**Azraq Oasis Restoration Project**

**Start Date:**
1994-01-19

**End Date:**
1997-01-19

 **Sources and Amounts of Funding**

Approx. 3 million USD The Azraq Oasis Conservation Project is conducted through joint funding by the Global Environmental Facility (GEF), the United Nations Development Program (UNDP), and the Government of the Hashemite Kingdom of Jordan.

**Project Goals**

The primary object of the project is to halt further degradation of the aquatic ecosystems in the oasis and to restore as much of the wetlands as possible to a natural or near-natural condition with a view to maintaining the biological diversity of this unique wetland ecosystem. Another important aim of the project is to establish a sustainable basis for the utilization of the water resources of the Azraq Basin.

**Overview**

The Azraq Oasis in Jordan’s Badia region is a unique mosaic of wetland ecosystems set in the middle of an arid desert. As the only such source of permanent freshwater within some 12,000 km2, the oasis provides crucial habitat for a multitude of avifaunal species, and is an indispensable part of the local economy. Increasing populations in the nearby cities of Amman and Zarqa, along with growing demands from the agricultural sector, have resulted in the intensive exploitation of water from the oasis and the near-total destruction of its ecosystems. Upon the complete cessation of flows from the four main springs feeding the oasis, the Government of the Hashemite Kingdom of Jordan solicited UNDP/GEF funds to begin a restoration project. Flows were restored to the site in June 1994, albeit greatly reduced, and re-establishment of wetland revegetation began shortly thereafter. To promote a more expeditious and complete recovery, local land managers took steps to exclude the site from harmful grazing activities and develop a management plan that would outline strategies for more efficient use of scarce water resources. Recovery of the site has proceeded gradually, and monitoring surveys have indicated an increase in terrestrial vegetation, aquatic vegetation, aquatic insects, and avifauna. Despite optimism garnered by the resurrection of the Azraq wetlands, socioeconomic and demographic factors continue to demand more water, and the future of the site remains uncertain.

**Ecosystem Description**

The Azraq Oasis is designated a RAMSAR Wetland of International Importance and an Important Birds Area (IBA) by BirdLife International. Until recently, the wetlands comprised a large complex of spring-fed marshes and seasonally flooded mudflats covering about 12,000 ha. The three principal systems were as follows: (1) a small area of freshwater marshes fed by two springs near the village of Druze or North Azraq in the northwest (31051 'N, 36Â°50'E); (2) a large area of fresh to brackish marshes and pools fed by two large springs near the village of Shishan or South Azraq in the west (31Âº49'N, 36Â°49'E); (3) a large seasonally or intermittently flooded mudflat or playa wetland (Qa Al Azraq) in the east (31Âº50'N, 36Â°53'E). Streams carried water from the main spring pools at Shishan eastwards towards the playa, creating extensive shallow wetlands with a variety of habitats. The once extensive spring-fed marshes contained a variety of habitats, including dense stands of Juncus maritimus, Carex sp., Typha angustifolia, Phragmites communis, Scirpus sp., Cyperus sp. and Arundo donax, and shallow pools with Ruppia sp. Nitraria and Tamarix communities occurred in the silty dunes between the streams and pools. The permanently wet areas around the artesian borehole support a small area of Tamarix bushes surrounded by wet marshes and meadows. The fishponds are fringed with Phragmites reeds. The playa is largely devoid of vegetation, except for a fringe of succulent halophytes such as Halopeplis sp. and Halocnemum sp. When the playa is flooded, there is abundant production of zooplankton, phytoplankton and some filamentous algae. In the past, when the water level in the playa lake was high, large numbers of fish (mostly Tilapia) escaped from Shishan marshes into the qa. Before its degradation, Azraq Oasis was an outstanding example of an oasis wetland in an arid region, with few parallels anywhere else in the world. The oasis lies at the centre of the eastern part of the Africa-Eurasian flyway and was especially important for migratory birds. In fact, up to a million birds utilized the area during the course of a single spring migration, and as many as 50,000 birds were present in the wetlands at any one time. In February 1967 (mid-winter), approximately 347,000 waterfowl were recorded in an aerial survey, and this count included: 20,000 Anas Penelope; 180,000 A. crecca; 2,000 A. plalyrhynchos; 100,000 A. acuta; 5,000 Aythyafuligula; and 40,000 Fulica atra. The oasis is also important for breeding birds, and at least 33 species of waterbirds were known to be breeding in the wetlands in the 1960s, including 21 species occurring in internationally important numbers. In addition to its many avifaunal residents, the oasis is also home to local subspecies of the Asian Jackal (Canis aureus syriacus), Red Fox (Vulpes vulpes Arabica) and Striped Hyaena (Hyaena hyaena syriaca), as well as the Tessellated Water Snake (Natrix tessellate) and two amphibians, Rana ridibunda and Bufo viridis. Moreover, the endemic Azraq Killifish (Aphanius sirhani), Jordan's only endemic vertebrate species, is found nowhere else in the country.

**DEFINING THE PROBLEM**

**Primary Causes of Degradation**

**Degradation Description**

The Azraq wetlands have been heavily over-exploited as a result of escalating water needs for agriculture, industrial development, tourism, and urban growth. Ever-increasing demands for water, particularly in the rapidly growing city of Amman, have precipitated large-scale pumping from the Azraq Basin. In fact, pumping for urban needs increased from about two million cubic meters (m3) in 1979 to about 25 million m3 in 1993. Furthermore, a huge expansion in agriculture in the region has drained an additional 25 million m3 per year from the basin. This level of exploitation is approximately double the annual natural recharge rate of 25 million m3 per year, and has had a devastating impact on the wetlands.

Discharge from the four main springs that feed the reserve fell rapidly during the 1980s (from 10.5 million m3/year in 1981 to less than 1 million m3/year in 1991), and in 1987, the two northern springs dried up completely. The southern springs ceased flowing in August 1992, and by December 1992, the wetlands were completely dry. Marsh vegetation died off, and slow-burning fires began moving through the ground in areas that were formerly deep swamps. The groundwater level dropped by 20m, and in 1993 and 1994, the spring-fed pools were almost dry too.

The intensive exploitation of water resources has further jeopardized ecosystem function and biodiversity by causing salinization of the basin. Growing pockets of saline waters exist adjacent to freshwater, and studies have demonstrated that a continuation of pumping at the present rate will most probably lead to the salinization of the entire basin.

In spite of the ecological impacts already witnessed, the low per capita water availability in Jordan (less than 160 m3/year), coupled with population growth, has meant continuing exploitation of water from the Azraq Basin. Consequently, groundwater levels continue to drop at a rate of 0.5-1 m/year.

**Description of Project Activities:**
The Azraq project has five main components:

(1) Rehabilitation and management of Azraq Wetland Reserve;

 (2) Establishment of an environmental impact assessment unit within the Department of Environment and improved implementation of the Ramsar Convention in Jordan;

(3) Establishment of guidelines for agricultural development in the Azraq Basin;

(4) Investigation of groundwater resources in the Azraq Basin and development of a water management plan for the basin;

And (5) support for long-term research on the conservation and management of water resources in arid and semi-arid regions.

 At the outset of the project, five staff members were recruited to conduct daily patrols of the reserve in order to control illegal grazing and fires. An on-site rangers' station was constructed, and large amounts of rubbish were removed. Water was returned to the wetlands in June 1994, and is being provided through pumping of underlying aquifers at a government well field 12 km north of the site. Current flows amount to c. 1.5 MCM/yr, or approximately 10% of the original input (although the project has been given a provision of up to 2.5 MCM). At the same time water was being returned to the wetlands, an extensive rehabilitation and clean-up effort was begun to enhance the potential for recovery. Two relic spring pools were dredged and enlarged, and many of the wadis leading to the reserve were also cleaned and deepened to enable channeling of as much surface runoff as possible during the rainy season. A new perimeter fence was erected to exclude the site from exploitative activities, and feral grazing animals (water buffalo and horses) were removed. A management plan for the site was finalized in 1996, and under this plan, procedures will be implemented to address the issues of grazing by domestic livestock, disposal of rubbish in the reserve, and hunting. This plan also includes strategies for making the fullest possible use of limited water supplies, and thus ensuring a viable nucleus of plant and animal communities from which rapid recolonization of wetland habitats can occur. Construction of a new visitors' center began in 1997, and the center opened to the public in autumn 1998. Other facilities of an educational, recreational and scientific nature for both national and international visitors will also be constructed.

**Ecological Outcomes Achieved**

**Eliminate existing threats to the ecosystem:**
Towards the end of October 1994, the water table in the lakes began rising, and parts of the oasis started to come back to life. Beginning in November, the rainy season of 1994-95 yielded above-average precipitation, and over ten million cubic meters of water reached the wetlands, almost twice the annual average of surface runoff. In that season, the area covered by water in the wetlands was about 16 km2, whereas it had been reduced to almost nothing prior to the project. Unfortunately, the next season (1995-1996) was a declared national drought, and the area received a total of less than 30 mm of rainfall for the season. Nevertheless, because of the rehabilitation efforts, a large portion of the wetlands remains in an environmentally and ecologically healthy state, with the water covering over 3.5 km2 in the marshes and lakes. Wetland communities soon re-established following the reintroduction of water to the site. Terrestrial communities in the marsh region now have 133 species of vascular plants belonging to 100 genera and 33 families, including 7 species new to Jordan and unique to Azraq. The rehabilitated ecosystem has also brought 12 new aquatic plant species and 20 species of aquatic insects, 11 of which are considered new to Azraq. These new species include: Corix spp, Pachynomus lethierryi, and Chironomus calipterus. Moreover, a total of 209 avifaunal species have been recorded during monitoring activities at the site, including: Ciconia nigra, Circaetus gallicus, Circus aeroginosus, Chettusia leucura, Caprimulgus aegyptius, Rhamphocoris clotbey, Eremalauda dunni, Oenanthe moesta, Acrocephalus arundinaceus, and Acrocephalus melanopogon.

**Factors limiting recovery of the ecosystem:**
The rehabilitation efforts of the Azraq Project have increased the flow of the springs again. However, the increase has been very slight and amounts to less than 200,000 m3 per year, a fraction of pre-disturbance flows. If an appreciable recovery of the site is to be achieved, more water must be allocated to the wetlands. Under the current conditions of population growth and development, however, increasing demand for scarce water resources has made the provision of additional flows a contentious issue. The success of this project will ultimately hinge on the ability of local policy makers to resolve this conflict and effectively manage the region's limited water resources.

**Socio-Economic & Community Outcomes Achieved**

**Economic vitality and local livelihoods:**
The near-total collapse of the wetlands ecosystem had immediate and direct effects on the livelihoods of the people of Azraq. The damages ranged from the collapse of the tourism industry to declining agricultural productivity and increased rural to urban migration. The agricultural losses were enormous. The increased salinity of soils and waters caused major financial losses for outside investors as well as for local farmers. Accurate figures for these losses are not available, but researchers in the Azraq Oasis Conservation Project estimate them to be in the hundreds of thousands of dinars. The rehabilitation of the oasis promises to reverse some of these negative socioeconomic trends and bolster the local economy with a source of revenue and livelihood. An especially important outcome of the project will be increased tourism, as visitors will stimulate investment in the local community from companies with an interest in eco-tourism.

**Key Lessons Learned**

Notable project achievements include the following:
1. An adequate amount of water was secured to revive and rehabilitate 10% of the Azraq wetland ecosystem and its biodiversity.
2. The water quality of the Azraq Basin was enhanced, as the advance of the saline front was slowed. Consequently, the danger of the complete salinization of the Azraq Basin has been lowered.
3. An incremental minimization of pumping was attained. The ideal solution of bringing pumping down to the system’s natural safe yields was not attained, but it is a move in the right direction. Indeed, the precedent of reverse pumping to save the Azraq water supply and ecosystem has been established.
4. Positive socioeconomic trends among the local community have been attributed to the rehabilitation of the oasis. Increasing numbers of tourists are visiting the area, and numerous companies have expressed interest in investing in eco-tourism.
5. The local people, after a lengthy period of frustration, were empowered and began to participate in the overall socioeconomic development of the area. With the support of the Azraq Oasis Conservation Project, a grassroots movement known as the Friends of Azraq Society was established to foster environmental preservation and the achievement of local socioeconomic stability.

**Continuing challenges include:**
1. population growth
2. Lack of commitment to protection measures under RAMSAR
3. Continuing economic development that demands more water
4. Regional scarcity of water resources.