

**GLOBAL  
ENVIRONMENT  
FACILITY**

**Jordan**

**Conservation of the Dana and Azraq Protected Areas**

**Project Document**

*This Project Document has been edited to facilitate public dissemination.  
The original is on file in the GEF Office at UNDP Headquarters in New York.*





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## **ABBREVIATIONS AND ACRONYMS**

<b>ACOR</b>	<b>American Center of Oriental Research</b>
<b>ALESCO</b>	<b>Arab League Educational, Scientific and Cultural Organization</b>
<b>DOE</b>	<b>Department of Environment</b>
<b>EEC</b>	<b>European Economic Commission</b>
<b>EIA</b>	<b>Environmental impact assessment</b>
<b>GIS</b>	<b>Geographic Information System</b>
<b>GTZ</b>	<b>Gesellschaft fuer Technische Zusammenarbeit</b>
<b>ICBP</b>	<b>International Council for Bird Preservation</b>
<b>IUCN</b>	<b>International Union for the Conservation of Nature and Natural Resources (now World Conservation Union)</b>
<b>MCM</b>	<b>Million cubic metres</b>
<b>MMRAE</b>	<b>Ministry of Municipal and Rural Affairs and Environment</b>
<b>NES</b>	<b>National Environmental Strategy for Jordan</b>
<b>NGO</b>	<b>Non-governmental organization</b>
<b>NRA</b>	<b>Natural Resource Authority</b>
<b>RSCN</b>	<b>Royal Society for the Conservation of Nature</b>
<b>UNEP</b>	<b>United Nations Environment Programme</b>
<b>USAID</b>	<b>United States Agency for International Development</b>
<b>WAJ</b>	<b>Water Authority of Jordan</b>
<b>WERSC</b>	<b>Water and Environment Research and Study Center (University of Jordan)</b>
<b>WWF</b>	<b>World Wide Fund for Nature</b>



UNITED NATIONS DEVELOPMENT PROGRAMME

GLOBAL ENVIRONMENT FACILITY

Project of the Government of Jordan

**Title:** Conservation of the Dana and Azraq Protected Areas

**Number:** JOR/92/G31/A/1G/99

**Duration:** Three years

**Project Site:** Jordan: Amman, Azraq and Dana

**UNDP Sector:** Land-Use Planning and Development

**Subsector:** Biological Resources

**Government  
Implementing Agencies:** Royal Society for the Conservation of Nature  
Department of Environment, Ministry of Municipal and Rural Affairs  
and Environment  
Ministry of Agriculture  
Ministry of Water and Irrigation  
Water and Environment Research and Study Centre, University of  
Jordan

**Executing Agency:** Government of Jordan

**Cooperating Agency:** The World Bank (Dana component)

**Estimated Starting  
Date:** May 1993

**Government Inputs:** Azraq component: Jordanian dinar 314,500 (in kind) (US \$459,170)<sup>1</sup>  
Dana component: to be determined

**UNDP/GEF Inputs:** US \$6.3 million

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<sup>1</sup> The May 1993 exchange rate of Jordanian dinar 1 = US \$1.46 has been used for conversions throughout this document.

## **Brief description**

The project will make an important contribution to the maintenance of biological diversity in Jordan by providing for the rehabilitation and management of the Dana Wildlands and the wetlands of Azraq Oasis. The project aims to strengthen the institutional capabilities of the Royal Society for the Conservation of Nature (RSCN), a non-governmental organization (NGO) mandated by the Government of Jordan with national responsibility for nature conservation, management of protected areas, and support to the Jordanian programme for conservation education. An institutional needs assessment has been carried out at RSCN as part of the preparatory assistance to the project, to provide practical recommendations for upgrading the institutional capability of the Society.

This document has been divided into three sections. The first section provides an overview of the entire project. Because of the rather different nature of the Dana and Azraq components of the project and their different modes of execution and implementation, separate "sub-project" documents appear as two separate parts.

## **INTRODUCTION**

During the 1980s, there was a noticeable deterioration in the state of the environment in Jordan. This led to efforts by the Government of Jordan to prepare a State of the Environment Report (1990) and subsequently to develop a National Environmental Strategy for improved management of the nation's natural resources (1992). The strategy was published in 1991 and subsequently authorized as an official government document in May 1992 at a ceremony attended by HM King Hussein and HM Queen Noor.

This project has been designed to address the priorities called for in the National Environmental Strategy:

- Strengthening of the RSCN
- Rehabilitation of Azraq Oasis
- Expansion of the protected areas system, with specific reference to the proposed Dana Nature Reserve
- Upgrading of local community environments while providing economic opportunities
- Improving the management and utilization of water resources and agricultural land
- Improving environmental education programmes
- Supporting research and excavation of archaeological remains in order to enhance tourism.



Specifically, the project aims to protect and conserve the biodiversity of the Dana Wildlands and the Azraq Oasis by developing and implementing conservation management plans. These are two of the most important sites in Jordan for the preservation of the nation's rich natural heritage, the former because of its great floral diversity, including many endemic species, and rich mammalian fauna, and the latter because it contains a unique system of spring-fed marshes comprising the most extensive freshwater ecosystem in the country. Both sites contain outstanding examples of ecosystems which are threatened throughout Jordan and in neighbouring countries in the Middle East. In recognition of their importance for nature conservation, the Government of Jordan has established reserves in both areas: the Dana Nature Reserve (1989) and the Azraq Wetland Reserve (1977). However, very little management has been undertaken at either site, and the natural ecosystems in both areas remain under threat from a variety of sources. The wetlands of Azraq Oasis, in particular, are now badly degraded and likely to suffer irreparable damage unless some remedial action is taken in the near future.

Although Dana Wildlands and Azraq Oasis are geographically separate and ecologically very different, the responsibility for the management of both reserves rests with the RSCN. This project provides substantial support for the RSCN, not only to ensure the successful implementation of the Dana and Azraq conservation management plans, but also to increase the scope of its environmental education programme to reach all sectors of Jordanian society, and enable it to initiate similar projects elsewhere in Jordan.

If the natural resources of Dana Wildlands and Azraq Oasis are to be effectively conserved and the integrity of the reserves maintained, it is essential that the broader issues of land and water management in the surrounding areas be addressed. At Dana Wildlands, the principal management problems relate to non-sustainable forms of land use (such as overgrazing and the excessive harvesting of fuelwood) and conflicting forms of land use (such as mining and quarrying). Here, the project will give particular attention to the social and economic needs of the various user groups, and will seek sustainable development initiatives which do not conflict with the objectives of conservation.

At Azraq Oasis, the principal management problems originate in the mismanagement of water resources in the basin as a whole. The project will give particular attention to the conservation and management of water resources in arid regions, specifically by providing support for studies on the water resources of the Azraq Basin, their utilization for water supply and agricultural purposes, and the use of infiltration techniques to accelerate groundwater recharge. At both Dana and Azraq, the adoption of a broad, integrated approach to resource management will necessitate the involvement of a number of government departments in several ministries, as well as various NGOs and academic institutions.

Overall coordination for the project will be provided by an interministerial Steering Committee, chaired by the Minister of Municipal and Rural Affairs and the Environment. This committee will include as its members the Secretaries General of the Ministry of Agriculture, Ministry of Planning, Ministry of Social Affairs, Ministry of Tourism and Antiquities, and Ministry of Water and Irrigation, or their representatives, as well as the President of the RSCN, the Director of the Water and Environment Research and Study Centre, and representatives of UNDP and the World Bank.

## Dana Wildlands

The Dana Wildlands cover an area of about 150 square kilometres on the eastern slope of the Jordan Rift Valley between the Wadi Araba desert in the west and the summits of the Shara mountains in the east. The wide range in elevation (300 metres to 1,300 metres above sea level) within the reserve has resulted in the inclusion of portions of three distinctly different but contiguous biomes. These are the Mediterranean Semi-Arid, Irano-Turanian and Saharan Tropical Arid Desert biomes. A geological fault has resulted in the presence of large areas of both sedimentary and basaltic igneous substrata. This diverse geology combines with a wide range in both elevation and precipitation to add to the diversity of microclimates and hence biodiversity. At least twenty of Jordan's approximately one hundred endemic species of plants have a distribution which is confined to the Dana area.

The fauna includes viable, remnant populations of ibex and two subspecies of gazelle. Other large mammals known or thought to occur include the wolf, striped hyaena, porcupine, honey badger, hyrax and caracal, and there is evidence that the leopard may still visit or inhabit some of the more inaccessible crags. The avifauna includes a number of species with relatively restricted ranges in the Middle East, such as the Arabian babbler, blackstart, Tristram's grackle, fan-tailed raven, Syrian serin and Sinai rosefinch, and the region is rich in birds of prey. The lesser kestrel (a bird listed in the *Red Data Book of Threatened Animals* of the World Conservation Union (IUCN)) breeds in the area, and the endangered houbara bustard is an occasional visitor. Amphibian and invertebrate populations which are confined to aquatic ecosystems associated with isolated springs and water courses may be distinct from those occurring elsewhere.

The proposal that a protected area be established at Dana was first made by IUCN and the World Wide Fund for Nature (WWF) in 1979. A proposal by RSCN followed in 1988. In 1989, 150 square kilometres of land were declared the Dana Nature Reserve, to be managed by RSCN in collaboration with the Department of Forestry.

Four separate socioeconomic and tribal groupings of resident and nomadic peoples graze their domestic animals (mainly goats) inside the reserve. The number of livestock appears to fluctuate seasonally between 2,500 and 5,000 animals. It now appears that in some areas (notably inside Wadi Dana), overgrazing has substantially reduced the abundance of all but the most resistant plant species, and may also have contributed to some loss of soil through erosion from the steep valley walls. A preliminary assessment of the status of *Cupressus sempervirens* suggests that regeneration of these rare and ancient trees was completely halted approximately twenty-five years ago due to the excessive grazing of seedlings.

In addition to these four social groups of pastoralists, two new communities are apparently becoming established both inside and outside the reserve boundary at the mouth of Wadi Dana. These include the settlement near the Finan Natural Resource Authority station, associated with former employment opportunities and a small school, and settlements on the south and west banks of Wadi Finan, established by agriculturalists who have recently come into the area.

The exploitation of mineral resources within or close to the reserve also poses a threat to the integrity of the reserve. The Jordanian Cement Corporation established a cement factory at

Rashadiya on a hill above the reserve in the early 1980s. The easterly winds which blow for several months in winter have, on occasion, carried dust from the factory into the reserve. In excessive amounts, this could be damaging to both vegetation and human health. The Cement Corporation also procures some of its raw material from quarries on the ridge above the northern boundary of the reserve. Some material from these quarries has accidentally spilt over the cliff edge and into the reserve, causing localized damage to vegetation. If allowed to continue, the damage to the skyline will also become obvious from Dana village, a location which has been targeted for tourism development.

The RSCN and the Jordanian Cement Corporation have recently concluded an agreement in which the Corporation agrees to limit its activities in a manner which will not compromise the objectives of conservation in the Dana Reserve. The German government has recently agreed to finance an assessment of the environmental impact of limestone/shale quarrying and cement production activities at Rashadiya, and to make formal recommendations for actions designed to minimize their effects.

Perhaps the most serious threat to the integrity of the Dana Reserve is the possibility that copper mining will be initiated at some time in the future, as a substantial proportion of the nation's deposits of copper ore occurs inside the reserve. A professional assessment of the resource has suggested that mining at Dana is never likely to be economically viable due to the poor copper content of the ore and the need for expensive mining techniques. However, there is an indication that the Jordanian Natural Resource Authority (NRA) plans to commence mineral exploration inside the Dana Reserve area. Such a survey would permanently scar the principal natural features of the reserve. It would scatter heavy metal ore throughout several of the reserve's main watersheds, and could cause substantial erosion problems and the destruction and disturbance of flora and fauna.

A consultancy which was funded under the preparatory assistance phase of the project has prepared an agreement between the NRA and RSCN, in which the NRA assents to limit all mineral activities in the Dana Reserve and environs to an acceptable level. Signature of the agreement will be a condition of negotiating and concluding a contract between RSCN and the World Bank.

This component will be implemented by the World Bank through a Letter of Agreement which will be signed between the Government of Jordan and the World Bank, and implemented by RSCN. Coordination throughout project implementation will be ensured by the Project Steering Committee and a special Scientific Advisory Committee which will include representatives from all relevant RSCN technical divisions, the University of Jordan, and other institutions or NGOs involved in research or technical aspects of project implementation.

### Azraq Oasis

Azraq Oasis is located some 80 kilometres ESE of Amman at the heart of a large internal drainage basin, most of which (94 percent) lies in Jordanian territory, with the remainder in Syria (5 percent) and Saudi Arabia (1 percent). The wetlands formerly comprised a large area of

permanent spring-fed marshes and pools, and a seasonally or intermittently flooded playa<sup>2</sup> wetland (Qa Azraq). Until recently, there were two groups of freshwater springs fed by the upper of three aquifer systems underlying the oasis. Streams carried water from the spring pools eastward towards the playa, creating extensive shallow wetlands which supported a variety of plant communities. However, the two springs which fed the northern marshes dried out completely in 1987 and these marshes are now desiccated. The more extensive southern marshes were also fed by two springs, but one of these ceased to overflow in 1990, while the other stopped discharging in August 1992. By December 1992, the oasis was dry except for two small stagnant pools at the southern springs.

Qa Azraq comprises a playa or salt flat which receives surface run-off from an extensive network of wadis.<sup>3</sup> The playa is sometimes flooded in winter or early spring, and is largely devoid of vegetation, except for a fringe of succulent halophytes. Even during years of deep flooding, the playa is usually completely dry by the end of May.

Until recently, Azraq Oasis was an outstanding example of an oasis wetland in an arid region, with few parallels in the world. The oasis was especially important for migratory birds, with up to a million birds using the oasis during the course of a single spring migration. Some 28 species of waterbirds were found breeding in the wetlands in the 1960s, and as many as 347,000 waterfowl have been recorded in mid-winter. Other interesting fauna included the Asian jackal, red fox, striped hyaena, black water snake, two amphibians and a variety of aquatic invertebrates including the tadpole shrimp—a "living fossil" with a strangely disjunct distribution in the Middle East.

The international importance of the wetlands of Azraq Oasis was recognized in 1977 when the Government of Jordan acceded to the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention), and designated Azraq Oasis for inclusion in the Convention List of Wetlands of International Importance. The Ramsar Site includes the marshes and pools fed by the southern group of springs, as well as the whole of Qa Azraq. The spring-fed marshes and adjacent parts of the "qa" were given reserve status in 1977, and have been managed since by the RSCN under an agreement with the Ministry of Agriculture. The Department of Environment in the Ministry of Municipal and Rural Affairs and Environment is the government body responsible for administration of the Ramsar Convention in Jordan.

The cessation of spring flows at Azraq Oasis has occurred as a direct result of the massive extraction of groundwater from the Azraq aquifers for water supply to Amman and for irrigation. As the water table has been lowered, the natural discharge of the four main springs has fallen from 10.49 million cubic metres per year in 1981, to an estimated 300,000 to 400,000 cubic metres in 1991, and to zero by the end of 1992. Interventions by RSCN and the government to reduce the rate of groundwater extraction have not so far led to any lasting solutions, and the condition of the spring-fed marshes has continued to deteriorate. Unless some remedial action is taken quickly, much of the biodiversity for which the oasis is particularly important (freshwater plant and animal communities) will be lost.

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<sup>2</sup> Flat-floored bottom of an undrained desert basin that sometimes becomes a shallow lake.

<sup>3</sup> Bed or valley of a stream that is usually dry except during the rainy season when it can make an oasis.

Qa Azraq, which comprises the greater part of the Ramsar Site, has not been affected much by the extraction of groundwater as it receives most of its water from surface run-off during winter and spring. However, the proliferation of salt pans around the qa has reduced the extent of natural qa wetland. More seriously, in 1992, a dam was constructed in Wadi Rajil about 45 kilometres north of Azraq, in an effort to alleviate water shortages and to accelerate infiltration into the aquifer. As Wadi Rajil is the single most important wadi feeding flood waters into Azraq Oasis (providing about one-third of the total inflow), the dam will undoubtedly reduce the frequency and extent of flooding in the qa and adversely affect the ecological character of the Ramsar Site.

Concern over the degradation of the Ramsar Site was expressed at the Third Conference of the Contracting Parties to the Ramsar Convention in May-June 1987, and was formalized in Recommendation 3.8 of that Conference (see Annex 3) which called for urgent measures to be taken to maintain the natural properties of the wetland. The rehabilitation of Azraq Oasis was identified by the National Environmental Strategy for Jordan as one of the highest priorities in the conservation of wildlife and habitats in Jordan.

The Azraq aquifer is one of the principal sources of drinking water for Amman, in addition to supplying water for irrigation within the Azraq basin. The extraction of water from the aquifer is at present far above the assumed safe yield. The general drawdown in the well-field is already more than six metres, with the water level in some wells now below the level calculated to be safe to prevent the intrusion of saline water into the wells. If the present high levels of offtake continue, there is a high probability that within as little as three to five years the freshwater aquifer will become contaminated with saline water from deeper aquifers. This would jeopardize the utility of Azraq water for urban use and agriculture alike.

In recognition of these problems, the Water Authority of Jordan in the Ministry of Water and Irrigation has recently initiated a two- to three-year study to investigate the characteristics of the middle and upper aquifers in the Azraq Basin as part of a plan to locate alternative sources of water supply for Amman. At the same time, the Water Research and Study Centre at the University of Jordan has been conducting studies on artificial recharge of groundwater in the basin with a view to developing new techniques to accelerate infiltration.

The Azraq component will be nationally executed in accordance with UNDP procedures. A small Management Unit will be established to administer the Azraq project as a whole and to provide essential liaison between the Steering Committee, UNDP, and the five sub-components of the project (see page 48).

#### Royal Society for the Conservation of Nature

The Royal Society for the Conservation of Nature (RSCN) is a private, voluntary organization with public service status. It was established in 1966 under the patronage of HM King Hussein, the Honorary President, and is the only NGO in Jordan dedicated to the conservation of nature and natural resources. In 1975, the Minister of Agriculture delegated his authority to the RSCN for enforcement of the law for wildlife protection and management of wildlife reserves in Jordan.

The RSCN currently manages five wildlife reserves (including the Azraq Wetland Reserve) covering approximately 1.3 percent (1,200 square kilometres) of the country's total area, and thus plays a leading role in the maintenance of biodiversity in Jordan. A further five reserves are planned to complete coverage of examples of the country's principal ecosystems. Establishment of these proposed reserves would bring the coverage of Jordan's reserve network up to 4.2 percent of the total land area.

In addition, the RSCN has been active in promoting public awareness of environmental issues, building a conservation education programme, and supervising and enforcing legal aspects of nature conservation. The RSCN collaborates closely with the Ministries of Agriculture, Energy and Mineral Resources, Municipal and Rural Affairs and Environment, Planning, Public Works, Tourism and Antiquities, and Water and Irrigation.

The RSCN's successes in the establishment and management of protected areas in Jordan represent a major achievement, and constitute a vital step towards ensuring the conservation of biodiversity in this region of the Middle East. However, although the staff of the RSCN are competent professionals, the organization is currently insufficiently funded and inadequately staffed to undertake any major expansion in its activities. Significant institution building will be required if it is to achieve its mandate effectively and implement its components of this project.

These needs will be addressed by this project through the upgrading of both the scientific and managerial competence of the RSCN. The immediate objective is to upgrade the institutional capability of the RSCN so as to facilitate implementation of the Dana and Azraq conservation management plans, initiate similar endeavours in other Jordanian reserves, and increase the scope of the Society's environmental education programme to include all sectors of Jordanian society.

An assessment of the structure, function and needs of RSCN management, research, and operational systems has already been carried out as part of the preparatory assistance for this project, and various practical recommendations concerning institutional adjustments have been made. By strengthening the RSCN, the project will establish an institutional framework in which professional natural and social scientists, and educational specialists and managers, can efficiently apply their expertise in a dynamic, internationally linked, secure and career oriented environment. The project will demonstrate the value of entrusting an NGO with responsibility for the management of a national system of protected areas, a unique operating arrangement in the Middle East, and one which could serve as a model for other countries in the region.

The costs incurred in the strengthening of the RSCN have been shared by the Azraq and Dana components of the project. Through the Letter of Agreement, the World Bank will be responsible for execution of this component and the RSCN for its implementation.

## COMPONENT 1: DANA WILDLANDS

### Brief description

The purpose of this project is the conservation of biodiversity in all ecosystems in the Dana Wildlands, an area of significant regional biological diversity and endemism. The greatest threat to biodiversity in the Dana Reserve is the unplanned, ecologically inappropriate, and unsustainable utilization of the reserve's natural resources. A significant component of the plan will address the economic needs of local communities in the vicinity of the reserve to ensure the sustainable utilization of the area's natural resources. A protected area management plan will be prepared and implemented. Wherever possible, activities which have the potential to generate foreign currency earnings through tourism will be encouraged.

The allocation of the Dana Reserve land to the RSCN for conservation management purposes will be effected as a matter of priority. Appropriate regulations and bylaws will then be prepared to strengthen the institutional capabilities of the RSCN to facilitate implementation of the Dana management plan. This will also enable the RSCN to implement similar initiatives throughout Jordan, and potentially provide training for other Arab countries. The project will also seek to ensure that appropriate legal provision is made to prohibit any unacceptable survey activities in the reserve, and that an agreement to this effect between NRA and the RSCN is drawn up and ratified.

### A. CONTEXT

#### 1. Description of subsector

The proposal that a protected area be established at Dana was first made by IUCN/WWF.<sup>4</sup> The selection of the site was based on an earlier ecological study<sup>5</sup> which divided the country into eight biogeographic regions. Dana was chosen so as to "protect and preserve a representative area of the western highlands land type together with its indigenous flora and fauna; and to preserve an area of special scenic beauty." In August 1988 the RSCN approached the Minister for Agriculture with a request that he declare 150 square kilometres of land as the Dana Nature Reserve, and that its management be delegated to the RSCN in collaboration with the Department of Forestry. An agreement to this effect was signed by both parties on 14 September, 1989.

While the Dana Reserve has not as yet been formally surveyed, its boundaries have been described in the correspondence between RSCN and the Ministry of Agriculture. The reserve's border follows recognizable natural features, such as water courses and contours at the top of steep inclines, for approximately two-thirds of its length. Where this has not been possible, it follows existing tracks and lines of sight between prominent features.

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<sup>4</sup> John E. Clarke, "A Proposal for Wildlife Reserves in Jordan." IUCN/WWF/Project 1591. Volume II, 1979.

<sup>5</sup> H. Madany, "An Ecological Framework for a Nature Preserve System in Jordan." Department of Botany, University of Illinois, Urbana, Ill. 1978.

The RSCN currently employs five field staff as wardens at the Dana Reserve. They are provisioned with one four-wheel drive vehicle, a pick up, and radio communication with other RSCN vehicles and with the Society's headquarters in Amman.

The biological diversity of the Dana Reserve has not yet been adequately described. However, the wide range in elevations (approximately 300 metres to 1300 metres) within the reserve has resulted in the inclusion of portions of three distinct but contiguous biomes. These are:

- *Mediterranean Semi-Arid* (higher elevations: 700 metres to 1300 metres). Characterized by the grasses *Poa bulbosa* (and *sinaica*) and *Cynodon dactylon*. Typical tree species include *Quercus coccifera* (evergreen oak), *Juniperus phoenicea*, *Pistachia atlantica* and *Cupressus sempervirens* (Syrian cyprus). These scattered trees represent the last vestige of what may have been extensive forest, prior to the increase in grazing pressure from domestic livestock. The cyprus trees are of particular note in that there are only a few hundred representatives of what is probably a genetically distinct population. Almost all of these occur inside the Dana Reserve.
- *Irano-Turanian* (intermediate elevations: 400 metres to 700 metres). In Dana, this biome is largely confined to steep slopes and is characterized by *Stipa spp.* grasses. Typical flora also includes *Pistachia Kunjuk*, *Retama Raetum*, *Ephedra Alata* and the thistle *Noaea mucronata*.
- *Saharan Tropical Arid Desert* (lower elevations: (< 400 metres). Flora typical of this ecosystem includes *Acacia tortilis* and *radiana*, *Zizphus spp.*, *Salvadora persica*, and the climber *Cocculus pendulus*. Some of the species most commonly grazed in this desert area include *Fagonia mollis*, *Salsola vermiculata* and *Ochradenus ballutus*.

A geological fault has resulted in the presence of large areas of both sedimentary (sandstone and calcareous) and granitic and basaltic igneous substrata inside the reserve. This geology adds to the diversity of micro habitats and hence to the reserve's biological diversity. At least twenty of Jordan's approximately one hundred endemic species of flora are found only in the Dana Reserve.

The fauna of this reserve has not yet been adequately surveyed. However, viable, remnant wild populations of ibex and two subspecies of gazelle (*Gazella gazella* and *Gazella dorcus*) are present. Other large mammals living inside the reserve include wolf, several species of fox, striped hyena, porcupine, honey badger, hyrax and caracal. There is evidence that the severely endangered Palestinian leopard may still visit or inhabit the more inaccessible crags inside Dana Reserve.

An isolated population of the extremely rare desert cat *Felis margarita*, which is confined throughout its range to sand dune ecosystems, is present in a neighboring section of the discrete sand dune system which runs across the international border and into the western portion of Dana Reserve. In all probability, this animal also occurs in Dana. Onagers (wild asses), resulting from a captive breeding and reintroduction programme, are also known to have migrated to this area.



Typical common avifauna of the higher elevations include common bulbul, pale crag martin, isabelline wheatear, blackstart, Tristram's grackle, fan-tailed raven, the Syrian serin, woodchat and great grey shrikes. Arabian babbler and Egyptian vulture are characteristic of the lower altitude desert areas where houbara bustard (*Chlamydotis undulata*) are occasionally seen. Birds of prey which appear to be breeding in the Dana Reserve and environs include long-legged buzzard (*Buteo rufinus*), short-toed eagle (*Circaetus gallicus*), eagle owl (*Bubo*), scops owl (*Otus scops cycladum*) and little owl (*Athene noctua glaux*). The lesser kestrel (*Falco naumanni*), a bird listed in IUCN's *Red Data Book of Endangered Species*, also breeds in the Dana Reserve. Hume's tawny owl (*Strix butleri*), which has an extremely limited distribution worldwide, may also be a breeding resident of the reserve.

The resident populations of reptiles, amphibians and invertebrates have yet to be described. However, amphibian and invertebrate populations which are confined to aquatic ecosystems associated with isolated springs and water courses may be distinct from those occurring elsewhere.

## **2. Host country strategy**

An increase in the rate of deterioration of Jordan's environment in the 1980s led to the preparation of a State of the Environment Report (1990) and the National Environmental Strategy (1992). The strategy was prepared by Jordanian experts working in consultation with IUCN and was funded by the United States Agency for International Development (USAID). The final document was published in 1991 and authorized as an official government document in May 1992.

Some of the priorities outlined in the National Environmental Strategy directly supported by this project include:

- Strengthening of RSCN
- Expansion of the protected areas system, with specific reference to Dana
- Upgrading local community environments while providing economic opportunities
- Development of an environmental education programme
- Management and utilization of water and agricultural land
- Research and excavation of archaeological remains for the purposes of enhancing tourism.

## **3. Prior or ongoing assistance**

The *National Environmental Strategy: a Resource Book and Guidelines for Action* (1991), which specifically recommends institutional strengthening of the RSCN and the creation of a protected area at Dana, was co-sponsored by the Government of Jordan and USAID, with the technical assistance of IUCN. USAID has in the past also assisted RSCN by supporting activities at other reserves, and provided funding for fencing portions of Dana Reserve and constructing visitor facilities at Dana village.

The report *Jordan—State of the Environment* (1990), published in Arabic, was funded by the United Nations Environment Programme (UNEP). The French Embassy in Amman recently funded a socio-archaeological study of Dana village. The German development agency Gesellschaft fuer

Technische Zusammenarbeit (GTZ) conducted a forest survey in the Dana Reserve while working with the Forestry Department in 1988. More recently, GTZ established a seed centre and nursery near Amman for the propagation of indigenous species of trees and shrubs in order to re-establish native flora in selected sites, including the Dana Reserve.

Several other organizations have demonstrated their recognition of the importance of the work of the RSCN by donating small sums of money for other specific projects and educational programmes. These include the Arab Bank Limited; the Arab League Educational, Cultural and Scientific Organization (ALESCO); the International Council for Bird Preservation (ICBP); the Rotary Club of Amman; the United Nations Educational, Scientific, and Cultural Organization (UNESCO); the United States Fish and Wildlife Service; and WWF.

#### **4. Institutional framework for subsector**

The RSCN was initiated in 1966 under the patronage of HM King Hussein as an NGO dedicated to the preservation of Jordan's nature and natural resources. The RSCN has been mandated by the Government of Jordan to undertake responsibility for nature conservation and the establishment of protected areas in Jordan. Since its inception, RSCN has established (and managed on behalf of the government) five nature reserves covering approximately 1.3 percent (1200 square kilometres) of the country's total area. A further seven reserves are planned to complete coverage of examples of Jordan's principal ecosystems. In addition, RSCN has been active in promoting public awareness of environmental issues, building and teaching a conservation education programme, and supervising and enforcing legal aspects of nature conservation.

One further initiative which is of particular note is the establishment of a captive breeding programme for the Arabian oryx. The RSCN coordinates closely with the Ministries of Agriculture, Energy and Mineral Resources, Municipal and Rural Affairs and Environment, Planning, Public Works, Tourism and Antiquities, and Water and Irrigation.

The RSCN's initiation of the concept of protected areas in Jordan represents a vital step towards establishing conservation in the Middle East. However, although the staff of the RSCN are competent professionals, the organization is currently insufficiently experienced and inadequately staffed to undertake the tasks of planning and implementing an integrated protected area and socioeconomic development programme such as that proposed for Dana. A major component of this project will address this issue by strengthening the institutional capabilities of RSCN.

### **B. PROJECT JUSTIFICATION**

#### **1. Problem to be addressed and the present situation**

##### Grazing by domestic livestock

Four separate socioeconomic and tribal groupings of resident, semi-nomadic and nomadic peoples graze their domestic animals (goats, sheep and camels) inside the reserve. The number of livestock in the reserve appears to fluctuate seasonally between 2,500 and 5,000 animals.

One component of this project will make a scientific assessment of the effects that this level of grazing has on the diversity and abundance of the reserve's flora and fauna. However, it appears that in some areas (notably inside Wadi Dana), overgrazing has substantially reduced the abundance of all but the most resistant plant species, and may also have contributed to some loss of soil through erosion from the steep valley walls.

A preliminary assessment of the status of *Cupressus sempervirens* suggests that regeneration of these rare and ancient trees was completely halted due to the excessive grazing of seedlings approximately twenty-five years ago. This corresponds with a time when regional political events brought about a substantial increase in Jordan's livestock populations due to the influx of nomadic people from the west. Hence it appears that the ecological impact of grazing pressure in the Dana area has been substantially more significant in recent years.

The origins, status, movements, and trends of the four social groups that graze livestock in the reserve area are poorly understood. Significantly, the relative social and economic importance to livestock owners of access to grazing in the Dana Reserve has never been assessed. As a result, the recommendation of the adoption of new animal husbandry and agricultural practices is not yet possible for all the social groups involved. The four identifiable social groups which use the reserve for grazing livestock include:

- Residents of Dana village
- Residents of Qadesiyya
- Permanent residents of the reserve living in Wadi Dana and at Finan
- Nomadic seasonal residents of the western desert portion of the reserve.

#### *Residents of Dana village*

These livestock owners do not live inside the reserve, are apparently not economically dependent on livestock, and have access to good agricultural land outside the reserve. Nevertheless, at least nine families reportedly maintain a total of about 500 goats inside the upper reaches of Wadi Dana. It is possible that this is a relatively recent phenomenon associated with the breakdown of traditional agricultural production systems which occurred when much of the community moved to nearby towns such as Qadesiyya for access to amenities and wage-paying labor opportunities.

#### *Residents of Qadesiyya*

These livestock owners are not resident in the reserve, are apparently not economically dependent on livestock, and frequently have jobs in town or at the nearby cement works. Nevertheless, some hundreds of goats and sheep are brought by Qadesiyya residents to graze the Salawan-Helaisya area of the eastern section of the reserve during winter and spring.

#### *Permanent residents of the Reserve*

This social group is, apparently, economically dependent primarily on the milk, wool, meat and livestock production of approximately 2,000 to 3,000 goats which graze year round inside the reserve. The size of this "resident" human population has apparently fluctuated considerably over the last fifty years. During the first half of this century there were reportedly no permanent residents, although perhaps as many as ten families of nomadic Rashide and Amarine Howeitat bedouin occasionally brought livestock into the lower Wadi Dana during severe winters. The area

was then considered dangerous and undesirable to live in due to the fear of losing livestock to leopard, wolf, hyena and snakes.

Following the regional social upheavals of 1948, Wadi Dana experienced an influx of Azazme nomads of Palestinian origin. At that time the Wadi Dana population may have risen to around thirty families. During the few years following the 1967 war, Wadi Dana was temporarily host to perhaps as many as one hundred families of Palestinian Azazme nomads. However, by 1975 most of these people had moved on, reportedly leaving only eight families resident in Wadi Dana.

Since 1975 the number of families permanently residing in Wadi Dana has reportedly risen to sixteen (approximately 100 people). Seven of these are based at a settlement at the mouth of Wadi Dana at Finan where employment opportunities with agencies operating outside the reserve have apparently reduced the economic necessity to maintain large numbers of livestock.

Of the nine families currently known to reside inside Wadi Dana, eight are Sarahine Azazme of Palestinian origin. Most of these people have reportedly lived here since the initial 1948 movement of peoples from the west. They claim to be economically dependent on grazing their goats inside Wadi Dana with nowhere else to go. Current national policy precludes the inclusion of this ethnic group in one of the Jordan Valley Authority permanent agricultural settlement schemes.

#### *Nomadic seasonal residents*

Grazing by these nomadic bedouin is reportedly confined to the desert area inside the western borders of the reserve, an area currently devoid of permanent human settlements. However, from October to May, this area is host to approximately twenty families of Azazme nomads who bring with them an additional 2,000 to 3,000 livestock (mainly goats).

#### Dynamic trends in local human settlement

In addition to these four social groups of livestock-owning peoples, the reserve management plan must take into consideration dynamic trends in local human settlement. Two different kinds of new communities are apparently becoming established at the mouth of Wadi Dana, both immediately inside and outside the reserve boundary. These include the settlement near the Finan Natural Resource Authority station just inside the reserve boundary, and the settlements on the southern and western banks of Wadi Finan by recently arrived cultivators.

#### *Settlement at Finan Natural Resource Authority station*

This settlement was a result of the job opportunities created by the establishment of a copper survey in the late sixties by the Department of Natural Resources, with backing from the former Czechoslovakia. After the survey, some of the residents stayed on as camp caretakers. A school built to accommodate their children during the survey also proved an incentive to stay.

The Finan school now has twenty-three pupils, from first to eighth grade. A new and larger school is currently being built nearby, just inside the reserve border. It is anticipated that the new school will enroll perhaps sixty pupils from the surrounding area and may even cause the Finan settlement to double in size over the next year or two.

### *Settlement on south-western banks of Wadi Finan*

Cultivation has recently been established on the banks of Wadi Finan and Araba, immediately outside the south-western border of the Dana Reserve, by Amarine, Saidyeen and Hasasine Howeitat nomads coming from the Shobak area. In the summers of 1991 and 1992, small experimental gardens of permanent crops such as olives, citrus, pomegranate and grape were planted by independent settlers from the Shobak area. Other crops successfully produced by these settlers include tomatoes, sunflower, alfalfa and onions. These cultivators employ simple, self-financed irrigation systems drawing water from the permanent source inside Wadi Finan.

Between the mouth of Wadi Finan and the settlement of cultivators at El Gregra (population approximately 100 families), much of the land has been cleared for cultivation and plowed in order to claim land rights. The absence of adequate irrigation has, to date, inhibited cultivation of most of the area. However, it seems likely that the whole south-western bank of Wadi Finan and Araba, from the mouth of Wadi Finan to El Gregra, will soon be under cultivation and that a population of farmers will eventually establish themselves immediately adjacent to the reserve boundary.

### Limestone/shale quarrying and cement production

The Jordanian Cement Corporation established a cement factory at Rashadiya on the hill above the Dana Reserve in the early 1980s. Dana villagers complain that easterly winds in the winter sometimes bring dust from the furnace chimneys. Excessive amounts of dust deposited in the reserve could damage both vegetation and human health.

The Cement Corporation also procures some of its materials from quarries at Ein Lahthlah, on the ridge above the northern boundary of the reserve. Some material from these quarries has accidentally spilled over the cliff edge into the reserve, causing localized damage to vegetation. If allowed to continue, the damage to the skyline will also become obvious from Dana village, a location which has been targeted for tourism development.

Prompted by this Global Environment Facility (GEF) project, RSCN and the Cement Corporation prepared and ratified an agreement on 14 May, 1992, whereby the Corporation would limit any activities that could compromise the conservation objectives of the Dana Reserve. If this agreement is honored, the quarrying and dust pollution will be maintained at a reasonable level.

The German government has since agreed to finance an assessment of the environmental impact of limestone and shale quarrying, and of cement production activities at Rashadiya, and to make formal recommendations to minimize their effects. This activity satisfies the requirement for the EIA which was outlined in the GEF Initial Executive Project Summary.

### Copper survey

Probably the most serious threat to the protected area status of the Dana Reserve is the possibility that, at some stage, copper mining might be initiated here. A substantial proportion of the nation's principal copper ore deposit occurs inside the reserve boundary.

Surveys conducted in 1976 and 1980 by the Bureau de Recherches Geologiques et Minières (BRGM) indicated that the ore body contains approximately 60 million tons of copper ore with an average copper content of 1.36 percent. Economic variables such as the world price of copper would influence the decision to commence exploitation of this mineral resource. However, a professional assessment<sup>6</sup> suggested that mining at Finan is unlikely to be economically viable due to the poor copper content of the ore, the high costs of using large amounts of acid for the extraction of metal from the ore which has a particularly high carbonate content, and the need to employ costly mining techniques. The NRA has concluded that, in view of the currently poor economic viability of copper production from the Dana ore body, mining is unlikely for "at least ten years."

Nevertheless, it is possible that the NRA (with technical assistance from the European Economic Commission) could conduct a mineral survey inside the Dana Reserve to assess the feasibility of mining. The NRA is also hopeful of discovering commercial quantities of gold and magnesium.

The area proposed for the survey includes:

- The exposed dolomite limestone shale features along the lower two-thirds of the northern wall of Wadi Dana, at approximately 50 metres elevation above the Wadi floor, following into the ancient mining sites at Wadi Khalid
- Along the upper third of the southern wall of Wadi Dana (at approximately 100 metres above the wadi floor) commencing at Dabbah and following the dolomite shale seam around the Salwan Helaisya area to the head of Wadi Finan
- Throughout the area known as Khirbet El Nahas in the central western foothills of the reserve.

Mineral sampling on the northern wall of Wadi Dana and in the Khirbet El Nahas area would involve the further excavation of thirty-three existing drift tunnels, and the establishment of at least six new ones. It is estimated that each excavation tunnel would remove 2 to 3 tons of heavy metal bearing material (a total of approximately 100 tons) which would be dumped at the mouth of each tunnel.

The survey would entail the construction of approximately 50 kilometres of road inside the reserve for the transportation of survey equipment. The construction of survey roads throughout the length of Wadi Dana would be undertaken with the use of explosives and bulldozer. As originally envisaged, the NRA mineral survey would permanently scar the principal natural features of the reserve, scatter heavy metal ore in some of the main watersheds, and lead to substantial erosion problems, along with the destruction and disturbance of flora and fauna. The survey would also result in an increase in the human population at Finan.

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<sup>6</sup> Seltrust Engineering Ltd., "The Performance of Pilot Plant; Test Work and Cottage Plant Feasibility Study on Wadi Araba Copper Ore." Phase 1: 1983 and Phase 2: 1985. Unpublished. Natural Resource Authority, Amman.

In view of the environmental consequences of the proposed survey, the preparatory assistance phase of this project commissioned a consultancy to assess the options for minimizing the negative impacts of a survey. The study concluded that mining of the Dana Reserve copper ore body would entail:

- Blasting, and removal of the sandstone overburden, which would then be dumped locally or, cost permitting, some distance from the site.
- The removal of 300,000 tons of copper ore per annum throughout a mine-life of ten years. Haulage of this volume of material would entail the loading of approximately twenty-five 40-ton trucks daily.

Even if all ore processing (which would involve heap leaching with acid), vehicle maintenance, camp construction and disposal of wastes were conducted off-site, some of the unavoidable effects of the mining would include the total destruction of the biological diversity and substrata in the immediate vicinity of the necessary open-cast mine. There would be noise from drilling, blasting, heavy equipment and truck traffic; dust from the stripping, mining and traffic; visual intrusion of the mine and essential on-site facilities, wastes and dumps; traffic problems; and surface contamination from spilled fuels and lubricants. The purpose of the mineral survey—to investigate the possibility of establishing commercial copper ore mining and copper extraction—is therefore irreconcilable with the conservation objectives of the reserve.

In light of the Government of Jordan's request for GEF funding for the conservation of the Dana Reserve, and in view of the incompatibility between the proposed mining and conservation activities, the GEF mineral survey consultancy outlined an agreement between the NRA and RSCN to limit mineral related activities in the Dana Reserve and environs to an acceptable level.

### Legal issues

The RSCN only has legal authority to control the hunting of game animals and birds in the Dana Reserve. Issues relating to grazing rights and the use or planting of trees remain the responsibility of the Ministry of Agriculture. Mineral exploration and use and water resource management, both inside the reserve and throughout Jordan, are the responsibility of other government agencies.

The National Environmental Strategy for Jordan (1991) notes: "Duplication among official agencies responsible for environmental matters has led to operational and managerial problems...Current legislation fails to mention the establishment and management of nature reserves and national parks, or fauna and flora...New environmental legislation (needs to) be introduced which would assign responsibility for implementing the law to those administrative agencies authorized to manage natural resources, so that duplication and overlap are avoided."

The direct conflict of interests illustrated by the preceding section emphasizes the need for appropriate legislation controlling the use of natural resources in Jordan's protected areas. New environmental legislation is currently under preparation and the IUCN Environmental Law Centre has been invited by the government to advise on the content of those sections of the act pertaining

to management of protected areas, and by the RSCN to assist with the preparation of bylaws specifically pertaining to the management of Dana Reserve. The new environmental law is expected to be enacted later in 1993.

The allocation of the Dana Reserve to the RSCN for conservation management purposes should be effected as a matter of priority. Two GEF/World Bank communications have requested clarification on the steps which are being taken to ensure that allocation of the reserve land (together with legal authority for the management of activities and natural resource management within the protected area) is transferred to the RSCN administration.

Once the land is allocated, the preparation of bylaws will be undertaken, entrusting the RSCN with legal responsibility for the management of all the natural resources at Dana Reserve. This may involve the provision of training for a Jordanian lawyer in the preparation of conservation law at an appropriate legal centre, such as the IUCN legal centre in Bonn, Germany.

### RSCN responsibilities

The RSCN field staff at Dana have, historically, been involved principally with the control of hunting in the reserve (where all hunting is banned) and with the supervision of the construction of fencing and other facilities. While the containment of poaching is an important activity, hunting is not the most significant threat to the conservation status of the reserve.

Two areas in which it will become increasingly important for RSCN field staff to operate competently are:

- Monitoring the status of the reserve's wildlife resources
- Managing (rather than policing) the activities of all reserve resource users.

At present the Dana field staff have no specific training or knowledge of basic flora and fauna monitoring techniques, nor have they been involved in managing community development activities to support conservation projects. For the Dana project to be successful, it is imperative that adequate training and supervision in both these important areas is provided. Such training will be provided for all RSCN field staff under the institutional strengthening component of this project.

## **2. Expected end-of-project situation**

By the completion of this project it is anticipated that effective conservation of the biological diversity of the Dana Reserve, incorporating sustainable economic development for the associated local human communities, will be in place. In addition, the staffing and capabilities of the RSCN will have been increased in a manner which will greatly enhance the organization's ability to perform its mandate, which is the conservation of biological diversity throughout Jordan.

In relation to the Dana Reserve this specifically entails:

- The establishment of legal provisions which entrust the responsibility for management of all the reserve's natural resources to RSCN.



- Detailed scientific knowledge of the ecology of the reserve (which is essential to formulate reserve management strategies) will have been collected and stored in a readily accessible computerized, Geographic Information System (GIS) format. This component also entails the construction of accommodation and laboratory facilities at Dana which will be used for ongoing applied research activities.
- An overall management plan for the reserve and associated economic developments will have been prepared, and field staff trained in the skills necessary to implement the plan.
- Complementary economic development activities will have been initiated amongst the local communities: terrace garden agriculture will have been re-established as the basis of the Dana village economy, and sustainable grazing regimes and additional appropriate small-scale primary and cottage industries will have been introduced amongst both the livestock- and agriculture-based communities. This will be complemented by the instigation of clearly defined user rights for specified groups of livestock owners.
- Recreational and educational activities based on the sustainable use of the natural and archaeological features of the reserve and environs will be promoted. The economic advantages of conservation at Dana, to both local communities and the nation, will be underscored by the establishment of Dana as a tourist destination demonstrating options for experiencing two different traditional Arab cultures living in harmony with diverse ecosystems and a rich history.

By strengthening the RSCN, the project will secure the sustainability of an institutional framework in which professional natural and social scientists, educational specialists and managers can efficiently apply their expertise in a dynamic, internationally linked, secure and career oriented environment. The project will introduce budget planning and allocation systems, in-service training, and the recruitment of additional appropriately qualified Jordanian staff.

### **3. Target beneficiaries**

The presence of a high proportion of endemic species imparts global significance to the conservation of the Dana Wildlands. Beneficiaries of this GEF initiative include the primary resource-based communities living in and around the Dana Reserve. The project will also benefit the nation as a whole by providing recreational and educational facilities at Dana for both Jordanians and overseas visitors, thereby generating local and foreign currency revenues. The project's innovative approach to conservation and economic development will provide both a model and stimulus for similar initiatives which can be implemented by the RSCN in other parts of Jordan.

### **4. Project strategy**

To achieve the conservation of biological diversity at Dana the project will:

- Ensure that the core reserve area is formally described and surveyed, and that

appropriate legal provisions authorizing the RSCN to manage all natural resources inside the reserve, are in place

- Equip and assist the RSCN, through institutional strengthening and training, to undertake/coordinate the following:
  - (i) An assessment of the social and economic importance of existing levels of human use of the reserve's resources to the various user groups;
  - (ii) An assessment of the ecological impact of existing levels of human use of the reserve's resources;
  - (iii) Assist the various user groups to achieve economic advancement in a manner compatible with the objectives of conservation; and
  - (iv) Wherever possible, to ensure that these local development initiatives are supportive of, and coordinated with, national economic development strategies and priorities.

Consequently, the essence of the project strategy is, wherever appropriate and possible, to address any social and economic needs of local communities that could, now or later, lead to conflict with the conservation objectives of the project. The opposite and alternative strategy of instigating and policing regulations which attempt to contain destructive local activities without providing viable economic alternatives, has been attempted unsuccessfully in many countries.

## **5. Reasons for assistance from GEF**

The protection and conservation of Dana is of global significance. This arid/semi-arid area (which is the only maquis<sup>7</sup> area in southern Jordan) is at the junction of several major biogeographic zones (African, European and Asian), and consequently contains a unique combination of flora and fauna. At least twenty species of flora are endemic to the reserve area which also hosts vestigial populations of various rare and endangered animal species. The reserve includes the only remaining occurrence of cyprus (*Cupressus sempervirens*) which is thought to represent a genetically distinct population. Other genetic resources occurring in the reserve include a wide variety of plants known to have traditional nutritional and medicinal applications, for example, *Atriplex spp.*, which is rich in protein and consumed by both livestock and humans.

The Dana project will be the first Jordanian initiative to conserve critical habitats and their biodiversity by addressing the social and economic needs of the communities whose unplanned livestock management and agricultural practices comprise the greatest current threat to biodiversity. The project will focus on those communities living inside and around the reserve. However, the socioeconomic issues which must be addressed at Dana (notably the shift away from dependency on unsustainable livestock grazing practices to other forms of income) are problems which impede economic development and cause environmental degradation in many parts of Jordan. Thus, the

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<sup>7</sup> Area of thick, scrubby underbrush.

experience gained through this exercise will be of assistance in planning initiatives aimed at balancing biodiversity conservation with economic development, both in protected and non-protected wildlands, throughout Jordan and in neighbouring countries.

Other innovative features of this project include: the assignment of an NGO as the implementing agency; the allocation of the land which is to become the protected area to the NGO responsible for conservation in the country; the involvement of local resident and semi-nomadic communities in participatory planning in a traditional cultural setting; the application of indigenous arid area water management research; and the revenue earning potential of the project as a whole.

## **6. Special considerations**

In view of the fundamental importance of involving local resource user groups in appropriate and possibly new forms of economic activity, it is essential that the communities involved contribute to the design of all the socioeconomic components of the project, and that formal agreements on inputs expected from all parties be obtained and upheld.

## **7. Coordination arrangements**

Coordination throughout project implementation is an intrinsic component of the management plan and will be ensured through:

- An interagency steering group including representatives from the Ministries of Agriculture, Energy and Mineral Resources, Municipal and Rural Affairs and Environment, Planning, Public Works, Tourism and Antiquities, and Water and Irrigation; the RSCN; local communities; NGOs; and other contributing donor organizations
- A scientific technical task force including representatives from all relevant RSCN technical divisions, the University of Jordan, and other institutions or NGOs involved in research or technical aspects of project implementation
- Coordination of all project activities by the Director of Conservation, in consultation with the sub-project managers, RSCN functional divisions, and relevant authorities.

## **8. Counterpart support capacity**

The RSCN has recently moved into new offices with ample space to house staff and facilities associated with all of the society's programmes and activities, including the Dana and Azraq components of this project. However, in view of present limited staffing levels, significant institution building will be required from project funds to enable the society to achieve its mandate effectively and implement all components of the project.

An institutional needs assessment study has been undertaken under the preparatory assistance phase of the Dana project. Its recommendations have been incorporated in the activities described in this document.

## **C. DEVELOPMENT OBJECTIVE**

The project has two broad objectives. The first is to ensure conservation of the biological diversity of all ecosystems in the Dana Reserve. The second is to enhance the national capability to conserve biodiversity throughout Jordan.

The greatest threat to the biological diversity of the Dana Reserve is unplanned, ecologically inappropriate, and unsustainable human use of the reserve's natural resources. Consequently, in order to achieve the first broad objective, it will be necessary for the project to address the social and economic needs and aspirations of the communities living in the vicinity of the reserve, and to support sustainable development initiatives which do not conflict with the objectives of conservation. Wherever possible, activities which have the potential to generate foreign currency earnings through tourism will be encouraged.

The socioeconomic issues which must be addressed at Dana (notably the change of emphasis from dependency on unsustainable livestock grazing practices to other forms of income) are problems which restrain economic development and cause environmental degradation in many parts of Jordan. Consequently, experience gained by the Dana project will have national significance.

The project's second broad objective will be achieved by upgrading both the scientific and managerial competence of the RSCN to enable it to deal more effectively with conservation issues throughout the country.

## **D. IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES**

### **IMMEDIATE OBJECTIVE 1**

Preparation and implementation of the Dana Conservation and Management Plan.

#### **Output 1.1**

Legal provision for the management of all natural resources in the reserve's core area.

#### **Activities for Output 1.1**

- 1.1.1 Identify, describe, and formally survey the entire course of the reserve boundary. Wherever possible, the boundary should follow permanent and easily recognizable natural features. However, where necessary, survey markers should be placed. The possibility of extending originally described borders so as to include whole watersheds, and the western border so as to incorporate a larger portion of the desert ecosystem (that is as yet uninhabited) into the reserve, should be considered at this time.

**Responsible Party:** RSCN, relevant government agencies, and private sector technicians.

- 1.1.2 Prepare and enact legislation which formally establishes Dana as a protected area and RSCN as the authority empowered to manage all natural resources occurring in the reserve.

Responsible Party: Relevant government agencies, the RSCN, and legal specialists in collaboration with an appropriate legal centre.

### **Output 1.2**

Provide basic equipment and facilities for reserve management, field staff, and researchers at Dana.

#### Activities for Output 1.2

- 1.2.1 Identify a suitable site for establishment of a laboratory (required for Output 1.3.) and accommodation facilities at Dana. Site selection should ensure that the facility is equipped with running water and mains or solar power supply.

Responsible Party: RSCN.

- 1.2.2 Construct facility.

Responsible Party: Private sector, subject to tendered competitive contract.

- 1.2.3 Purchase essential project equipment (including vehicles, camping gear, optical equipment, and so on).

Responsible Party: RSCN and the World Bank.

### **Output 1.3**

Assessment of the biological diversity occurring in the reserve's core area.

#### Activities for Output 1.3

- 1.3.1 Initiate applied postgraduate research (conducted by Jordanians) aimed at producing the following information about the reserve area:
- A comprehensive inventory and map of the floral communities
  - A comprehensive inventory and map of the vertebrate and invertebrate animal populations
  - A study of the status, distribution, biology, ecology, population dynamics, and seasonal and circadian ranges of endangered animal populations

- A comprehensive inventory and map of all geological systems, soil types, and ground and surface water sources.

**Responsible Party:** Jordanian academic and research institutions in collaboration with RSCN scientific staff and relevant overseas research institutes.

- 1.3.2 Provide on-site training for Dana Reserve staff in wildlife monitoring techniques, and establish a routine workplan for continuous and/or periodic monitoring and recording of the status of the reserve's endangered species.

**Responsible Party:** Specialist trainers, Dana scientific coordinators, and RSCN field staff.

- 1.3.3 If possible, conduct two low-level photographic aerial surveys of the entire reserve (late winter and late summer). Photographic coverage should be on a sufficiently large scale to provide optimum information on topography and vegetation for input to the project GIS (see Activity 2.2.2).

**Responsible Party:** To be identified.

#### **Output 1.4**

Quantify existing threats to biological diversity from livestock grazing and fuelwood collection in the reserve's core area.

##### **Activities for Output 1.4**

- 1.4.1 Initiate applied postgraduate research (conducted by Jordanians) aimed at producing an assessment of the impact of current levels of grazing by large herbivores (domestic and wild) on reserve biodiversity, and vis-a-vis biomass productivity, of the principal plant species consumed.

**Responsible Party:** Jordanian researchers and relevant overseas research institute in collaboration with RSCN scientific staff.

- 1.4.2 Introduce a standardized system for periodic monitoring of livestock numbers and ownership in the reserve's core area.

**Responsible Party:** Dana Scientific Coordinators and RSCN field staff.

- 1.4.3 Undertake a socioeconomic study which will:

- Verify the number, origins, and degree of occupancy of the various social groups using the reserve core area for grazing livestock or collecting fuelwood

- Quantify the constant and seasonal levels of livestock and fuelwood use of the reserve
- Assess the economic significance that continued access to these primary resources has for the resident, nomadic, and semi-nomadic groups involved
- Produce practical recommendations (which can be implemented by this project) for socioeconomic development initiatives that will best incorporate the livestock owning peoples into the sustainable development/conservation strategy for the area.

**Responsible Party:** Independent consultant (to be identified).

Note: All data produced by Activities 1.3.1 - 1.4.3 will be prepared in a manner suitable for entering into the project GIS (see Activity 2.2.2). It will also facilitate the preparation of cartographic and/or written information which will be of direct practical value to reserve management and staff.

### **Output 1.5**

Address the economic needs of communities impacting on the Dana Reserve ecosystem.

#### **Activities for Output 1.5**

1.5.1 Implement the recommendations of the study described in Activity 1.3.3. Conservation measures will necessitate limiting grazing rights to an identified social group (grazing an acceptable number of livestock) and introducing appropriate and sustainable alternative socioeconomic development programmes among all communities impacting on the reserve's resources. All initiatives will be introduced and accompanied by conservation education outreach programmes. Local perceptions and attitudes to all conservation and development initiatives will be monitored closely through local community involvement in all related planning and decision-making processes.

**Responsible Party:** RSCN, socioeconomic component manager, relevant government agencies and NGOs.

1.5.2 Appraise the technical feasibility, social acceptability, and likely impact of all small-scale income generation projects (such as honey and handicrafts production) proposed for Dana communities. Prepare an implementation schedule and budget for those activities likely to support the objectives of the Dana project.

**Responsible Party:** RSCN, socioeconomic component manager, relevant government agencies and NGOs.

1.5.3 Implement income generation projects selected in 1.5.2.

**Responsible Party:** RSCN, socioeconomic component manager, relevant government agencies and NGOs.

### **Output 1.6**

Re-establish agricultural production in the Dana terrace gardens as the basis for the Dana village economy.

#### **Activities for Output 1.6**

1.6.1 Complement cadastral mapping with detailed survey of ownership of the terrace garden area; establish appropriate landowner representative organization; and negotiate and formalize agreement with landowners regarding respective inputs into the agricultural development programme.

**Responsible Party:** RSCN, socioeconomic component project manager, landowners, and the Dana community.

1.6.2 Rehabilitate existing terrace walls, establish new terraces as appropriate, construct a small vehicle access track through the centre of the terrace garden area, and install drip irrigation systems.

**Responsible Party:** RSCN, socioeconomic component project manager, contractors and individual landowners.

1.6.3 Conduct market surveys of possible cash crops (notably grape vines, fruit trees and indigenous medicinal or herbal plants). Provide horticultural extension services, make available suitable seed, vines and/or trees, and establish marketing systems for existing and new crops.

**Responsible Party:** RSCN, socioeconomic component manager and local entrepreneurs.

1.6.4 Establish effective marketing systems.

**Responsible Party:** RSCN, socioeconomic component project managers, agricultural producers and entrepreneurs.

### **Output 1.7**

Establish reserve facilities and management procedures which ensure the maintenance and/or rehabilitation of biodiversity and which encourage recreational and educational activities based on the sustainable use of the natural and archaeological features of the reserve and environs.



### Activities for Output 1.7

- 1.7.1 Undertake a review and survey of the known archaeological sites in the reserve area and, if appropriate, restore one or more sites which will enhance the touristic potential of the reserve (for example, Nabatean and Roman copper mines, or Roman aqueducts).

Responsible Party: Department of Antiquities, with support from a foreign archaeological research institute (the American Center of Oriental Research (ACOR)).

- 1.7.2 Prepare educational materials (such as museum artifacts and/or boards, illustrated pamphlets and a video) featuring the history of human occupancy of the reserve and environs for display and/or distribution from the RSCN museum at Dana.

Responsible Party: Department of Antiquities, with support from a foreign archaeological research institute (ACOR).

- 1.7.3 Appraise options for private sector involvement in tourism development which focus on Dana's natural features, cultural history and local communities.

Responsible Party: RSCN, ACOR, socioeconomic component manager and ecotourist consultant.

- 1.7.4 Prepare a plan and field manual, for the use of all reserve management and field staff (in English and Arabic), detailing management priorities and activities. The plan will incorporate and apply information and skills resulting from Activities 1.1.1; 1.1.2; 1.3.1; 1.3.2; 1.3.3; 1.4.1; 1.4.2; 1.4.3; 1.5.2; 1.6.1; 1.6.3; 1.7.1; and 2.2.2. The plan will identify different activity/user zones, identify tourist trails, include a programme for the reintroduction of indigenous species of flora (supplied by the GTZ/Forest Department seed centre), identify and commission specific on-site training requirements for field staff, and establish continuous monitoring and recording of endangered animal species. The plan will be continually updated in the light of new information and as objectives are attained. Any additional equipment or materials required should be specified and justified in the plan.

Responsible Party: RSCN and Dana Scientific Coordinator in consultation with all researchers and relevant authorities.

- 1.7.5 Implement the conservation management plan described in Activity 1.7.4.

Responsible Party: RSCN.

### IMMEDIATE OBJECTIVE 2

Upgrade the institutional capability of the RSCN to facilitate implementation of the Dana and Azraq Conservation Management Plans, initiate similar endeavours in other Jordanian reserves, and

increase the scope of the environmental education programme to include all sections of Jordanian society.

### **Output 2.1**

Institutional needs assessment.

#### Activities for Output 2.1

- 2.1.1 Assess the structure, function, and needs of RSCN management, research, and operational systems. Provide practical recommendations for institutional adjustments necessary to provide a framework in which professional RSCN natural and social scientists, educational specialists, and managers can apply their expertise effectively. This will necessitate updating the organizational structure and the drafting of specific job descriptions. Details of budget planning and allocation systems, in-service training, and any requirement for additional qualified Jordanian staff and purchase of essential equipment will be included.

### **Output 2.2**

Establish new organizational systems.

#### Activities for Output 2.2

- 2.2.1 Implement the recommendations of the institutional needs assessment, including reorganization of the system of voluntary inputs which will require:
- The adoption of a more efficient hierarchic committee structure so that only three voluntary committees would need to report directly to the Board of Directors
  - The servicing of all committee meetings (including the preparation of agendas, minutes, reports; responsibility for follow-up action; and so on) by the relevant RSCN staff member such as the head of a division or section, thereby relieving the Director General who should only be required to service meetings of the Board of Directors
  - The creation of a membership category which is readily accessible to new subscribing members.

Responsible Party: RSCN voluntary officers, Board of Directors, RSCN section heads, the Director of Conservation, and the Director General.

- 2.2.2 Adopt new management structures and systems as described in the report entailing the creation of a new tier of middle managers (heads of sections) with delegated

responsibilities, clear objectives, and accountability for their own sub-budgets. This will involve:

- The creation of two new RSCN functional sections (Research and Surveys Section, and Fundraising and Public Relations Section) and grouping the three operational sections (Research and Surveys, Reserves, and Wildlife Enforcement) under the umbrella of a new Conservation Division. This division would be supported for the first three years by an international specialist (who would serve as Director of Conservation) funded by the GEF.
- The adoption of a standardized office procedures system and the introduction of computerized cost centre budgeting.

**Responsible Party:** RSCN Board of Directors, RSCN section heads, the Director of Conservation, and the Director General.

2.2.3 Introduce new staff terms and conditions as indicated in the recommendations. In order to retain existing committed high quality staff and to attract new, appropriately qualified key staff, it will be necessary for the RSCN to:

- Upgrade conditions of service (salaries and family insurance plans) so as to be in line with comparable Jordanian organizations
- Adopt a standardized appointments procedure involving public advertising and formal interviews for all vacant posts, and create a selection panel which includes the immediate superior for the post
- Provide contractual employment agreements for RSCN staff.

**Responsible Party:** RSCN Board of Directors, RSCN section heads, the Director of Conservation, and the Director General.

### **Output 2.3**

Establish financial support systems.

#### **Activities for Output 2.3**

2.3.1 Explore opportunities to establish long-term financial security, and make provision of core income that would be sufficient to fund all RSCN operations and allow for long-term planning after the three-year life of the GEF project. This will entail:

- Creation of a new RSCN Fundraising and Public Relations Section
- The procurement (through advance planning) of government contributions for longer planning periods of at least three years

- Establishment of an interest generating trust fund (which would be initiated with a token contribution through this project).

Responsible Party: RSCN Board of Directors, Director General, and Fundraising and Public Relations Section.

#### **Output 2.4**

Provide essential facilities.

##### Activities for Output 2.4

- 2.4.1 Purchase office equipment detailed by assessment outlined in Activity 2.1.1, together with a GIS appropriate for the needs of conservation management as recommended in the report of the institutional needs assessment.

Responsible Party: Head of Administration Section.

- 2.4.2 Train at least four RSCN technical staff in the preparation of a GIS appropriate to the needs of conservation management. The trained RSCN staff should later be able to fully utilize the GIS equipment in order to compile and process information on reserves and sites of conservation significance throughout Jordan. However, the system will initially be employed in the preparation of management materials for Dana Reserve as a priority.

Responsible Party: Dana Scientific Coordinator and training consultants.

#### **Output 2.5**

Strengthen local expertise.

##### Activities for Output 2.5

- 2.5.1 Implement recommendations of the institutional needs assessment report, notably the creation of a staff development strategy requiring the adoption of a clear system of planning by objectives, progress appraisal, and appropriate skills development. All RSCN professional and support staff should be provided with training in the use of word processing and spreadsheet office accounting procedures. Where a suitable appointee does not exist within RSCN, new key staff should be recruited (in accordance with the recommended appointments procedures and subject to the approval of the World Bank) for the following positions: Head of Fundraising and Public Relations Section; Fundraising and Public Relations Assistant; Head of Research and Surveys Section; Head of Public Awareness and Education Section; and Head of Administration Section. Section heads will implement all sectional initiatives proposed in the report.

**Responsible Party:** RSCN Board of Directors, RSCN section heads, the Director of Conservation, the Director General, and the private training contractor.

## **E. INPUTS**

The GEF has allocated US \$3.3 million to this project component for disbursement over the period 1993-1995. Funds have been allocated under the UNDP portfolio and the project will be implemented by the World Bank under a Letter of Agreement to be signed between the Government of Jordan and the World Bank. The Bank will also provide staff for professional backstopping without charge.

The RSCN has been formally identified as the implementing agency and, with the assistance of expatriate counterpart staff, will be responsible for overall coordination of the agencies and inputs associated with the various project components. Inputs are mainly comprised of professional staff training and equipment. In summary:

- (i) Personnel requirements include permanent Jordanian scientific and managerial RSCN staff, Jordanian postgraduate research scholars, and medium- and long-term expatriate project management staff. In addition, consultants will be required to make short-term inputs associated with staff training, monitoring, evaluation, and the socioeconomic and archaeological surveys.
- (ii) Training will be provided through:
  - Academic scholarships for Jordanians engaged in ecological research at Dana (researchers will be affiliated with the University of Jordan and appropriate overseas institutions)
  - Short-term courses or educational visits overseas for RSCN technical staff
  - Short-term on-site instruction courses for counterpart and Dana field staff (included as duties for all expatriate staff).
- (iii) In addition, training will be provided for local communities by project staff through agricultural extension services associated with the socioeconomic development components of this project.
- (iv) Equipment will include: vehicles, computer hardware and software (including protected area management plan software and related GIS), and a fax machine for the RSCN office in Amman. At Dana there will be a requirement for vehicles, optical equipment, camping gear, laboratory and research facilities, and so on.

## **F. RISKS**

Factors which may, *at the outset*, cause delays or prevent achievement of the project's outputs and objectives:

1. Delay in passing legislation which provides complete protection for the Dana Reserve and which entrusts the management of all natural resources in the Dana protected area to the RSCN.

**Estimated likelihood:** Low.

2. Delays in identifying and contracting key personnel and consultants, notably the Director of Conservation, the Scientific Coordinator, and the socioeconomic component manager.

**Estimated likelihood:** Medium.

3. Delay in identifying postgraduate supervision and students, and in arranging the initiation of research scholarships.

**Estimated likelihood:** Medium.

4. Delay in procuring essential equipment.

**Estimated likelihood:** Low.

Factors which could, *over time*, cause delays or prevent achievement of the project's outputs and objectives:

1. The initiation of copper mining in the reserve.

**Estimated likelihood:** Low.

2. Inability of the project's socioeconomic component to offset local interest/requirement to graze excessive numbers of livestock inside the reserve core area.

**Estimated likelihood:** Low.

3. Failure of RSCN to recruit appropriate technical staff or adopt effective management systems.

**Estimated likelihood:** Low.

4. The development of substantial settlements on the reserve boundary combined with the reserve management's inability to contain any associated incompatible activities through community outreach education and development programmes.

**Estimated likelihood:** Low.

## **G. PRIOR OBLIGATIONS AND PREREQUISITES**

### Prior obligations

Approval of the proposed workplan and its annexes as outlined in the original Project Document.

### Prerequisites

The Government of Jordan will need to prepare and enact legislation which establishes Dana's protected area status and entrusts the management of all natural resources in the reserve to the RSCN. The Project Document will be signed by UNDP, and UNDP assistance to the project will be provided, subject to UNDP receiving satisfaction that this prerequisite has been fulfilled or is likely to be fulfilled. When anticipated fulfillment of the prerequisite fails to materialize, UNDP may, in consultation with the World Bank, at its discretion, either suspend or terminate its assistance.

## **H. PROJECT REVIEW, REPORTING AND EVALUATION**

### Review

The project will be subject to periodic reviews in accordance with UNDP policies and procedures for monitoring project execution. This will entail joint reviews by representatives of the Government of Jordan, RSCN, UNDP and the World Bank. In addition, it is recommended that, wherever possible or relevant, representatives of local communities, consultants that have been engaged with the project, and researchers involved at Dana should take part in the reviews.

These meetings will consider the Project Performance Evaluation Reports (PPERs) prepared by the RSCN, and will take place at least once every six months. Dates for these review meetings will be chosen by the principal parties involved.

### Reporting

The following reports will be prepared by the RSCN/Director of Conservation and submitted to the World Bank and UNDP:

#### *Quarterly progress reports*

These will be contributed throughout the life of the project and will contain a description of progress in relation to each project activity, any problems encountered, expenditures made during programme execution, and the performance of consultants and staff. All on-site and overseas training activities will also be detailed.

#### *Technical reports and outputs*

Within the first twelve months a comprehensive Reserve Management Plan and Field Manual will be produced for the use of all reserve management and field staff, in English and Arabic, detailing management priorities and activities. The plan will incorporate and apply information and

skills resulting from Activities 1.1.1; 1.1.2; 1.3.1; 1.3.2; 1.3.3; 1.4.1; 1.4.2; 1.4.3; 1.5.2; 1.6.1; 1.6.3; 1.7.1; 1.7.4 and 2.2.2. The plan will: identify different activity/user zones and positions of tourist trails; include a programme for the reintroduction of indigenous species of flora (supplied by the GTZ/Forest Department seed centre); identify and commission specific on-site training requirements for field staff; and establish continuous monitoring and recording of endangered animal species. The plan will be continually updated in the light of new information and as objectives are attained. Any additional equipment or materials required will be specified and justified in the plan.

#### *Reports and recommendations produced by consultants*

The areas covered will include socioeconomic issues, institutional strengthening, archaeology, tourism development and mineral survey plans.

#### *Geographic Information System*

- The first output (within the first six months) will be a detailed topographical map
- The second output (within the first twelve months) will include water sources, geological structures, major vegetational zones, and the known distribution of large mammal and endangered animal species
- The third output (by the end of the project) will include detailed distribution of flora and fauna; circadian and seasonal ranges of large mammal and endangered animal populations; circadian and seasonal ranges of domestic livestock; and any other significant human activities inside the reserve (including tourism) and immediately outside the reserve (including grazing and agricultural settlement).

#### *Annual reports*

These will provide a comprehensive overview of progress in relation to each project activity, problems encountered, expenditures made during programme execution, the performance of consultants and staff, as well as on-site and overseas training activities.

#### *Periodic status reports*

Updates of the quarterly reports and comments on specific issues may be requested for presentation at review meetings and by the scientific advisory committee.

#### *Final report*

This will summarize project execution and make specific recommendations for further action.

## **I. LEGAL CONTEXT**

This Project Document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the Government of Jordan and the UNDP, signed by the parties on 12 January, 1976. The host country implementing agency shall, for the purposes of the Standard Basic Assistance Agreement, refer to the government cooperating agency described in that agreement.



The Dana Reserve has been established for the protection and preservation of unique natural resources in Wadi Dana and its vicinity under the management of RSCN. The NRA is responsible for management and development of the mineral resources of Jordan. It is understood that environmental legislation currently under preparation will address the issue of management of natural resources in protected areas.

In view of the unavoidable environmental impacts that could reasonably be expected to result from any commercial mining operations in the reserve, the government will limit its activities to geologic studies for scientific purposes, and collection of small quantities of mineral materials without use of power equipment or explosives. In order to ensure that such mineral related activities will not be incompatible with the objectives of the reserve, the NRA will first consult with both the Ministry of Municipal and Rural Affairs and Environment, and RSCN.

Prior to conducting or authorizing any mineral activities in the vicinity of the reserve which could possibly result in a significant impact on the Dana Reserve environment, the government will notify RSCN and give it an opportunity to identify any possible adverse effects which the proposed mineral activities may have on the reserve. If the RSCN identifies a possibility of adverse effects on the reserve, the government will coordinate with RSCN to address these concerns in an effort to avoid adverse effects on the reserve or, where avoidance is not feasible, reduce them to acceptable levels.

Environmental assessments (EAs) will be required for any mineral exploration or development activities. When an EA is required for activities in the vicinity of the reserve, the government should consult with RSCN in the preparation of these documents under the following guidelines:

- The government will promptly notify RSCN as to the type, location, scope and timing of any mineral activities proposed in the vicinity of the reserve
- RSCN will identify competent professional staff to coordinate with government staff and advise them of any RSCN concerns regarding the proposed activities
- RSCN will promptly provide any available ecological resource data for use in preparing EAs
- RSCN will identify any significant ecological data gaps and assist in developing studies to provide the needed data (study costs to be borne by the government/applicant)
- RSCN will work with the government/applicant to identify any mitigation measures necessary to eliminate or reduce adverse effects on the ecological resources of the reserve (mitigation costs to be borne by the government/applicant).

The following types of revisions may be made to this Project Document with the signature of the UNDP Resident Representative only, provided he or she is assured that the other signatories of the document have no objection to the proposed changes:

- Revisions in, or additions to, any of the annexes of the original Project Document, with the exception of the legal agreement which is a precondition for UNDP assistance
- Revisions which do not involve significant changes in the immediate objectives, outputs or activities of a project, but are caused by the rearrangement of inputs already agreed to or by cost increases due to inflation
- Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation, or take into account agency expenditure flexibility.

## **J. BUDGET**

The combined budget for the Dana and Azraq components, incorporating both government and GEF inputs, is attached on page 75.

## **COMPONENT 2: AZRAQ OASIS**

### **Brief description**

This component will contribute to the maintenance of biodiversity in the wetlands of Azraq Oasis through the provision of a permanent water supply to supplement the greatly reduced natural spring flow, and through the implementation of a management plan for the Azraq Wetland Reserve. The component will also lead to improved management of the qa wetland which, along with the spring-fed marshes, has been designated by the Government of Jordan as a wetland of international importance under the terms of the Ramsar Convention.

In addition, the component will provide substantial support for studies on the water resources of the Azraq Basin and their utilization for water supply and irrigation purposes, with a view to developing a comprehensive water management plan for the basin. The component will also support long-term research on the conservation and management of water resources in arid regions by focusing on the use of infiltration techniques to accelerate groundwater recharge.

The project will endeavour to resolve the present institutional stalemate by promoting cooperation in the management of water resources in the Azraq Basin. The project provides substantial support to strengthen the institutional capabilities of the RSCN, with a sum of US \$300,000 being provided for this purpose from the Azraq component budget. Three ministries, an NGO (RSCN), and an academic institution (University of Jordan) will be involved in project implementation.

### **A. CONTEXT**

#### **1. Description of subsector**

Much of Jordan is desert or semi-desert, with an arid climate. Over 95 percent of the land area has an annual rainfall of less than 200 millimetres (mm), while only 2 percent has more than 350 mm. The water resources are scarce, and in most cases insufficient to meet the growing demands of a rapidly increasing population. The precarious water situation has become a serious concern for the government. Numerous studies have been made of the availability and quality of the nation's water resources, and a variety of recommendations for water conservation and sound water management have been put forward, but the problem continues to grow. One result of this lack of implementation of sound water management schemes has been the gradual disappearance of the natural wetlands of the Azraq Oasis.

Azraq Oasis is located some 80 kilometres ESE of Amman at approximately 31 degrees 49' North, 36 degrees 48' East. It lies at the heart of a large internal drainage basin (covering around 12,710 square kilometres), with 94 percent in Jordanian territory, 5 percent in Syrian territory, and 1 percent in Saudi Arabian territory. The highest relief in the basin is at Tillin Town in Syria with an elevation of 1,550 metres; the lowest point is in the Azraq Depression (Qa Azraq) with an elevation of 500 metres. This depression is the natural base level for both surface water and groundwater which collect there to form the Azraq Oasis. The catchment area is drained by a

number of wadis, the principal ones being Wadi Rajil, Wadi Hassan, Wadi Asekim, Wadi Shaumari, Wadi Jesha and Wadi Ghadaf.

The mean annual rainfall in the catchment ranges from 300 mm in the north (in Syria) to about 150 mm in the west, and less than 50 mm in the east and south. The average annual rainfall in the entire basin is 87 mm. The mean annual evapo-transpiration is approximately 2,000 mm.

Major highways from Amman/Zarqa to Iraq and Saudi Arabia transect the basin, passing through the villages of South Azraq (formerly Shishan) and North Azraq (formerly Druze) on the north-western edge of the oasis. Both villages were founded this century (Druze after World War I and Shishan in the 1920s) and remained small until the main highways from Amman to Iraq and Saudi Arabia were re-routed past the oasis. The population of Druze then grew from 1,500 in 1975 to over 3,500 in 1990, while that of Shishan grew from a few hundred in 1975 to over 1,000 in 1990. This rapid expansion has been closely linked with the rapid increase in heavy traffic through the oasis, with most people now being involved in the service industry.

Azraq Basin belongs geologically to the East Jordanian Limestone Plateau, which is partially covered by basalt flows. The basin is surrounded by a series of hills consisting mainly of limestone deposits and basalt craters. The sedimentary rocks overlay the basement complex, found at a depth of 2,550 metres in the eastern part of the basin. Three partly connected aquifer systems have been identified in the sedimentary rocks overlaying the basement: the Upper Aquifer System (Basalt/B4), the Middle Aquifer System (B2/A7), and the Lower Aquifer System (Kurnub). Natural discharge from the upper aquifer occurs at large springs at Shishan and Druze on the north-western edge of the oasis.

Most research to date has concentrated on the upper aquifer, and little information is available on the deeper aquifers. However, samples from the few wells which have been drilled into the deeper aquifers indicate that in general, salinity increases with depth.

The pattern of water flow indicates that most of the recharge to the upper aquifer takes place in the north-northeast and northwest, with about 50 percent of the recharge taking place in the Jebel El-Drouz in Syria. The velocity of groundwater flow from the recharge area in Jebel El-Drouz to the springs in Azraq Oasis is believed to be very slow. Recent studies have shown that the groundwater in the well-field about 3 kilometres north of the oasis is between 4,000 to 20,000 years old. Tritium, which has a half-life of 12.3 years, has never been detected in the wells, indicating that no recent recharge to the groundwater has taken place.

#### Wetlands of Azraq Oasis

The wetlands of Azraq Oasis comprise three inter-related systems covering about 7,500 hectares: a small area of freshwater marshes fed by two springs near the village of Druze; a large area of fresh to brackish marshes and pools fed by two large and several smaller springs near the village of Shishan; and a large seasonally flooded mudflat or playa wetland (Qa Azraq) fed by surface run-off from an extensive network of wadis. Streams carry water from the spring pools eastward towards the playa, creating extensive shallow wetlands with a variety of habitats including *Typha*, *Scirpus* and *Cyperus* communities, and shallow pools with *Ruppia*, *Nitraria* and *Tamarix*

communities occur in the silty dunes between the streams and pools. The playa is largely devoid of vegetation, except for a fringe of succulent halophytes such as *Halopeplis* and *Halocnemum*. The playa is flooded irregularly in winter and early spring, but even during years of deep flooding, is usually completely dry by the end of May.

Until recently, Azraq Oasis was an outstanding example of an oasis wetland in an arid region, with few parallels in the world. The wetland supported a rich and varied aquatic fauna and flora characteristic of freshwater habitats and, with the loss of most natural freshwater wetlands in neighbouring Syria, Lebanon and Israel, constituted the only significant tract of its type within a very large region of the Middle East.

Azraq Oasis was especially important for birds. Of the 250 species which have been recorded there, the great majority are migratory species belonging to the West Palearctic-Afrotropical flyway. Estimates made in the 1960s and 1970s indicate that between several hundred thousand and a million birds utilized the oasis during the course of a single spring migration, with up to 50,000 birds being present at any one time. Some 28 species of waterbirds were found breeding in the wetlands in the 1960s, several at the extreme edge of their ranges, and over 100,000 waterfowl have been recorded in mid-winter. Despite the loss of most of the permanent wetland habitat during the last decade, the oasis remains important for migratory birds (particularly species of shorebirds and passerines such as swallows, wagtails and warblers) and continues to support a variety of breeding species, especially during years of extensive flooding in the qa. In 1990 and 1991, five species of waterfowl were found breeding for the first time at Azraq, including a globally threatened species, the marbled teal (*Marmaronetta angustirostris*). In the winter of 1991-92, over 7,000 ducks and 2,500 common cranes (*Grus grus*) were present at the qa.

Other interesting fauna in and around the Azraq Oasis include local subspecies of the Asian jackal (*Canis aureus syriacus*), red fox (*Vulpes vulpes arabica*), striped hyaena (*Hyaena hyaena syriaca*), black water snake (*Tropidonotus tessalate*), two amphibians (*Rana ridibunda* and *Bufo viridis*), and a variety of aquatic invertebrates including the tadpole shrimp (*Triop canseriformes*)—a "living fossil" with a strangely disjunct distribution in the Middle East.

The great international importance of the wetlands of Azraq Oasis was recognized in 1977 when the Government of Jordan acceded to the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the Ramsar Convention), and designated Azraq Oasis for inclusion in the Convention List of Wetlands of International Importance. The Ramsar Site covers some 7,372 hectares, and includes the marshes and pools fed by the southern group of springs, as well as the whole of Qa Azraq. Legal ownership of the Ramsar Site rests with the Forest Department in the Ministry of Agriculture, while the Department of Environment in the Ministry of Municipal Affairs and Environment has responsibility for matters relating to the implementation of the Ramsar Convention in Jordan.

The southern area of spring-fed marshes and adjacent parts of the playa wetland (an area of 1,245 hectares) were given reserve status in 1977, and have been managed since that time by RSCN under an agreement with the Ministry of Agriculture. The Azraq Wetland Reserve is fenced, and there is an RSCN warden allocated to the reserve.

### Agricultural development in Azraq Oasis

Since about 1980, there has been rapid expansion in agricultural activities in and around the Azraq Oasis. By the end of 1991, there were approximately 1,400 hectares of olive groves and orchards, and 153 hectares of vegetable gardens in the Azraq area. New farms are continually being established and the area under cultivation is increasing rapidly. Approximately 310 shallow wells and 140 deep wells have been dug to provide water for irrigation, and the extraction of groundwater for irrigation has increased from under 1 million cubic metres (MCM) of water in 1981 to approximately 22 to 23 MCM in 1990.

### Water supply for Amman

The Azraq aquifer is one of the principal sources of drinking water for Amman, contributing approximately a quarter of the total consumption in the Amman District in recent years. Pumping from Azraq springs began as long ago as September 1963, but throughout the remainder of the 1960s and during the 1970s, only small quantities of water were extracted to supply the town of Irbid, some 125 kilometres northwest of Azraq. However, in November 1980, the then Amman Water Authority (now part of the Water Authority of Jordan in the Ministry of Water and Irrigation) began pumping water to Amman at the rate of about 1.5 MCM per year. In 1981, the Water Authority dug 15 wells some 3 to 10 kilometres northwest of the Druze springs, and in 1982 pumping from the springs was replaced by extraction from the new well-field. Extraction rates rose rapidly over the next six years to a peak of about 22 MCM in 1988, and have since stabilized at about 16 MCM per year.

Although numerous studies have been carried out on the water resources of the Azraq Basin during the past thirty years, there is still widespread disagreement with respect to the characteristics of the different aquifers, their suitability as supply sources, and their rate of recharge. The available figures for groundwater recharge and "safe yield" are based on run-off rates, infiltration rates, and loss calculations from similar catchments elsewhere in the world. They are at best, therefore, only rough estimates. Estimates of the "safe yield" have ranged from 16 MCM per year, based on the natural discharge of the springs, to 28 MCM per year, based on an estimated annual recharge of 34 MCM per year. However, the concept of "safe yield" has always been open to question and now, with the discovery that the wells are "mining" fossil water, has been more or less abandoned.

### Research on water harvesting and artificial recharge

Significant applied research has been carried out in recent years in the field of groundwater engineering by the Water and Environment Research and Study Centre (WERSC) at the University of Jordan. This work has concentrated on field testing of the infiltration characteristics associated with dams fed by flash floods in wadis in semi-arid zones (zones with an annual rainfall of about 200 mm). The research has demonstrated the resource value of this rainfall zone, and how the flash floods might be exploited through infiltration schemes rather than wasted as surface flow into the desert. The WERSC has also been investigating possible uses of waste water, and is currently considering its use in infiltration projects.

## **2. Host country strategy**

The National Environmental Strategy for Jordan (NES), endorsed by the government in 1992, gives great importance to the conservation of natural resources. This strategy identifies the rehabilitation of Azraq Oasis as one of the most urgent priorities in the conservation of wildlife and habitats in Jordan. As a contracting party to the Ramsar Convention, one of the government's principal obligations is to maintain the ecological character of its designated Ramsar Site.

In the agricultural sector, the NES has identified depletion and salinization of groundwater and low efficiency of irrigation as being major environmental issues in arid regions such as the Azraq Basin. The NES recommends that studies be carried out on the water needs of various crops to avoid accumulation of minerals and salts; that pumping of groundwater be limited to set levels to prevent water and soil salinization due to over-extraction; and that modern high-efficiency irrigation techniques, such as drip irrigation, be adopted.

The Government of Jordan has accorded high priority to the water sector in the context of economic development planning and management. The country has a National Water Master Plan, prepared in 1977, and is presently updating this with support from UNDP. The new strategy is expected to be adopted by the end of 1992. The National Environmental Strategy states that "water resources should be conserved and used efficiently since scarcity of these resources will be a determining factor in future development plans." The NES also recognizes the need for more water-harvesting schemes in desert areas, and recommends that greater attention be focused on the artificial recharge of groundwater.

## **3. Prior or ongoing assistance**

A considerable amount of international attention has been given to the wetlands of the Azraq Oasis in the past. Several ornithological expeditions in the 1960s documented the importance of the wetlands for migratory birds, and a draft management plan was prepared and published under the International Biological Programme in 1966. An International Biological Research Station was established at Azraq in 1968, but this was closed as a result of the Iraqi intervention in 1969. In 1979, WWF and the World Conservation Union (IUCN) assisted RSCN in the preparation of a preliminary management plan for the Azraq Wetland Reserve, but only a few of the recommendations in this plan were ever implemented.

The Government of Jordan has received considerable assistance in water sector development from various donors and organizations. The United Kingdom is assisting the country (through Official Development Assistance) in exploration for and assessment of groundwater resources in the south of the country. Japan has been assisting in feasibility studies for small dams, and water resources studies. Germany assisted Jordan in the preparation of the National Water Master Plan (1977), and has also supported groundwater investigations in southern parts of the country. Germany is currently supporting groundwater resource evaluations in the northern part of Jordan—in the Azraq Basin, Amman-Zarqa Basin and Yarmouk Basin. These studies will utilize existing data to prepare hydrogeological maps for planning purposes. The Canadian International Development Agency (CIDA) has supported a feasibility study and design for desert dams, while the European Economic Community (EEC) has been sponsoring groundwater investigations for deep aquifers in the Azraq,

Hamad and Sirhan basins. The United States (through USAID) has provided support for the recent updating of the National Water Master Plan, and is currently providing support for a project called Water Quality and Conservation in the Zarqa River Basin.

USAID is also providing support for a University Development Linkages Project (No.B/PCD-92-100) involving the University of Jordan and Washington State University. The major objectives of this project are:

- To strengthen the capacity of the University of Jordan and its newly developed WERSC to plan and manage research, technology transfer, and human resource development programmes in support of societal needs in environment and natural resources
- To strengthen the applied research/technology transfer capabilities of WERSC through the planning and conduct of collaborative research and technology transfer activities.

An EEC sponsored project, Groundwater Investigations in the Azraq Basin (Project Nos. 67/89 Central (JOR) and SEM/03/628/006 (EEC)), was initiated by the Water Authority of Jordan in 1991, and will continue for 26 to 28 months. The aim of this project is to investigate the characteristics of the middle and upper aquifers in the Azraq Basin with a view to locating alternative sources of water supply for Amman. The study will involve drilling 8 to 11 boreholes into the middle aquifer, establishing a borehole database for the basin based on a Groundwater Information Processing System (GRIPS), and carrying out modelling studies using the programme MODFLOW.

UNDP has provided funding for the project Water Resources Policies Planning and Management (JOR/87/003). This project is being executed by the United Nations Department for Economic and Social Development (formerly the Department of Technical Cooperation for Development) in cooperation with the Ministry of Water and Irrigation. Its main objectives are the preparation of guidelines for water policy, establishment of a computerized databank, and updating of the National Water Master Plan. The report of Phase I of the project has been completed, and Phase II is about to commence. UNDP has also recently approved funding for a complementary project, Strengthening of the National Capacity in Water Resources Planning (JOR/92/007), which is intended to strengthen the Water Resources Planning Unit within the Ministry of Water and Irrigation.

The UNDP regional project Current Technologies in Water Resource Management in the Maghreb and the Masheq (RAB/89/003) is a capacity building project in water resource management involving six countries of the Maghreb and the Masheq, including Jordan. The project includes training for planners and technicians, the establishment of a regional network, and the development of water resource management technologies. Another UNDP regional project involving Jordan, Regional Network for Supplementary Water Management under Rainfed Agriculture and Improved Water Management at the Farm Level (RAB/90/005), also has some relevance to the present project.



#### **4. Institutional framework for subsector**

The Ministry of Planning will be responsible for the overall implementation and coordination of the project. The key national institutions involved in the research, conservation, and development of the water resources of the Azraq Basin are: the Department of Environment in the Ministry of Municipal and Rural Affairs and the Environment; the Ministry of Agriculture; RSCN; the Water Authority of Jordan in the Ministry of Water and Irrigation; and WERSC at the University of Jordan.

A brief description of the status and role of RSCN is provided in the introduction to this document. The Department of Environment, which has responsibility for regulating and enforcing environmental protection measures, is also the government body responsible for administration of the Ramsar Convention in Jordan.

The Ministry of Water and Irrigation, created in 1987, has responsibility at national level for the study and development of water resources. The ministry has two authorities, the Water Authority of Jordan (WAJ) and the Jordan Valley Authority. The WAJ is responsible for water resources studies, planning and allocation, as well as for the provision of water supply and sewerage services throughout Jordan. The Jordan Valley Authority is responsible for the social and economic development of the Jordan Valley, including irrigation activities.

The Water and Environment Research and Study Centre (WERSC) was established in 1982 by royal decree to contribute to national efforts to develop and protect the nation's scarce water resources. The centre's activities have recently been expanded to include wider environmental concerns. The principal objectives of WERSC are:

- To conduct research on the development and management of water resources
- To provide services to the public and private sectors in the areas of water engineering design, environmental impact assessment (EIA), and laboratory and field analysis
- To identify solutions to water and environmental problems.

The centre has already conducted some studies on artificial recharge of groundwater in the Azraq Basin with a view to developing new technologies to accelerate infiltration.

### **B. PROJECT JUSTIFICATION**

#### **1. Problem to be addressed and the present situation**

##### Degradation of spring-fed marshes

The ecological character of Azraq Oasis has been radically altered by man's activities in the basin during the past two decades. Some of these changes are relatively superficial and are linked to the routing of new highways through the area, and the rapid growth of villages in the north and south of Azraq. However, major changes to the wetland ecosystems have occurred as a result of the

massive extraction of groundwater from the Azraq aquifers for water supply to Amman, and the irrigation of agricultural land around the oasis. The natural rate of discharge of the four main springs fell rapidly from 10.49 MCM per year in 1981 to less than 1 MCM in 1991. The two northern springs dried up completely in 1987, and the southern springs finally ceased to flow in August 1992.

The RSCN has protested to the government on a number of occasions in an attempt to reduce the rate of groundwater extraction and conserve the natural wetland ecosystems. A special Cabinet Committee, headed by the Prime Minister, was set up in the late 1980s to investigate the problem, but no meaningful progress was made, and the condition of the spring-fed marshes continued to deteriorate. The RSCN has recently moved its permanent warden from the Azraq Wetland Reserve to the nearby Shaumari Wildlife Reserve, although he continues to patrol the Azraq Reserve about once a week.

Despite the severe degradation of the wetland ecosystems which has occurred in the last two decades, the wetland retains much of its natural biodiversity and is still a site of considerable international importance. A mission from the Ramsar Convention Bureau in March 1990 concluded that Azraq Oasis "remains a wetland of great ecological, economic and social value, meeting several of the criteria established under the Convention for identifying wetlands of international importance." The mission also concluded that populations of aquatic plants and animals would recover rapidly if the wetlands could be restored.

However, the situation is now critical. The total discharge of the springs in 1989 was estimated at 1.96 MCM, and in March 1990, much of the main marsh remained flooded, with some water reaching the Burgess, Monfilit and Ingilesi pools. By early June 1992, the total overflow from the southern springs had fallen to about 0.25 MCM per year—a mere 2 percent of its level in 1981. This overflow created a single stream which extended for about one kilometre through the marsh and then dried up. Only the vegetation around the spring pool and along the stream remained green. All other marsh vegetation was dead and brown; the Burgess, Monfilit and Ingilesi pools were completely dry, slow-burning fires were moving through the ground in areas which had formerly been deep swamp, and heavy grazing pressure from the feral water buffalo and horses in the reserve was causing considerable damage to the surviving marsh vegetation. Natural discharge from the southern springs ceased completely in early August 1992, and by December 1992, Azraq Wetland Reserve was completely dry. Unless some action is taken within the next few months, the spring pools will also dry up completely, fires and overgrazing will destroy the last vestiges of marsh vegetation, and a significant proportion of the biodiversity of the system will be lost.

All previous attempts to save these wetlands have called for a reduction in the pumping of groundwater, either for Amman water supply or for irrigation purposes, or for both. Such a solution is clearly unacceptable. The Water Authority will continue to pump water to Amman as long as potable supplies last, while the Ministry of Agriculture has little control over pumping for agriculture, since over 95 percent of the 450 wells in operation are unlicensed and therefore illegal.

The obvious solution to the problem of water supply for the wetland would be to drill new wells into the upper or middle aquifers to provide the wetland with its own water supply. A potential problem with this solution is that if the pumped water has a higher salinity than the natural

spring flow, some changes could occur in the ecology of the wetlands. However, water from the southern springs (which feed the wetland reserve) contains about 760 parts per million (ppm) of dissolved solids, and the wetlands are already slightly brackish. An artificial supply of water from the upper or middle aquifer with a slightly higher concentration of dissolved solids (for example, in the range of 1,000 to 1,500 ppm) would therefore be unlikely to cause any major changes in the ecological character of the marshes.

The installation of one or two wells to provide an immediate supply of up to 2.5 MCM of water per year to the wetland reserve is seen as an essential emergency measure if anything of the original character of the spring-fed marshes is to be preserved. In the long term, the survival of the wetlands will be dependent on a drastic reduction or cessation in pumping from the well-field to the north of the oasis. It now seems likely that intrusion of saline water from the lower aquifers will render the water from the well-field unsuitable for drinking purposes within as little as three to five years. If this happens, the Water Authority will be forced to move its well-field elsewhere or utilize a deeper aquifer. In either case, some return of natural spring flow might be expected. When the Amman wells last stopped operating for a short period in 1988 or 1989, the Druze springs began to flow again within just ten days.

#### Threats to Ramsar Site

The Azraq Wetland Reserve comprises only a small part of the Azraq Ramsar Site. The major part consists of Qa Azraq, outside the reserve. This wetland has scarcely been affected by the extraction of groundwater, as it receives most of its water from surface run-off during winter and spring. The proliferation of salt pans around the qa has reduced the extent of natural qa wetland, but the detrimental effect on waterfowl populations seems to have been negligible. However, in 1992, a dam was constructed in Wadi Rajil about 45 kilometres north of Azraq, in an effort to alleviate water shortages during the summer months. Unfortunately, no environmental impact assessment was ever carried out.

Wadi Rajil is the single most important wadi feeding flood waters into Azraq Oasis, providing approximately one-third of the surface run-off from the catchment area. The new dam, along with two other dams on the upper reaches of Wadi Rajil in Syria, are undoubtedly reducing the frequency and extent of flooding in the qa and thus adversely affecting the ecological character of the Ramsar Site. During the unusually wet winter of 1991-92, there was no recorded surface flow at the Wadi Rajil dam site in Jordan. This was attributed to the presence of the two dams further upstream in Syria. Heavy rainfall in the Wadi Rajil catchment in December 1992 filled the new Wadi Rajil dam, but the qa, downstream, remained dry.

Concern over the degradation of the Ramsar Site has been expressed in several international forums, most notably the third conference of the Ramsar Convention in Regina, Canada, in May-June 1987. The concerns of the Conference were formalized in Recommendation 3.8 which called for urgent measures to be taken to maintain the natural properties of the wetland (see Annex 3). A follow-up mission from the Ramsar Convention Bureau in March 1990 prepared a detailed report on the situation at Azraq Oasis, and made a series of recommendations for action which have subsequently been reproduced in the National Environmental Strategy for Jordan.

### Agricultural malpractice

The extraction of groundwater in and around Azraq Oasis for agricultural purposes has increased rapidly in recent years, and has been largely uncoordinated and uncontrolled. Concern is now being expressed that the widespread use of slightly brackish water for irrigation will soon lead to severe problems of increased soil salinity. Most of the illegal wells produce water with a concentration of dissolved solids in the range 2,000 to 4,000 ppm. The Azraq Basin Water Resources Study of 1989 recognized this potential problem, and concluded that "an emergency programme should be implemented to advise the farm people on the non-repairable damaging effects on the soil of brackish water irrigation." No action has, however, been taken, and the volume of water extracted for irrigation purposes has continued to increase, from about 12 MCM in 1988, to 22 to 23 MCM in 1990.

### Depletion and contamination of groundwater

Natural discharge of the Azraq springs in the 1960s, before the extraction of groundwater commenced, was estimated at about 14 to 16 MCM per year. Extraction rates have exceeded this every year since 1983, and in 1990 an estimated 40 MCM were extracted, with 14 to 16 MCM being pumped to Amman and the remainder used for irrigation purposes in the Azraq area.

There is now general agreement that the upper aquifer is being over-exploited and that this is causing a lowering of the water table and deterioration in water quality. The Azraq Basin Water Resources Study of 1989 concluded that if the groundwater level in the well-field supplying Amman were to fall below an elevation of 504 metres (the static water level in Qa Azraq saline aquifer), a movement of saline water from Qa Azraq towards the well-field might be expected to occur. Measurements taken in January and May 1991 have shown that the groundwater level has now fallen by as much as 6 metres below this critical level at four of the seven wells tested. There are already signs of increasing salinity in some of the wells, and it is now thought that saltwater intrusion could become a critical problem within as little as three to five years. Unless something is done to reduce the rate of extraction of water from the upper aquifer, there is a real danger that it will be contaminated with salt water to the detriment of both the water supply to Amman and agricultural activities in the basin.

## **2. Expected end-of-project situation**

### Restoration and management of Azraq Wetland Reserve

The unique biodiversity of the wetlands of Azraq Oasis will have been conserved through the restoration and management of the Azraq Wetland Reserve. The immediate problem of water supply to the spring-fed marshes will have been resolved through the provision of water of a suitable quality from one or two new wells drilled into the upper and/or middle aquifers. Management procedures will have been implemented to make the best use of the limited water available to halt further degradation of the wetlands, and to preserve a viable nucleus of the animal and plant communities from which rapid recolonization of wetland habitats can occur if more water should become available in the future (for instance, following closure of the well-fields because of salinity problems).

A comprehensive management plan for the Azraq Wetland Reserve will have been prepared and implemented. This will have addressed the issues of grazing by domestic livestock, disposal of rubbish and other pollutants in the reserve, and hunting. Existing reserve infrastructure will have been repaired, a new reserve headquarters and two ranger stations will have been constructed, and a Visitors Centre will have been established along with a variety of other facilities of an educational, recreational, and scientific nature for both national and foreign visitors.

RSCN staff will have received on-the-job training and formal training in wetland management techniques and conservation awareness/education, and the Society will be fully capable not only of managing the Azraq Wetland Reserve, but also of developing and implementing management for any future wetland reserves.

#### Establishment of an EIA unit and implementation of the Ramsar Convention

A small unit will have been established within the Department of Environment, adequately trained and equipped to coordinate environmental impact assessments (EIAs) in Jordan. Appropriate EIA legislation will have been enacted and several EIAs will have been undertaken. Development activities within the Azraq Basin potentially impacting on the wetlands of the Ramsar Site will have been evaluated and assessed, and recommendations will have been made concerning appropriate mitigation measures. Guidelines will have been prepared for salt extraction, the development of aquaculture, and the use of agricultural chemicals in and around Azraq Oasis. A permanent monitoring procedure and management strategy will have been developed for the Azraq Ramsar Site and other potential Ramsar Sites in Jordan. These activities will assist the Government of Jordan in fulfilling its obligations under the terms of the Ramsar Convention.

#### Guidelines for agricultural development in Azraq Basin

Investigations will have been carried out on agricultural practices in the Azraq Basin with a view to promoting more efficient irrigation techniques and improved crop selection, and to solving the problem of increasing soil salinity. A series of guidelines will be available for agricultural development in the basin based on sustainable utilization of the limited surface and groundwater resources.

#### Studies on water resources of Azraq Basin

Ongoing studies by the Water Authority of Jordan on the water resources of the Azraq Basin will have been complemented and extended to provide a better understanding of the characteristics of the aquifer systems of the basin, and a water management plan will have been prepared. This will have assessed all existing information, provided an inventory of boreholes and wells in and around the oasis, assessed the present situation with respect to water quality and withdrawal practices, predicted future trends under various scenarios, and established the requirements for sustainable and environmentally sound management of water resources in the basin. Staff of the Ministry of Water and Irrigation will have been trained in water quality monitoring, groundwater modelling, and the analysis of remote sensing data, and will be capable of conducting similar studies in other arid and semi-arid basins in Jordan.

### Long-term studies on water conservation and management

Substantial support will have been given to WERSC to continue and expand its long-term studies on water conservation and management in arid and semi-arid regions. New research will have been carried out on techniques to increase the rate of groundwater recharge through artificial infiltration, and there will be available a series of published reports with practical guidelines relating to water harvesting and the artificial recharge of surface run-off and treated waste water.

#### **3. Target beneficiaries**

Azraq Oasis is an outstanding example of an oasis wetland in an arid region, of considerable international importance for its biodiversity values. The conservation of the oasis will thus be of global benefit in the maintenance of biodiversity. Investigations of the characteristics of the Azraq aquifer systems could lead to the discovery of additional supplies of drinking water for Amman as well as additional water for irrigation purposes, while applied research on artificial infiltration could help to provide long-term solutions to water supply in arid and semi-arid lands. The project would thus be of direct relevance to water conservation and management issues throughout the world's arid regions.

#### **4. Project strategy and implementation arrangements**

##### Strategy

If the important biodiversity values of Azraq Oasis are to be maintained, drastic measures will have to be taken within the next two to three years. The only acceptable solution is one that does not affect either the pumping of water for Amman city or the pumping of water for irrigation purposes. This project will provide such a solution, while at the same time providing considerable support for studies to resolve the much broader issues of water supply for Amman and agricultural development in the Azraq Basin.

##### Implementation

The Azraq component of the project includes five sub-projects which fall within the realms and responsibilities of three ministries, a private NGO (RSCN), and an academic institution (University of Jordan). This component will be nationally executed in association with UNDP. Overall coordination will be provided by the Project Steering Committee, an interministerial steering committee established under the umbrella of the Ministry of Municipal and Rural Affairs and the Environment to coordinate both the Azraq and Dana components of the project. The Project Steering Committee will be chaired by the Minister of Municipal and Rural Affairs and Environment or his representative, and will include representatives from the Ministry of Agriculture, Ministry of Planning, Ministry of Social Affairs, Ministry of Tourism and Antiquities, Ministry of Water and Irrigation, RSCN, WERSC and UNDP.

Responsibility for implementation of the five sub-projects of the Azraq component will be as follows:

- Restoration and management of Azraq Wetland Reserve—RSCN

- Establishment of an EIA unit and implementation of the Ramsar Convention—Department of Environment, Ministry of Municipal and Rural Affairs and the Environment
- Preparation of guidelines for agricultural development—Ministry of Agriculture
- Studies on the water resources of the Azraq Basin—Water Authority of Jordan, Ministry of Water and Irrigation
- Long-term studies on water conservation and management—WERSC, University of Jordan.

As mentioned above, overall coordination for the project will be ensured by the Ministry of Planning. Those project activities which lie outside the immediate expertise and capability of the primary agencies involved will be subcontracted to other local agencies, or to foreign or United Nations agencies, if no suitable local agencies are available.

A small Management Unit will be established for the Azraq component with an Azraq Project Manager and support personnel to provide essential liaison between the Project Steering Committee, UNDP, and the five sub-project managers. It will be housed in the new offices of the RSCN. This unit will be responsible for the day-to-day administration of the Azraq component. The Azraq Project Manager will work under the supervision of the Project Steering Committee and UNDP in order to ensure full coordination among government and NGO counterpart organizations. An administrative officer will be appointed at UNDP to assist in the general administration of both the Azraq and Dana components of the project.

## **5. Reasons for assistance from UNDP/GEF**

The Azraq component of the project seeks to demonstrate how the problem of competitive water resource needs for human consumption, irrigation, and conservation of natural ecosystems can be resolved through integrated water resource management with a focus on groundwater. Azraq Oasis has outstanding biodiversity values which are seriously threatened, but which may still be restored through swift action.

As one of the few significant natural wetlands in a large arid region, it is of major strategic importance for migratory birds, especially waterfowl, raptors, and passerines using the Palearctic-Afrotropical flyway. It belongs to an internationally shared aquifer, and has been recognized as a wetland of international importance under the Ramsar Convention. Rehabilitation of Azraq Oasis has been identified as a high priority in the National Environmental Strategy for Jordan.

The project addresses a priority issue in arid lands (namely water supply), and places emphasis on an integrated "wise use" approach to the utilization of a scarce resource. The project is multidisciplinary, involving a variety of government departments as well as an NGO and an academic institution, and fits in well with ongoing projects and proposed projects for which funding has already been secured. Finally, the project includes long-term research on new technologies for groundwater recharge in arid regions—research which could have wide applicability in arid regions elsewhere in the world.

## **6. Special considerations**

The Azraq component of the project is appropriate for funding by the Global Environment Facility because it falls under one of the four focal areas of the GEF—the protection of biodiversity. Much the most important biodiversity values of the Azraq Oasis relate to the aquatic plant and animal communities of the spring-fed wetlands in the Azraq Wetland Reserve. The restoration and management of these wetlands is thus an essential element of the Azraq component. Unless the supply of fresh water to these wetlands can be significantly increased in the immediate future, the wetlands will lose their unique biodiversity values and the entire Azraq component will lose its validity in the context of the GEF.

## **7. Coordination arrangements**

The Project Steering Committee, established under the umbrella of the Ministry of Municipal and Rural Affairs and Environment, will be the primary link between the Dana and Azraq components, and between related past and ongoing assistance. This committee will meet at regular intervals (every two to three months) to ensure close collaboration between the two main components (Dana and Azraq) as well as the five sub-projects, while the Azraq Project Manager and Sub-project Managers will be responsible for day-to-day coordination of project activities.

Some of the investigations to be carried out by the Water Authority of Jordan under the present project are partly covered under ongoing or planned studies. The Water Authority of Jordan will be responsible for ensuring that there is close coordination between these ongoing or planned water resource investigations and the complementary studies proposed under this project.

## **8. Counterpart support capacity**

The Department of Environment in the Ministry of Municipal and Rural Affairs and Environment, the Department of Plant Production in the Ministry of Agriculture, and the Water Authority of Jordan in the Ministry of Water and Irrigation are already carrying out various activities in project related fields. During the course of project formulation discussions, these three government agencies agreed to provide counterpart staff for the project as well as office accommodation and other facilities for their respective sub-project teams.

WERSC too has already conducted a considerable amount of research relevant to its proposed sub-project activities, and has ample office space and laboratory facilities to house its sub-project team. In addition to its own permanent staff, WERSC has access to a wide range of qualified personnel within the University of Jordan, and will therefore have no difficulty in finding sufficient staff to meet the demands of this project.

The RSCN has recently moved into new offices with adequate space to house the entire Management Unit for the Azraq component, as well as the management unit for the Dana component. RSCN has already agreed to make this office space available to the project. In view of the present limited staffing levels of RSCN, significant institution building will be required from project funds to enable the Society to implement its sub-project of the Azraq component, while at the same time implementing the Dana component.



### **C. DEVELOPMENT OBJECTIVE**

The primary development dimension of the Azraq component of the project is to establish a sustainable basis for the utilization of the water resources of the Azraq Basin for water supply and agriculture, while at the same time conserving the outstanding biodiversity values of the natural wetland ecosystems. Because of the high rates of water extraction, natural spring flow has now ceased, and unless some remedial action is taken soon, much of the biodiversity for which the oasis is particularly important (freshwater plant and animal communities) will be lost, perhaps irrevocably. Similarly, if the present high levels of offtake continue, there is a high probability that within as little as three to five years the freshwater aquifer will become contaminated with saline water from deeper aquifers. This would jeopardize the utility of Azraq water for urban use and agriculture alike.

Rehabilitation of the aquatic ecosystems of the Azraq Oasis has been identified as a high priority in the National Environmental Strategy for Jordan. The project will endeavour to resolve the present institutional stalemate by improving institutional cooperation in the management of water resources in the Azraq Basin, and by adopting an integrated approach to introduce practical and innovative techniques for water management. By conserving a severely threatened wetland of international importance, the project will assist the Government of Jordan in fulfilling its obligations under the Ramsar Convention. At the same time, the project will provide substantial strengthening to RSCN, an NGO which plays a leading role in the maintenance of biodiversity in Jordan.

The Azraq component will have five main sub-components:

- Rehabilitation and management of Azraq Wetland Reserve
- Establishment of an EIA unit within the Department of Environment and improved implementation of the Ramsar Convention in Jordan
- Establishment of guidelines for agricultural development in the Azraq Basin
- Investigation of groundwater resources in the Azraq Basin and development of a water management plan for the basin
- Support for long-term research on the conservation and management of water resources in arid and semi-arid regions.

The project as a whole will provide substantial support for RSCN to upgrade its institutional capacity so as to facilitate implementation of the Azraq and Dana components, initiate similar endeavours in other Jordanian reserves, and increase the scope of its environmental education programme to include all sections of Jordanian Society.

## **D. IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES**

### **IMMEDIATE OBJECTIVE 1**

To halt further degradation of the aquatic ecosystems in the Azraq Wetland Reserve and to restore as much of the reserve as possible to a natural or near-natural condition, with a view to maintaining the biological diversity of this unique wetland ecosystem.

#### **Achievement Indicators**

A core area of the formerly extensive spring-fed wetlands at Azraq Oasis will have been restored to a near-natural condition, and the biodiversity of the wetland ecosystems will have been maintained almost intact. Existing infrastructure at the Azraq Wetland Reserve will have been repaired, a new reserve headquarters and Visitors Centre will have been constructed, and an effective and well trained reserve staff will be in place. A new management plan will have been prepared, and many of the components of the plan will have been implemented. A variety of scientific, educational and recreational opportunities will be available for both national and foreign visitors.

#### **Output 1.1**

Immediate provision of a permanent water supply of between 1.5 to 2.5 MCM per year to the wetland reserve, this water to be of appropriate physico-chemical characteristics to halt further degradation of the aquatic ecosystems and to allow for restoration of a part of the former wetland area.

#### **Activities for Output 1.1**

- 1.1.1 Provide a permanent water supply of between 1.5 to 2.5 MCM per year to the wetland reserve from one or two wells drilled into the upper (Basalt/B5/B4) aquifer or the middle (B2/B1/A7) aquifer.
- 1.1.2 Monitor on a continuous basis the quality of the water being pumped into the marsh and its effects on the aquatic ecosystems. An automatic water quality recorder will be installed to measure temperature, electrical conductivity (EC) or total dissolved solids (TDS) and pH, to ensure that the quality of the water entering the wetland remains within acceptable limits, and to allow for immediate reduction in pumping rate should any problems of increasing salinity become apparent.

**Responsible Parties:** Sub-project and RSCN staff, with the assistance of technicians from the Ministry of Water and Irrigation and subcontractors.

#### **Output 1.2**

Rehabilitation of the Azraq Wetland Reserve.

### Activities for Output 1.2

- 1.2.1 Provide essential staffing and infrastructure to ensure adequate policing and management of the wetland reserve.
- 1.2.2 Extend the boundary of the wetland reserve to incorporate the two Shishan springs (now abandoned by the Water Authority).
- 1.2.3 Repair the fencing around the reserve and extend this to include the two Shishan springs.
- 1.2.4 Remove feral horses and water buffalo from the reserve.
- 1.2.5 Remove abandoned and unnecessary infrastructure (such as small buildings, portions of fencing, and pipelines) and unsightly rubbish from the reserve.

Responsible Parties: Sub-project and RSCN staff, with the assistance of subcontractors.

### **Output 1.3**

The preparation and implementation of a comprehensive management plan for Azraq Wetland Reserve. The objectives of the management plan will be to provide for the better conservation of the wetland habitats of the Azraq Wetland Reserve by:

- Preserving, and where necessary, improving both the habitats for wildlife and the scenic attractions and antiquities
- Providing facilities of an educational, recreational, and scientific nature for both national and foreign visitors.

### Activities for Output 1.3

- 1.3.1 Using the Proposed Management Plan prepared in 1979 as a basis, produce a comprehensive management plan for the Azraq Wetland Reserve.
- 1.3.2 Introduce a system of zonation (strict nature sanctuaries, public access zones, intensive use zones, and so on).
- 1.3.3 Implement wetland management practices designed to make the most efficient use of the limited water resources to maintain the full range of wetland plant and animal communities present in the reserve.
- 1.3.4 Install nature trails, observation towers, and other basic infrastructure (such as a car park, picnic area and toilets) to enable national and foreign visitors to obtain maximum educational and recreational value from a visit to the reserve without compromising any of the wetland's natural qualities.

- 1.3.5 Renovate the Roman wall around Ain Soda spring and promote tourism in the Azraq Oasis in association with other sites of interest nearby (such as Azraq Fort, Qasr Al Amra Castle and the Arabian oryx herd at Shaumari Reserve).
- 1.3.6 Establish a Visitors Centre at Shishan springs, perhaps taking advantage of the existing but now abandoned pump house near Ain Soda, and install appropriate educational awareness exhibits.

**Responsible Parties:** Sub-project staff, RSCN staff and consultants, with the assistance of subcontractors.

#### **Output 1.4**

Training for staff of the Azraq Wetland Reserve, through provision of on-the-job training (using international wetland experts), study tours and training fellowships.

##### **Activities for Output 1.4**

- 1.4.1 Provide on-the-job training to reserve staff in wetland management techniques.
- 1.4.2 Provide a study tour for three RSCN personnel (including the manager and assistant manager of the Azraq Wetland Reserve) to visit appropriate wetland reserves and institutions in the United Kingdom.
- 1.4.3 Provide formal training (a fellowship) in wetland conservation and management techniques for the manager of the Azraq Wetland Reserve.
- 1.4.4 Support participation by an RSCN staff member in the fifth conference of the Ramsar Convention to be held in Japan in June 1993.

**Responsible Parties:** Consultants.

#### **IMMEDIATE OBJECTIVE 2**

To establish a broadly-scoped EIA unit within the Department of Environment with a capability to evaluate, assess, and monitor environmental sites and developments in Jordan. The unit will coordinate government inputs to multisectoral environmental problems. One of the unit's roles will be to service the government's obligations under the Ramsar Convention; one of its first operational tasks will be to assess the impact of existing and ongoing development projects on the wetlands of Azraq Oasis, the nation's only Ramsar Site.

##### **Achievement Indicators**

A small unit will have been established within the Department of Environment, adequately trained and equipped to coordinate the carrying out of environmental impact assessments in

Jordan. Appropriate EIA legislation will have been enacted and several EIAs will have been undertaken. Development activities within the Azraq Basin potentially impacting on the wetlands of the Ramsar Site will have been evaluated and assessed, and recommendations will have been made concerning appropriate mitigation measures.

## **Output 2.1**

Establishment of an EIA unit within the Department of Environment.

### Activities for Output 2.1

- 2.1.1            Develop a four-person core unit comprised of Jordanian staff: a senior EIA coordinator, a technical expert in biodiversity issues, a socio-economist, and an environmentalist with experience in resource management.
- 2.1.2            Devise arrangements to backstop the EIA unit with seconded government personnel and contracted non-government experts (universities, NGOs and individuals).
- 2.1.3            Prepare and enact national EIA legislation in support of the Department of Environment's EIA unit and the EIA process.
- 2.1.4            Undertake EIAs for proposed development projects in Jordan as and when the need arises.

Responsible Parties: Sub-project staff, Department of Environment staff and consultants.

## **Output 2.2**

Assessment of the impact of existing, ongoing, and proposed projects in the Azraq Basin which are having or are likely to have a negative impact on the wetlands of the Azraq Ramsar Site, and design of appropriate mitigation measures wherever possible. This assessment will include a detailed socioeconomic analysis addressing the socioeconomic causes of the degradation of the site as well as proposals for how they can best be addressed.

### Activities for Output 2.2

- 2.2.1            Carry out an assessment of the impacts of the recently constructed Wadi Rajil Dam on Qa Azraq, and identify measures which might be taken to minimize any adverse effects of the dam.
- 2.2.2            Carry out an initial scoping of all proposed dam projects in the Azraq Basin which are likely to impact on the Ramsar Site, preparatory to carrying out full-scale EIAs.
- 2.2.3            Carry out a full socioeconomic assessment of the land uses and practices in the Azraq Basin and how these impact on the overall management of the land

and water resources. This socioeconomic component will be considered an integral part of the EIA activities of the unit.

- 2.2.4 Investigate all past and present salt extraction activities in Qa Azraq with a view to assessing their impact on the ecological character of the site and identifying mitigation measures which might be taken to offset any negative impacts which have occurred in the past.
- 2.2.5 Prepare a set of guidelines for salt extraction in and around the Ramsar Site.
- 2.2.6 Investigate all aquaculture projects in the Azraq Oasis with a view to assessing their impact on the ecological character of the Ramsar Site and identifying mitigation measures which might be taken to offset any negative impacts.
- 2.2.7 Prepare a set of guidelines for the development of aquaculture in the Azraq Oasis.
- 2.2.8 Investigate the use of agricultural chemicals in the Azraq Basin and assess their impact on water quality in the Ramsar Site.
- 2.2.9 Prepare a set of guidelines for the use of agricultural chemicals in the Azraq Basin.

**Responsible Parties:** Sub-project staff, Department of Environment staff and consultants.

### **Output 2.3**

Establishment of a permanent monitoring procedure and management strategy for the Ramsar Site which would be applicable for other significant wetlands in Jordan.

#### **Activities for Output 2.3**

- 2.3.1 Establish a permanent monitoring procedure at the Ramsar Site.
- 2.3.2 Identify possible conflicts of interest between development activities in the region and maintenance of the ecological character of the site.
- 2.3.3 Establish institutional mechanisms whereby such conflicts of interest can be open to debate and resolution.
- 2.3.4 On the basis of activities under Outputs 2.2 and 2.3, prepare a management strategy for the Ramsar Site and other significant wetlands in Jordan.

**Responsible Parties:** Sub-project staff, Department of Environment staff and consultants.

## **Output 2.4**

Promotion of the Ramsar Convention and increased awareness of its implications in Jordan.

### Activities for Output 2.4

- 2.4.1 Prepare a series of informative and educational materials on the Ramsar Convention and its implications in Jordan for dissemination to schools, universities and the mass media.
- 2.4.2 Prepare a display on the Ramsar Convention and the Azraq Ramsar Site to be installed in the proposed Visitors Centre in the Azraq Wetland Reserve.

Responsible Parties: Sub-project and Department of Environment staff in collaboration with RSCN.

## **Output 2.5**

Training for personnel of the Department of Environment's EIA unit and Ramsar Office, through provision of an in-country training workshop, on-the-job training (using international EIA experts), training fellowships, and participation in international seminars and workshops.

### Activities for Output 2.5

- 2.5.1 Provide on-the-job training for staff of the EIA unit and Ramsar Office.
- 2.5.2 Provide an in-country training workshop on policies and procedures for EIAs.
- 2.5.3 Provide formal training (fellowships and training courses) for Department of Environment staff in EIA techniques.
- 2.5.4 Support participation by Department of Environment staff in international seminars, workshops, and conferences on EIA and wetland conservation. This will include participation by two individuals in the Fifth Conference of the Contracting Parties to the Ramsar Convention, to be held in Japan in June 1993.

Responsible Parties: Consultants.

## **IMMEDIATE OBJECTIVE 3**

To provide a series of guidelines for agricultural development in the Azraq Basin aimed at improving agricultural practices and providing more efficient irrigation systems within the basin.

### Achievement Indicators

The availability of a series of guidelines for agricultural development in the Azraq Basin based on sustainable utilization of the limited surface and groundwater resources.

#### **Output 3.1**

A set of guidelines for the rationalization of agricultural development in the Azraq Basin to ensure greater efficiency in irrigation practices and application of fertilizers, better crop selection, and improved soil and water conservation.

#### Activities for Output 3.1

- 3.1.1 Carry out a detailed study of current agricultural activities and irrigation practices (including use of fertilizers) in the Azraq Basin.
- 3.1.2 Investigate the characteristics of return flow through soil strata to determine the influence of irrigation practices on groundwater quality in the Azraq Basin.
- 3.1.3 Prepare soil salinity maps for all cultivated areas and the Azraq Wetland Reserve.
- 3.1.4 Construct an irrigation water quality map for the cultivated areas.
- 3.1.5 Provide a study tour for sub-project staff to visit institutions tackling similar problems in other arid regions.
- 3.1.6 On the basis of the above activities, prepare a set of guidelines for agricultural development in the Azraq Basin.

Responsible Parties: Sub-project staff, Ministry of Agriculture staff and consultants.

### IMMEDIATE OBJECTIVE 4

To develop a water management plan for the Azraq Basin to ensure sustainable and environmentally sound management of water resources throughout the basin.

#### Achievement Indicators

A water management plan for the Azraq Basin will have been completed by the end of the project. The water management plan will have:

- Assessed available data and reports



- Provided an inventory of boreholes and wells in the areas surrounding the Azraq Oasis
- Assessed the present situation with respect to water quality and withdrawal practices, and predicted future trends under various scenarios
- Established the requirements for sustainable and environmentally sound management of the water resources in the basin.

In addition, more staff members from the Ministry of Water and Irrigation will have become familiar with water quality monitoring, groundwater modelling and remote sensing analysis, and will be capable of conducting similar studies in other arid and semi-arid basins in Jordan.

#### **Output 4.1**

An assessment report on the past and present water resource situation in the Azraq Basin with respect to water quality, quantity, and withdrawal practices.

##### Activities for Output 4.1

- 4.1.1 Review and assess previous and ongoing studies and reports relating to the geology, hydrology, hydrogeology, meteorology and soil science of the Azraq Basin.
- 4.1.2 Prepare a detailed workplan for a series of studies designed to complement other ongoing investigations in the Azraq Basin.
- 4.1.3 Conduct an inventory of all boreholes and wells in the area surrounding the Azraq Oasis, with information on location, depth, water level, chemical characteristics and, if available, lithology, well design, yield and water use.
- 4.1.4 Select representative wells for monitoring purposes.
- 4.1.5 Establish a monitoring programme, and monitor water levels, withdrawal practices and chemical characteristics in representative wells not included in the present EEC-funded study.
- 4.1.6 If the need is identified during Activity 4.1.4, drill a maximum of four new monitoring wells, and include these in Activity 4.1.5.

**Responsible Parties:** Ministry of Water and Irrigation staff under the supervision of the Sub-project Manager, assisted by consultants.

#### **Output 4.2**

Establish the characteristics of groundwater flow and water quality in the two upper aquifers

under various recharge and withdrawal conditions, using existing groundwater modelling and water-balance modelling techniques.

#### Activities for Output 4.2

- 4.2.1 Update the Ministry of Water and Irrigation's existing databank with data collected and evaluated under Output 4.1.
- 4.2.2 Conduct a modelling study of groundwater flow in and between the two aquifers under various recharge and withdrawal conditions based on old data in the databank, data entered during the EEC-funded project, and data entered during Activity 4.2.1.
- 4.2.3 Conduct a modelling study of groundwater quality distribution and migration within the aquifers, and possible migration of saline/brackish water between the two aquifers under various recharge and withdrawal conditions.

Responsible Parties: Ministry of Water and Irrigation staff under the supervision of the Sub-project Manager, assisted by consultants.

#### **Output 4.3**

Strengthen the water resources investigation, planning and management capabilities within the Ministry of Water and Irrigation through training of staff in groundwater quality monitoring, groundwater modelling of limestone and fractured rock aquifers, and remote sensing analysis in arid regions.

#### Activities for Output 4.3

- 4.3.1 Provide on-the-job training for Ministry of Water and Irrigation staff in sampling and chemical analysis of groundwater, and modelling of limestone and fractured rock aquifers.
- 4.3.2 Provide formal training for government staff in sampling and chemical analysis of groundwater, modelling of limestone and fractured rock aquifers, and remote sensing analysis, through fellowships and training courses abroad, preferably using data from the Azraq Basin.

Responsible Parties: Consultants.

#### **Output 4.4**

Establish the requirements for sustainable and environmentally sound management of the water resources in the Azraq Basin, based on data collected during previous studies, data compiled and analyzed under the EEC-funded study, and information gathered under Output

4.1, using the tools provided by the UNDP-funded project, Strengthening of the National Capacity in Water Resources Planning (JOR/92/007).

#### Activities for Output 4.4

- 4.4.1 Forecast future water needs in the basin under various scenarios with the aid of existing modelling tools.
- 4.4.2 Analyze the results of Output 4.2 with respect to the future water availability and needs in the basin.
- 4.4.3 Assess the options available to ensure sound management of the water resources in the basin.
- 4.4.4 Prepare a water management plan for the Azraq Basin.

Responsible Parties: Ministry of Water and Irrigation staff under the supervision of the Sub-project Manager, assisted by consultants.

### IMMEDIATE OBJECTIVE 5

To seek practical and applicable measures for the conservation of groundwater resources in arid and semi-arid regions, through enhancing natural groundwater recharge and evaluating artificial recharge; and to prepare guidelines for the investigation and design of water harvesting schemes in arid and semi-arid regions.

To disseminate the results of this research through publication of research reports and guidelines on water harvesting, artificial recharge of surface run-off and treated waste water, and water conservation and management practices in arid and semi-arid regions.

#### Achievement Indicators

Availability of published research reports and practical guidelines relating to water harvesting, artificial recharge of surface run-off and treated waste water, and water conservation and management practices in arid and semi-arid regions.

Responsible Parties: All outputs and activities will be subcontracted to WERSC at the University of Jordan.

#### **Output 5.1**

Selection and establishment of one or more representative research areas for field studies of water harvesting and artificial recharge of surface run-off and treated waste water in an arid region.

### Activities for Output 5.1

- 5.1.1 Compile and assess available data on the geology, hydrology, hydro-geology, meteorology and topography as well as environmental conditions of possible areas, and select one or more suitable study areas.
- 5.1.2 Prepare the land at the study area(s), through levelling, construction of dykes, and so on.
- 5.1.3 Install appropriate instruments in the study area(s) to monitor surface flow, precipitation, evaporation, evapo-transpiration, humidity, and so on.
- 5.1.4 Install soil moisture sampling systems and monitoring wells to monitor and sample groundwater and surface water in the vadose zone.
- 5.1.5 Install drain discharge recorders, parshal flumes, weirs, and so on, in the study area(s) to calculate the optimal leaching requirement that would prevent salt accumulation and increased salinity.

### **Output 5.2**

Collection, assessment and analysis of data relating to precipitation, surface flow, evaporation, evapo-transpiration and infiltration within the study area(s), and establishment of a rainfall/run-off model for the study area(s).

### Activities for Output 5.2

- 5.2.1 Monitor the surface flow in major wadis in the catchments of the study area(s). The monitoring process will be carried out with the aid of automatic water level recorders and hydrometers installed in representative wadis during Activity 5.1.3.
- 5.2.2 Collect and analyze data on the amount and intensity of rainfall, temperature, humidity, wind speed, solar radiation and evaporation from the agrometeorological station(s) established during Activity 5.1.3, and from other existing meteorological stations representative of the study area(s). These data will be used to calculate evaporation and evapo-transpiration.
- 5.2.3 Perform soil surveys with respect to the available water and land allocation in the study area(s). Maps, aerial photographs and remote sensing images will be used together with field visits, to gain an understanding of the water supply potential, soil fertility, facility of transportation routes, and so on, as well as constraints of slope instability, erosion, floods and drought hazards. These data will be merged with data related to geology, geomorphology, lithology, soil type and land use/cover, and used as input data for a rainfall/run-off model.

- 5.2.4 Develop a mathematical rainfall/run-off model for the purpose of calculating the water harvesting and artificial recharge potential in the study area(s). This model will use data on: characteristics of the aquifers, measurements of run-off in the major wadis in the study area(s), and the soil and land surveys, and will be developed further to be applicable in similar areas elsewhere.

### **Output 5.3**

Assessment of the potential for using treated waste water in artificial recharge, and establishment of a procedure to monitor changes in the quality of groundwater. Determination of the optimal rate for application of treated waste water and artificial recharge of surface run-off to minimize undesirable effects on soil and groundwater quality.

#### **Activities for Output 5.3**

- 5.3.1 Collect and analyze water samples from different depths in the soil moisture sampling systems and monitoring wells (see Activity 5.1.4). The chemical and physical parameters of the water will be measured once every month. These parameters will include: temperature, electrical conductivity, pH, Eh, total dissolved solids (TDS), sodium, calcium, potassium, magnesium, chloride, nitrate, sulphate, hydrogen carbonate, phosphate and trace elements. In addition, total organic carbon (TOC), chemical oxygen demand (COD), biological oxygen demand (BOD), ammonium and nitrite will be measured in the case of waste water. Biological parameters will also be measured for the groundwater, waste water and infiltrated water. These will include: total viable counts, total and faecal coliforms, and nematodes.
- 5.3.2 Calculate the optimal leaching requirement that would prevent salt accumulation and increased salinity.
- 5.3.3 Assess the change in water quality of treated waste water and surface run-off during infiltration, and any resulting changes in soil characteristics such as structure, porosity, bulk density, permeability, organic content, pH, electrical conductivity, calcium carbonate and infiltration rate.

### **Output 5.4**

Establishment of guidelines for water harvesting through artificial recharge of surface run-off and treated waste water as a means of conserving and managing scarce water resources in arid and semi-arid regions.

#### **Activities for Output 5.4**

- 5.4.1 Prepare guidelines for identifying areas with a potential for natural recharge of groundwater using maps, aerial photographs and satellite data. Describe the methodology for field investigations required at these sites.

- 5.4.2** Perform EIAs in the study area(s) as follows:
- Evaluate the impact of small-scale and large-scale water harvesting on wetland ecosystems
  - Evaluate the impact of water conservation measures on the ecosystem
  - Assess the environmental impact of using treated waste water in artificial recharge.
- 5.4.3** Based on Outputs 5.2 and 5.3 and Activities 5.4.1 and 5.4.2, assess present practices regarding design, construction, operation and maintenance of water harvesting and artificial infiltration schemes in arid and semi-arid regions and, if necessary, suggest changes in these practices.
- 5.4.4** Conduct and participate in local and international seminars and training courses in related fields. These would include:
- Seminars:**
- Conservation and management of water resources in arid and semi-arid regions
  - Artificial recharge in arid and semi-arid regions
  - The use of treated wastewater in artificial recharge
  - Design of water-retention, infiltration and abstraction structures.
- Training:**
- Groundwater and artificial recharge modelling
  - Rainfall/run-off modelling
  - The use of Geographic Information Systems with data from the Systeme Probatoire d'Observation de la Terre (SPOT) and other remote sensing data.
- 5.4.5** Document the findings and conclusions of the study in reports and publications.
- 5.4.6** Prepare a special publication on guidelines for water harvesting, artificial recharge of surface run-off and treated waste water, and water conservation and management practices in arid and semi-arid regions.

## IMMEDIATE OBJECTIVE 6

To strengthen the capability of the RSCN to manage the Azraq Wetland Reserve, Dana Reserve and other protected areas in Jordan, and to foster environmental education and public awareness.

(This objective will be cost-shared by the Azraq and Dana components of the project. The outputs and activities under this objective are given under Immediate Objective 2 in the Dana section of this document. An allocation of US \$300,000 has been made for this objective from the Azraq component budget.)

### **E. INPUTS**

#### Justification for procurement of equipment proposed for the project

The equipment under this project component will be procured by the government/RSCN according to UNDP rules and regulations and will be essential to the achievement of project objectives, and in particular to the development and transfer of knowledge and skills to the national counterparts. The equipment provided to national institutions could not be acquired by the government in the absence of hard currency and specific technical know-how.

All equipment used by the project will be operated by staff trained in the use and operation of such equipment.

The National Project Manager will determine the exact specifications of the required equipment and ensure that the acquisition of equipment will be made on the basis of (i) the best quality including productivity and durability at the lowest possible price, (ii) costs, availability and productivity of spare parts, and (iii) costs of operation and maintenance. The final list of required equipment will be determined upon the appointment of the Project Manager.

#### Justification for budget line 43.00—Premises

RSCN will be managing the Azraq Wetland Reserve. In order to facilitate proper management and protection of the reserve, and to ensure that the flow of visitors and tourists is well regulated, the following premises will be constructed:

1 Reserve Headquarters	US \$20,000
2 Ranger Stations	US \$20,000
1 Visitors Centre	US \$30,000

The RSCN, being an NGO, is unable to fund the construction of these basic premises. Project funding is therefore being allocated for this purpose. RSCN will finance the management, maintenance, and all running costs of the buildings.

## 1. Government of Jordan

Total US\$ 456,560

### Personnel (national staff)

US\$ 178,660

- The government will designate a suitable individual to act as a focal point in the Ministry of Municipal and Rural Affairs and Environment to follow up the day-to-day activities of the project, and to ensure coordination with the project's Management Unit. This person will act as liaison between the Minister of Municipal and Rural Affairs and Environment and the Azraq Project Manager.
- The Ministry of Agriculture, the Ministry of Municipal and Rural Affairs and Environment, and the Ministry of Water and Irrigation will select and provide suitable counterparts to work alongside the respective Sub-project Managers and to be directly involved in carrying out project activities.
- The Ministry of Water and Irrigation will also provide a variety of professional staff and technicians to work with the sub-project team. These will include: a water resources planner, a surface water hydrologist, two other hydrologists, a hydrochemist, a programmer, a mathematical modeller, a computer drafting technician and two data entry technicians.
- The Ministry of Municipal and Rural Affairs and Environment and the Ministry of Water and Irrigation will provide secretaries (36 man-months (mm)) and office clerks/technicians (108 mm) to assist the sub-project teams in carrying out their tasks.

The following personnel will be provided by the government:

Liaison Officer (MMRAE)	36 mm
Deputy Sub-project Manager (Environment)	36 mm
Deputy Sub-project Manager (Agriculture)	18 mm
Deputy Sub-project Manager (Water & Irrigation)	36 mm
Water Resources Planner	30 mm
Surface Water Hydrologist	36 mm
Hydrologists (2)	72 mm
Hydrochemist	30 mm
Programmer	4 mm
Mathematical Modeller	30 mm
Computer drafting technician	30 mm
Data entry technicians	45 mm
Secretaries/office clerks	144 mm

### Training

The Department of Environment, Ministry of Agriculture, Ministry of Water and Irrigation, RSCN and WERSC will nominate staff for training fellowships and participation in study tours, seminars and workshops.



Office accommodation, facilities and supplies

US \$225,900

- RSCN will provide office accommodation for the Project Management Unit (four offices) in its offices in Amman, and accommodation for visiting consultants at its guest house at Azraq (4 mm)
- The Department of Environment will provide the necessary office accommodation and other facilities for the EIA unit and short-term staff and consultants associated with its activities under the project
- The Ministry of Agriculture will provide the necessary office accommodation for its sub-project team, including short-term national and international experts
- The Ministry of Water and Irrigation will provide the necessary office accommodation for its sub-project team and counterpart staff (ten offices), and will cover a major part of the office running costs
- WERSC will provide office accommodation (six offices) and laboratory facilities for its sub-project team, and will cover the office running costs.

Equipment

US \$52,000

The Ministry of Agriculture, Ministry of Water and Irrigation, and WERSC will allow their respective sub-project teams to use existing office, laboratory, and field equipment as required to carry out project activities, and will undertake some of the basic laboratory tests and analyses.

Information

All participating agencies will make available existing data and other information which may be required to enable the sub-project teams to carry out their activities.

**2. UNDP/GEF**

US \$3 million

Personnel

US \$1,289,700

Project Manager	36 mm
Executive Secretary	36 mm
Sub-project Managers	126 mm
National experts	429 mm
Administrative/support staff	633 mm
Reserve rangers	72 mm
Local consultants	31 mm
International consultants	21 mm
International experts	36 mm
Missions	

Subcontracts

US \$624,500

<b><u>Training</u></b>		US \$299,000
	Fellowships	33 mm
	Study tours	5 mm
	International seminars/workshops	6 mm
	In-country seminars	

**Equipment** US \$556,000

**Miscellaneous** Operations and maintenance, reporting, field office support cost US \$231,092

**Reimbursement to field office** for services provided in relation to GEF projects (see also budget line 54.00)

Experience indicates that field offices are incurring a significant workload in relation to the identification, formulation, processing, support and monitoring of GEF projects. In line with UNDP's financial regulations such support must be reimbursed, and should be charged to the project budget.

The field office therefore requests reimbursement for the following services provided during implementation of this project:

- National Professional Officer to assist in the backstopping of the project and to assist the executing agent in project management on a daily basis (three years—US \$40,000)
- Locally recruited administrative assistant/secretary to assist National Professional Officer in the execution of daily monitoring and duties (three years—US \$30,000)
- Monitoring/field travel of programme staff, four times, three days per year (daily allowance, travel, rental of vehicles, and so on—US \$5,000)
- Sundries: communication, office supplies, and so on (US \$4,000)
- Contingencies (US \$8,212).

Total: US \$87,212

**Project Management Unit (Azraq Component)** US \$274,855

**Personnel** US \$206,305

Azraq Project Manager (National Coordinator)	36 mm
Executive Secretary	36 mm
Administrative/support staff	144 mm

<u>Equipment</u>	US \$48,750
<u>Miscellaneous</u> (Operations and maintenance, reporting, and so on)	US \$19,800
<b>Restoration and management of Azraq Wetland Reserve</b>	<b>US \$929,135</b>
<u>Personnel</u>	US \$349,735
Sub-project Manager (international expert)	36 mm
National experts	72 mm
Administrative/support staff	72 mm
Reserve rangers	72 mm
Local consultants	4 mm
International consultants	4 mm
<u>Subcontracts</u>	US \$364,500
Provision of two wells	
Installation of water control structures	
Repairs to fencing and gates	
Cleaning-up operations	
Restoration of archaeological sites	
Removal of feral water buffalo and horses	
Construction of nature trails, bridges, observation hides, and so on	
Construction of car park, picnic area, toilets, and so on	
<u>Training</u>	US \$35,000
Fellowships	2 mm
Study tours	1.5 mm
International seminars/workshops	0.5 mm
<u>Equipment</u>	US \$72,700
<u>Premises</u> (see above)	US \$70,000
<u>Miscellaneous</u> (Operations and maintenance, reporting, and so on)	US \$37,200
<b>Establishment of an EIA unit and implementation of the Ramsar Convention</b>	<b>US \$372,356</b>

<b><u>Personnel</u></b>	US \$195,356
Sub-project Manager	36 mm
National experts	72 mm
Administrative/support staff	108 mm
Local consultants	9 mm
International consultants	4 mm
<b><u>Training</u></b>	US \$60,000
Fellowships	4 mm
International seminars/workshops	2 mm
In-country seminar	
<b><u>Equipment</u></b>	US \$91,500
<b><u>Miscellaneous</u></b> (Operations and maintenance, reporting, and so on)	US \$25,500
<b>Guidelines for agricultural development in the Azraq Basin</b>	US \$241,626
<b><u>Personnel</u></b>	US \$140,546
Sub-project Manager	18 mm
National experts	18 mm
Administrative/support staff	90 mm
Local consultants	18 mm
International consultants	3 mm
<b><u>Subcontracts</u></b>	US \$10,000
Geochemical analyses	
Soil analyses	
Water quality analyses	
<b><u>Training</u></b>	US \$15,000
Study tours	1.5 mm
<b><u>Equipment</u></b>	US \$62,700
<b><u>Miscellaneous</u></b> (Operations and maintenance, reporting, and so on)	US \$13,380
<b>Studies on water resources of Azraq Basin</b>	US \$732,057

<b><u>Personnel</u></b>	<b>US \$228,957</b>
Sub-project Manager	36 mm
National experts	30 mm
Administrative/support staff	108 mm
International consultants	8 mm

**Subcontracts** **US \$200,000**

**Training** **US \$152,000**

Fellowships	21 mm
Study tours	2 mm
International seminars/workshops	2 mm
In-country seminars	

**Equipment** **US \$130,100**

**Miscellaneous (Operations and maintenance, reporting, and so on)** **US \$21,000**

**Long-term studies on water conservation and management** **US \$365,592**

The whole of this sub-project will be subcontracted to WERSC at the University of Jordan.

**Personnel** **US \$168,347**

Team leader (part time)	36 mm
National experts	237 mm
Administrative/support staff	111 mm
International consultants	2 mm

**Subcontracts** **US \$50,000**

**Training** **US \$37,000**

Fellowships	6 mm
In-country seminars	

**Equipment** **US \$80,250**

**Miscellaneous (Operations and maintenance, reporting, and so on)** **US \$30,000**

## **F. RISKS**

If the Azraq component of the project is to achieve its primary objective of maintaining the unique biodiversity of the wetland ecosystems of Azraq Oasis, it is essential that an adequate supply of water of suitable quality be made available to replace the former natural spring flow, and that this supply of water be guaranteed for the foreseeable future.

A firm commitment must be obtained from all parties concerned to ensure that the water supply to be provided during the project will be maintained beyond the duration of the project, and until such time as the springs begin to flow naturally again, and in sufficient quantity to maintain the wetlands in their restored condition. If the water supply is cut off at the end of the project, the wetlands will rapidly deteriorate again, and much of the effort made for the restoration and management of the reserve will have been wasted.

## **G. PRIOR OBLIGATIONS AND PREREQUISITES**

### Prior Obligations

None.

### Prerequisites

1. The Government of Jordan will establish an interministerial Steering Committee, chaired by the Minister of Municipal and Rural Affairs and Environment, to coordinate the implementation of project activities in the Azraq Basin. This committee, which will also serve as the Steering Committee for the Dana component of the project, should include as its members the Secretaries General of the Ministries of Agriculture, Planning, and Water and Irrigation, as well as the President of the RSCN, the Director of WERSC, and a representative of UNDP.
2. The Government of Jordan will designate an individual within the Ministry of Municipal and Rural Affairs and Environment to follow up the day-to-day activities of the project, and to coordinate with the Azraq Project Management Unit. This person will act as liaison between the Minister of Municipal and Rural Affairs and Environment, the Steering Committee, and the Azraq Project Manager.
3. The Government of Jordan will designate counterpart staff in the Ministry of Agriculture, Ministry of Municipal and Rural Affairs and Environment (Department of Environment), and the Ministry of Water and Irrigation, who will participate full time in the project.
4. The Government of Jordan and all parties concerned in the Azraq component of the project should agree that a supply of fresh water will be provided to the spring-fed marshes in the Azraq Wetland Reserve at the start of the project, and that this supply of water will be guaranteed for at least five years. The supply of water should amount to an absolute minimum of 1.5 MCM per year, and preferably between 2.0 and 2.5 MCM.

5. The Government of Jordan agrees to transfer jurisdiction of the small parcel of land around the Shishan springs from the Ministry of Water and Irrigation to the RSCN, so that this land and the springs can be fully incorporated within the Azraq Wetland Reserve.
6. The Government of Jordan agrees to waive customs duty on those pieces of equipment and materials provided by the project, so that they can be handed over at the end of the project to the relevant implementing agencies as part of the general institutional strengthening component of the project.
7. The Project Document will be signed by UNDP, and UNDP assistance to the project will be provided, subject to UNDP receiving satisfaction that the prerequisites listed above have been fulfilled or are likely to be fulfilled. When anticipated fulfilment of one or more prerequisites fails to materialize, UNDP may, at its discretion, either suspend or terminate its assistance.

#### **H. PROJECT REVIEW, REPORTING AND EVALUATION**

The Azraq component of the project will be subject to review by representatives of the government, World Bank, and UNDP at least once every twelve months, with the first such meeting to be held within the first twelve months of the start of full implementation. The National Coordinator for the Azraq component shall prepare and submit to each review meeting a Project Performance Evaluation Report (PPER). Additional PPERs may be requested, if necessary, during the project.

A terminal report for the Azraq component will be prepared by the Azraq component manager for consideration at the terminal review meeting. It shall be prepared in draft sufficiently in advance to allow review by the government, World Bank, and UNDP at least four months prior to the terminal review. This terminal report will include a series of action-oriented recommendations for the management of water resources and the maintenance of biodiversity in the Azraq Basin, based on the outputs of the five sub-components of the Azraq project.

The Azraq component of the project shall be subject to evaluation eighteen months after the start of full implementation, and three months prior to the scheduled termination. The organization, terms of reference, and precise timing will be decided after consultation between the parties to the Project Document.

In view of the importance of water availability to the success of this component of the project, close monitoring will be carried out by the UNDP Office regarding the fulfillment of prerequisite 4, listed above.

The Project Manager will therefore report to the UNDP Office regarding water availability in a separate narrative report to be submitted six months after signature of the project, and every six months thereafter. This report will be forwarded to UNDP Headquarters for review and comments.

Of particular importance is the illegal and unlicensed usage of water resources which, at the moment, is causing severe stress on the aquifers supporting the Azraq Basin. To ensure a sustainable supply of water to the Azraq Wetlands and the city of Amman, the natural spring flow must return as pumped supplies for the wetlands do not provide a long-term solution to the problem. The Ministry of Water and Irrigation is working towards finding solutions to the recurring problem of unlicensed usage.

The first annual project review will consider the two six-monthly narrative water reports which the Project Manager will have submitted, and will determine if prerequisite 4 is being fulfilled, and whether successful project implementation is viable. Subsequent annual project reviews will also review the six-monthly narrative reports and recommend actions for the project to attain its objectives. If corrective actions are not taken, the project reviews will assess whether the project merits continued support.

Output 4 of the project will produce a Water Management Plan (project months 24 to 27). This plan will outline sustainable yields from the Azraq aquifers, and its adoption and implementation should assure the conservation of the Azraq Wetlands as well as the city of Amman's water supply.

## **I. LEGAL CONTEXT**

This Project Document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the Government of the Hashemite Kingdom of Jordan and UNDP signed by the parties on 12 January, 1976. The host country implementing agencies shall, for the purpose of the Standard Basic Assistance Agreement, refer to the government cooperating agency described in that agreement.

The following types of revisions may be made to this Project Document with the signature of the UNDP Resident Representative only, provided he or she is assured that the other signatories have no objections to the proposed changes:

- Revisions in, or additions to, any of the annexes of the original Project Document
- Revisions which do not involve significant changes in the immediate objectives, outputs or activities of a project, but are caused by the rearrangement of inputs agreed to or by cost increases due to inflation
- Mandatory annual revisions which rephrase the delivery of agreed project inputs or increased expert or other costs due to inflation, or take into account agency expenditure flexibility.

## **J. BUDGET**

The combined budget showing government and GEF inputs for both the Dana and Azraq project components is attached.



**Project Budget**  
(combining government and World Bank sub-budgets)

Project Number: JOR/92/G31/A/1G/99  
 Project Title: Conservation of the Dana and Azraq Protected Areas  
 Source of Funds: GEF  
 Executing Agent: Government of Jordan  
 Cooperating Agency: World Bank

B/L	Item	Agency	Total	1992	1993	1994	1995	1996
	Personnel							
11.01	Director of Conservation	IBRD	250,000	0	51,000	83,000	78,000	38,000
11.02	Socio-Eco Dev Comp Mngr	IBRD	150,000	0	31,500	50,000	45,000	23,500
11.03	Scientific Res Coordinator	IBRD	75,000	0	44,000	31,000	0	0
11.04	Wetlands Mgt Expert-RSCN	GOVT	198,000	0	66,000	66,000	66,000	0
11.51	Project design	IBRD	115,000	0	115,000	0	0	0
11.52	Institutional needs	IBRD	25,000	0	25,000	0	0	0
11.53	Socio-economic appraisal	IBRD	80,000	0	60,000	10,000	10,000	0
11.54	Mineral activities	IBRD	20,000	0	20,000	0	0	0
11.55	Ecotourism	IBRD	25,000	0	0	25,000	0	0
11.66	Staff dev & training	IBRD	88,000	0	40,000	24,000	24,000	0
11.67	Monitoring & evaluation	IBRD	95,000	0	35,000	25,000	35,000	0
11.97	International consultants	GOVT	378,000	5,564	127,715	156,247	88,474	0
13.01	Administrative support	GOVT	199,320	0	66,440	75,710	57,170	0
16.00	Mission costs	GOVT	85,221	0	45,000	20,221	20,000	0
16.01	Field travel	GOVT	17,690	0	5,750	6,000	5,940	0
17.01	NPPP	GOVT	410,700	0	143,480	149,460	117,760	0
19.99	Component total		2,211,931	5,564	875,885	721,638	547,344	61,500
20.00	Sub-contracts							
21.00	Sub-contract 1	IBRD	2,187,000	0	747,000	655,000	555,000	230,000
22.00	Sub-contract 2	GOVT	624,500	0	562,000	62,500	0	0
29.00	Component total		2,811,500	0	1,309,000	717,500	555,000	230,000
30.00	Training							
31.00	Fellowships	GOVT	165,000	0	62,500	95,000	7,500	0
32.00	Study tour	GOVT	65,000	0	20,000	40,000	5,000	0
34.00	Int'l conf/seminars	GOVT	45,000	0	20,000	15,000	10,000	0
35.00	In-country seminars	GOVT	24,000	0	17,000	3,500	3,500	0
39.99	Component total		299,000	0	119,500	153,500	26,000	0

**Project Budget**  
(combining government and World Bank sub-budgets)

Project Number: JOR/92/G31/A/1G/99  
 Project Title: Conservation of the Dana and Azraq Protected Areas  
 Source of Funds: GEF  
 Executing Agent: Government of Jordan  
 Cooperating Agency: World Bank

B/L	Item	Agency	Total	1992	1993	1994	1995	1996
40.00	Equipment							
41.00	Expendable equipment	GOVT	77,500	0	47,000	16,000	14,500	0
42.01	Non-expendable equipment	IBRD	170,000	0	122,000	32,000	16,000	0
42.02	Non-expendable equipment	GOVT	426,500	0	392,500	22,500	11,500	0
43.00	Premises	GOVT	70,000	0	40,000	0	30,000	0
49.99	Component total		744,000	0	601,500	70,500	72,000	0
50.00	Miscellaneous							
51.00	Operations and maintenance	GOVT	89,000	0	31,000	31,000	27,000	0
52.00	Reporting cost	GOVT	18,000	0	1,000	7,500	9,500	0
53.01	Sundries	IBRD	20,000	0	5,000	5,000	5,000	5,000
53.02	Sundries	GOVT	19,190	0	6,250	6,500	6,440	0
54.00	Direct cost FO support (3%)	DIRECT	87,379	0	49,956	22,834	14,589	0
59.00	Component total		233,569	0	93,206	72,834	62,529	5,000
99.00	TOTAL		6,300,000	5,564	2,999,091	1,735,972	1,262,873	296,500

**WORKPLAN FOR KEY ACTIVITIES**

Activity	Lead agent	Year 1 (quarters)				Year 2 (quarters)				Year 3 (quarters)				
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	
<b>1. DEFINITION OF DANA RESERVE</b>														
Define & survey reserve borders	RS													
Prepare & endorse conservation legislation	IUCN/GOJ													
Mark reserve boundary	RS													
<b>2. ASSESSMENT OF STATUS OF BIODIVERSITY OF DANA RESERVE</b>														
Finalize design of lab. & accommodation. Tender & award construction subcontract	AS/PC RS													
Construct Dana Reserve laboratory & accommodation	PC/RS													
Equip laboratory with furnishings & basic research facilities	RSS													
Purchase basic field research equipment	RSS/RS													
Identify research supervisors & students, & initiate postgraduate research programmes	RSS/RI													

WORKPLAN FOR KEY ACTIVITIES													
Activity	Lead agent	Year 1 (quarters)				Year 2 (quarters)				Year 3 (quarters)			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Postgraduate research programmes (biodiversity and grazing effects)	RSS/ RI												
Design Dana research activities to be conducted by Dana & RSCN field staff	RSS/RS WE/DSC												
On-site training for reserve staff in monitoring wildlife & livestock populations	RSS/RS DSC												
Monitoring of wildlife & livestock populations by RSCN field staff	DSC/RS/ RSS/WE												
<b>3. DANA MANAGEMENT PLAN AND GEOGRAPHIC INFORMATION SYSTEM</b>													
Identify, recruit & field Dana Scientific Coordinator & technical staff	WB/RS RSS												
Purchase of CMS & GIS equipment & commencement of training for RS/RSS staff	DSC/RS RSS/WB												
Preparation of Dana Reserve management plan outline	DSC/RS RSS												
Conduct low-level aerial photographic survey of Dana Reserve	RSCN GOJ												
GIS training: production of large-scale topographical map of Dana Reserve	DSC/RS RSS												
Add water sources, major vegetation zones, geology, large & endangered species	DSC/RS RSS												

**WORKPLAN FOR KEY ACTIVITIES**

Activity	Lead agent	Year 1 (quarters)				Year 2 (quarters)				Year 3 (quarters)						
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th			
Add details of flora/fauna, ranges of domestic & endangered species, & human activities	DSC/RS RSS															
Reintroduce, tend & monitor indigenous flora	RS/SED															
<b>4. SOCIO-ECONOMIC COMPONENT</b>																
Identify & recruit Socio-Economic Development Component Manager	RS/RSS WB															
Socio-economic survey of needs of groups impacting on reserve resources	WB/SED RS/RSS															
Review feasibility & implications of recommendations of socio-economic survey	SED/RS RSS															
Implement selected development proposals recommended & supported by survey	SED/RS PA															
Establish association of Dana terrace land owners & plan for terrace rehabilitation	SED/RS															
Rehabilitate terrace gardens, build access track & drip irrigation system	SED/RS PC															
Conduct market survey of possible crops & indigenous herb species	SED/RS															
Agricultural extension services—introduce crops & establish marketing system	SED/RS GOJ															

**WORKPLAN FOR KEY ACTIVITIES**

Activity	Lead agent	Year 1 (quarters)				Year 2 (quarters)				Year 3 (quarters)								
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th					
Agricultural extension assistance with horticulture & marketing	SED/GOJ																	
Investigate opportunities for ecotourism development	SED/RS WB																	
Investigate & develop opportunities for archaeological tourism	SED/RS ACOR																	
<b>5. STRENGTHENING OF RSCN</b>																		
Identify and recruit DC; section heads for RSS, PA, FPR; technical & support staff	WB/RSCN																	
Reorganize system of voluntary input	RSCN																	
Adoption of new management structures & introduction of new terms & conditions	RSCN																	
Establishment of new financial support systems	DG/FPR																	
Establishment of new facilities	AS																	
All sections prepare & update objective, focused action & financial plans	All sections																	

**Legend:** ACOR: American Center for Oriental Research  
AS: Administration Section

**CMS:** Conservation Management Systems  
**DC:** Director of Conservation  
**DG:** Director General  
**DSC:** Dana Scientific Coordinator  
**FPR:** Fundraising and Public Relations Section  
**GIS:** Geographic Information System  
**GOJ:** Government of Jordan  
**IUCN:** World Conservation Union  
**PA:** Public Awareness and Education Section  
**PC:** Private Contractor  
**RI:** Research Institutes  
**RS:** Reserve Section  
**RSCN:** Royal Society for the Conservation of Nature<sup>8</sup>  
**RSS:** Research and Surveys Section  
**SED:** Socio-Economic Development Component Manager  
**WB:** World Bank  
**WE:** Wildlife Enforcement Section

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<sup>8</sup> This designation is used when all section heads, senior staff, relevant voluntary committees, the Board of Directors, and the President of the Board of Directors are involved in implementing the initiative.

## Annex 2

### CHRONOLOGY OF EVENTS AT AZRAQ OASIS

- 1922: Azraq Oasis visited by Colonel R. Meinertzhagen and described as "a perfect paradise for birds with green meadows, pools and bushes."
- 1950s: Commencement of pumping of water from springs to Druze village and Irbid city.
- 1963: First of a series of four detailed surveys by teams of British ornithologists (1963, 1965, 1966 and 1967).
- 1965: Azraq Oasis declared a reserve by Royal Proclamation.
- 1966: Draft Management Plan "Azraq Desert National Park" produced by Hemsley and George, and published by the International Biological Programme.
- 1968: International Biological Research Station established with Dr. J.B. Nelson as Director.
- 1969: International Biological Research Station closed on the orders of the Iraqi Army.
- 1970: Fifty-four unlicensed wells dug in oasis to provide water for irrigation.
- 1971: Digging of wells for irrigation purposes prohibited.
- 1975: Natural flow in northern (Druze) springs much reduced.
- 1977: Government of Jordan acceded to the Ramsar Convention and designated Azraq Oasis for inclusion in the List of Wetlands of International Importance. Establishment of the Azraq Wetland Reserve (1,255 hectares). Responsibility for management of the reserve delegated by the Ministry of Agriculture to RSCN.
- 1979: Management Plan for Azraq Wetland Reserve prepared for RSCN by P.J. Conder under a joint IUCN/WWF project.
- 1981: Fifteen wells dug by the Water Authority of Jordan to provide water for Amman.
- 1982: Commencement of pumping of water to Amman. Pumping stopped following protestations from RSCN but resumed later in the year.
- 1984: Digging of unlicensed wells for irrigation purposes resumed.
- 1985: Hunting declared illegal in Azraq Oasis.
- 1987: Recommendation 3.8 of the Third Conference of the Contracting Parties to the Ramsar Convention called for a proper assessment of the environmental impact of pumping and



suggested that the level of extraction be reduced by at least 50 percent. Special Cabinet Committee formed by the Prime Minister to study the situation and suggest a plan to save the wetlands. The Cabinet Committee approved a "safe yield" of 20 MCM per year identified by the Water Authority and recommended that 14 MCM be allocated for Amman water supply, 3.5 MCM for irrigation, and 2.5 MCM for natural discharge from the springs. The Ministry of Agriculture issued an Agricultural Policy for the Azraq Area based on an allocation of 3.5 MCM of water per year for irrigation. Northern (Druze) springs ceased to flow.

- 1989: Publication of Azraq Basin Water Resources Study by Water Authority of Jordan.
- 1990: A team from the Ramsar Convention Bureau visited Azraq Oasis to carry out the convention's monitoring procedure, and submitted a full report with thirteen recommendations to the Jordanian Government. Total extraction of water estimated at almost 40 MCM (16 to 17 MCM for Amman, 22 to 23 MCM for irrigation).
- 1991: Rehabilitation of the Azraq Oasis identified as an urgent priority in the National Environmental Strategy for Jordan. Government approval given on 27 July for construction of a dam on the Wadi Rajil, 45 kilometres north of Azraq. Initiation of Ground Water Investigation in the Azraq Basin with funding from EEC. Natural spring flow in November estimated at only 300,000 to 400,000 cubic metres per year.
- 1992: Construction of Wadi Rajil dam completed. Natural spring discharge had fallen to an estimated 200,000 to 250,000 cubic metres per year by early June and ceased completely by early August. Entire Wetland Reserve dry by early December, with underground fires in former marsh area. Surface water present only in the two spring pools at Shishan, with no signs of any spring discharge (water murky and stagnant, with abundant algal growth). Wadi Rajil dam flooded in early December following heavy rains in catchment, but no water reached Qa Azraq, which remained dry.

**Annex 3**

**RECOMMENDATION 3.8 OF THE REGINA CONFERENCE**

**CONVENTION ON WETLANDS OF INTERNATIONAL IMPORTANCE  
ESPECIALLY AS WATERFOWL HABITAT**

Third Meeting of the Conference of the Contracting Parties  
27 May to 5 June, 1987  
Regina, Saskatchewan, Canada

Conservation of Azraq Ramsar Site

**NOTING** that Jordan has designated the Azraq wetland for the List of Wetlands of International Importance established under the Ramsar Convention;

**AWARE** that under Article 3 of the Convention, Contracting Parties "formulate and implement their planning so as to promote the conservation of the wetlands included in the List;"

**INFORMED** that the Amman Water Authority is currently pumping 16 million cubic metres of water per annum from Azraq to supply drinking water for the Jordanian capital;

**CONCERNED** that extraction at this rate is likely to provoke serious changes in the natural properties of the Azraq wetland and, in particular, may increase the salinity of the remaining water there;

**THE CONFERENCE OF THE CONTRACTING PARTIES**

**CALLS** for a proper assessment of the environmental impact of the pumping;

**SUGGESTS** that pumping be reduced by at least 50%, as demanded by conservation bodies in Jordan, at least until the environmental impact study is completed; and

**URGES** that there be established a long-term water resources plan guaranteeing the maintenance of the natural properties of this wetland of international importance.