatives should proceed on the remaining uncontested land to prevent further degradation.

In response, the management staff of Kol-e Hashmat Khan Wetland expressed concerns that proceeding with management activities—such as establishing boundaries on the currently available land—might inadvertently legitimize the encroachment, thereby complicating future reclamation efforts. They stressed the importance of ensuring that restoration efforts do not grant implicit recognition to land grabbers, as this could weaken legal claims to reclaim the encroached areas in the future. Balancing immediate conservation needs with the long-term goal of recovering illegally occupied land remains a significant challenge.

6.2.2. BIODIVERSITY CONSERVATION AND BIRDS SURVEY

The participants emphasized the need for updated bird surveys, particularly focusing on migratory and breeding birds that rely on the wetland. They noted that the last comprehensive survey was conducted 15 years ago, making it essential to reassess the current bird population and migration patterns.

To conduct this survey effectively, stakeholders recommended inviting foreign ornithologists to Afghanistan. These experts would not only carry out the survey but also train young ornithologists from the Ministry of Agriculture, Irrigation and Livestock (MAIL) and the National Environment Protection Agency (NEPA). Additionally, they highlighted the need for technical equipment, including cameras, camera traps, and bird identification books, to monitor and document bird movements. The survey should be designed for long-term monitoring to track changes in waterfowl populations and migration trends over time.

6.2.3. FLORAL AND HYDROLOGICAL STUDIES

In addition to bird surveys, the participants stressed the importance of studying the flora and hydrology of Kol-e Hashmat Khan. Understanding the wetland's vegetation and water dynamics is crucial for effective conservation planning, as it directly impacts the habitat suitability for wildlife.

6.2.4. WETLAND MANAGEMENT PLAN REVISION

Stakeholders agreed that the current wetland management plan is outdated and largely unimplemented, with less than 10% of its recommendations being executed. The main reasons for this failure were identified as lack of funding and weak coordination among stakeholders.

To address this, the participants strongly recommended the revision or development of a new management plan that aligns with the current ecological, social, and institutional realities of Kol-e Hashmat Khan. The revised plan should also include clear implementation strategies and funding mechanisms.

6.2.5. SEDIMENT REMOVAL AND CLEANING EFFORTS

Community members raised concerns about sediment accumulation in the wetland, which has reduced water retention capacity and degraded habitat quality. While stakeholders agreed that sediment removal is necessary, they emphasized that it should be carried out under expert guidance to avoid disrupting the wetland's ecosystem.

6.2.6. STRENGTHENING STAKEHOLDER COORDINATION

A key challenge identified during the discussion was the lack of coordination among relevant stakeholders. Participants recommended establishing an official coordination platform to facilitate collaboration between government agencies, NGOs, and community representatives. This platform would enhance decision-making, resource allocation, and implementation of conservation actions.

6.2.7. POLLUTION CONTROL AND WASTE MANAGEMENT

The issue of human activities contributing to pollution was also discussed, with a strong emphasis on the role of Kabul Municipality in regulating such activities. Stakeholders highlighted several concerns, including:

- Uncontrolled waste dumping around the wetland.
- Poorly managed livestock trading facilities near the wetland.
- Unregulated car washing stations and repair workshops located along the wetland's edges, contributing to water contamination.

To mitigate these threats, the participants recommended that Kabul Municipality take responsibility for controlling waste disposal, regulating business activities around the wetland, and enforcing environmental regulations. Proper waste management strategies and strict monitoring of industrial activities should be prioritized to reduce pollution levels.

7. PROPOSED CONSERVATION AND RESTORATION STRATEGIES

7.1. WATER MANAGEMENT AND HYDROLOGICAL RESTORATION

- Prevent excessive summer drainage: Implement water conservation policies that re strict exces sive diversion for irrigation, particularly during peak summer months, to reclaim wetland Haq-Aba. Additionally, enforce strict regulations to prevent the drilling of underground water wells, which contribute to the depletion of Kol-e Hashmat Khan's water resources.
- Rehabilitate water channels and control structures: Restore or construct small dams or embank ments to regulate water existence and prevent the premature drying of the wetland. Additionally, the Kabul Urban Framework Design 2017 recommends creating small water ponds to retain water during the dry seasons and periods when the wetland's wa ter levels are declining or drying up.These measures aim to sustain the wetland's water levels and ensure its ecological stability throughout the year.

7.2. HABITAT RESTORATION AND PROTECTION

- Control reed harvesting: Enforce a seasonal ban on reed harvesting before September to protect nesting birds. Implement sustainable harvesting techniques that leave suffi cient cover for wildlife.
- Expand vegetation cover: Plant native wetland vegetation, including reeds and aquatic plants, to stabilize the ecosystem, provide breeding habitats, and improve water quality.
- Prevent land encroachment: Strengthen legal protection against urban expansion, con struction, and agricultural encroachment into the wetland.

7.3. BIODIVERSITY CONSERVATION

- Enforce strict anti-hunting policies: Strengthen hunting regulations and patrols to pre vent poach ing, particularly of migratory and threatened bird species.
- Enhance monitoring programs: Expand regular bird surveys and ecological monitoring to track changes in biodiversity, breeding success, and habitat health.
- Develop a bird sanctuary zone: Designate a core protected area within the wetland where human activity is restricted, ensuring an undisturbed refuge for key bird populations.

7.4. COMMUNITY ENGAGEMENT AND LIVELIHOOD SUPPORT

- Promote alternative livelihoods: Provide sustainable livelihood options for local commu nities, such as eco-tourism, birdwatching, and wetland-friendly agriculture, to reduce dependence on wet land resources.
- Raise awareness and education: Conduct community education programs on the impor tance of wetlands, conservation ethics, and sustainable resource use.
- Strengthening stakeholder collaboration: Establish partnerships with local communi ties, universi ties, and NGOs to promote participatory wetland management.

7.5. CLIMATE RESILIENCE AND POLLUTION CONTROL

- Develop a climate-adaptive wetland management plan: Assess and mitigate the im pacts of climate change, including droughts and fluctuating precipitation, on the wet land ecosystem.
- Control pollution and waste management: Implement waste disposal regulations to pre vent dump ing of solid and liquid waste into the wetland. Introduce buffer zones with trees and vegetation to filter pollutants.

- Restore degraded areas: Identify and rehabilitate eroded or polluted zones within the wetland through soil stabilization and bioremediation techniques.

7.6. INSTITUTIONAL STRENGTHENING AND POLICY INTEGRATION

- Strengthen legal frameworks: Advocate for protective measures of Kol-e Hashmat Khan as a pro tected wetland under Afghan environmental laws and international con servation agreements (e.g., Ramsar Convention).
- Improve governance and enforcement: Establish a wetland management committee with represen tatives from government, academia, and local communities to oversee conservation actions.
- Secure long-term funding: Seek national and international funding for wetland conser vation, in clud ing grants from environmental organizations and development agencies.

7.7. ECO-TOURISM AND SUSTAINABLE RECREATION DEVELOPMENT

- Develop a visitor center: Construct an eco-friendly visitor center to support education, tourism, and research activities.
- Promote responsible eco-tourism: Design birdwatching trails, observation towers, and guided tours to attract tourists while minimizing disturbance to wildlife.
- Regulate recreational activities: Establish zoning regulations to balance tourism and conservation, ensuring non-intrusive activities such as controlled birdwatching and photography.

8. RECOMMENDATIONS AND NEXT STEPS FOR THE RESTORATION OF KOLE HASH MAT KHAN WETLAND

To ensure the long-term ecological health and resilience of the Kole Hashmat Khan Wetland, a series of well-structured and data-driven interventions must be implemented. Below are concrete recommendations and the next steps, aligned with the assessment findings:

8.1. MIGRATORY AND BREEDING BIRDS SURVEY

A comprehensive bird survey should be conducted to assess the wetland's faunal diversity, focusing on migratory and breeding species. This will require the involvement of international ornithologists to guide local experts through training and capacity-building programs. The project should include the procurement of advanced monitoring equipment, such as binoculars, tracking devices, and data collection tools, as well as the construction of birdwatching towers to facilitate observation and eco-tourism. Regular seasonal surveys will help track species population trends and identify necessary conservation measures to protect globally threatened species.

8.2. COMPREHENSIVE WETLAND MANAGEMENT PLAN AND STAKEHOLDER COORDINATION

A scientifically robust and participatory wetland management plan should be developed to address the current ecological, social, and institutional challenges facing Kole Hashmat Khan. The plan must be updated or newly developed to align with recent environmental data and involve stakeholder consultations to ensure collaboration among government agencies, NGOs, and local communities. Establishing a formal coordination platform with regular meetings, resource-sharing mechanisms, and monitoring structures will enhance communication and accountability, leading to more effective and sustainable wetland management.

8.3. PUBLIC AWARENESS AND EDUCATION CAMPAIGN

Public awareness is critical to ensuring long-term community engagement in wetland conservation. A structured education and awareness campaign should be launched, using media outreach, community workshops, and school programs to inform local populations about the ecological importance of the wetland. Social media, radio, and television campaigns can help disseminate conservation messages, while interactive programs, such as volunteer-driven clean-up drives and eco-tourism initiatives, can encourage local participation in preservation efforts. Increased public awareness will foster a sense of environmental stewardship and reduce human-induced threats to the wetland.

8.4. HYDROLOGICAL, FLORA, AND SOIL-WATER QUALITY ASSESSMENT

A detailed environmental assessment should be conducted to map the hydrological patterns, vegetation cover, and water quality of the wetland. This requires a multi-disciplinary study involving hydrologists, botanists, and environmental scientists to analyze water flow dynamics, seasonal fluctuations, and contamination levels. These findings will serve as the foundation for sustainable wetland management policies and conservation actions.

8.5. SEDIMENT REMOVAL AND WETLAND DEEPENING

To restore water retention capacity, an ecologically sensitive sediment removal process should be implemented. This involves dredging key areas, particularly along the wetland's edges, to improve water storage and reduce seasonal drying. Additionally, measures should be taken to prevent future sedimentation, such as erosion control structures and controlled water inflows. The restoration process must be carefully managed to avoid disturbing existing biodiversity, ensuring that aquatic life and wetland vegetation remain intact while enhancing the overall hydrological balance.

8.6. USURPED LAND CLEANING AND ECOLOGICAL RESTORATION

Reclaiming illegally encroached wetland areas is essential for restoring ecological balance. This effort should begin with the demolition of unauthorized structures and the removal of accumulated debris and pollutants. Following cleanup, soil restoration techniques should be applied, including erosion control, organic soil enrichment, and native vegetation replanting. Ensuring proper water distribution to the restored areas will help reestablish wetland hydrology. Additionally, local community engagement programs should be launched to prevent future encroachment and encourage long-term stewardship.

8.7. POLLUTION CONTROL AND WASTE MANAGEMENT

A comprehensive waste management system must be implemented to tackle municipal solid waste and wastewater discharge around the wetland. This includes the construction of a waste collection and treatment facility, as well as the development of a wastewater diversion canal along Benehisar Road to prevent untreated sewage from contaminating the wetland. Public awareness campaigns and enforcement of pollution regulations should also be introduced to ensure proper waste disposal practices in the surrounding communities.

8.8. JOEE MASTAN CANAL REHABILITATION

The Joee Mastan Canal is a critical water source for the Kole Hashmat Khan Wetland, and its rehabilitation is necessary for ensuring continuous and controlled water inflows. Restoration efforts should include removing accumulated sediments and debris, reinforcing embankments, and repairing structural damages to prevent erosion and blockages. Additionally, flow regulation structures such as adjustable gates should be installed to optimize water supply management. Community participation in long-term canal maintenance will be essential for sustaining water flow and preventing further degradation.

8.9. WATERSHED MANAGEMENT ON SURROUNDING HILLSIDES

To reduce soil erosion and improve water infiltration, watershed management strategies should be implemented on the hillsides surrounding the wetland. This includes the installation of contour trenches, check dams, and terracing techniques to minimize runoff and sedimentation. A reforestation program should also be launched to stabilize soil and increase water absorption capacity. Training local communities in sustainable land management and alternative livelihoods will help ensure long-term conservation and reduce harmful land use practices.

8.10. ESTABLISHING A GREEN BELT AROUND THE WETLAND

A green belt should be developed around the wetland to act as a protective buffer against external environmental pressures. This initiative requires the strategic planting of native trees and shrubs to stabilize soil, filter pollutants, and provide wildlife habitat. Community engagement in afforestation efforts will help foster local ownership of conservation activities. Regular monitoring and maintenance programs should be established to ensure the long-term sustainability of the green belt and its role in protecting the wetland ecosystem.

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