

# 2

## Conserving biodiversity in the Badia region: Jordan



### BACKGROUND AND JUSTIFICATION

The main aim of the initiatives described in this report was to assess the reasons for biodiversity loss in Jordan, specifically in the Badia region (eastern plateau), which covers about three quarters of the total land area. The Badia, which is the main rangeland area of Jordan, is flat and arid, with long, hot dry summers and an annual average rainfall of 100 millimetres. It is part of the Syrian Desert on the northwest edge of the Arabian Desert and its vegetation is classed as Saharo-Arabian-Sindian.

The northern part of the Badia region is far richer in biodiversity than the south, mainly because of the massive Azraq Basin and oasis and the higher rainfall. It has a low population density and there is good potential for the development of such natural resources as mineral deposits, surface and groundwater sources, renewable natural rangelands for animal production, and sites of natural beauty and interest. In addition, there are excellent opportunities for exploiting wind and solar power to provide non-polluting, renewable energy. The area's valuable mineral deposits include phosphate, white cement, limestone, quartz, clay, marble, natural gas, non-commercial oil and oil shale. The area also includes nine of the 27 important bird areas in the country, according to Birdlife International guidelines.

Since 1977, scientists have been collecting samples from

different habitats and localities and all collected specimens have been deposited with the Department of Biological Sciences of the University of Jordan Museum, Amman, and the Jordan Natural History Museum at Yarmouk University, Irbid. Photographic surveys have been carried out. Reports and articles resulting from these surveys have been published, including a checklist of the flora of the Badia. As a result, there is now a wealth of information that makes it possible to assess the changes in bird, plant and mammal populations. If a population is seen to be declining, for example, scientists now have the data required to try to determine the reasons for the decline. From this, they are able to devise both general and species-specific recommendations for protecting the biodiversity of Jordan. The following in-depth case study on the Azraq Wetland Reserve provides a good model for natural resources management in arid zones.



Ghadir Burqu, a spring-fed pool

## DESCRIPTION

The Azraq Basin in Jordan's eastern desert receives the floodwater of several wadis that drain a large area of Jordan and

the southern part of the Syrian Arab Republic and also receives a large amount of groundwater from springs. The 120-square-kilometre Azraq oasis, therefore, consists of permanent freshwater pools and springs. Part of the oasis has been designated as the Azraq Wetland Reserve, which lies about 110 kilometres east of Amman. The reserve is of particular interest because it is a wet ecosystem that falls within a large, arid area. It also provides a varied natural habitat for the conservation and protection of unique aquatic and terrestrial species, including the endemic killifish (*Aphanius serbani*).

Over the past 20 years, however, intensive pumping of water from the oasis has caused a lowering of the water table and increasing salination of the area's soils. By 1993, the springs had dried up so much that wildfires burned across the dry environment.

One example of a damaging agricultural practice in the Badia is intensive watermelon production. The low water table in the region has encouraged the excavation of wells that are used to provide water for irrigation. Often, areas of land are used to their maximum potential, and once they are no longer productive, they are abandoned. The increase in unproductive land caused by unplanned agricultural expansion has become a serious problem.

Not surprisingly, the combination of these types of negative impact has resulted in the destruction of much of the area's wildlife habitats and caused a concomitant decrease in wildlife populations. The frog, *Rana bedriagae*, for example, has experienced a

drastic population decline, as has its predator, the grass snake *Natrix tessellata*.

Rehabilitation of the Azraq Basin will cost millions of dollars, so it is essential that the reasons for the initial damage and the impact of any future development or exploitation be assessed accurately. As a first step, the researchers identified the following causes of biodiversity loss:

- *Destruction of habitats*: Over the past 50 years, the population of Jordan has increased more than five-fold. As a result, cities and urban areas have spread dramatically at the expense of natural areas and wildlife. A growing population has also led to more intensive exploitation of remaining lands for agriculture, animal grazing, road building, etc., which has caused erosion, desertification and fragmentation of the land and reduction or extinction of many wildlife populations.
- *Poor water management*: Increasing demands on the limited water supplies of Jordan have led to excessive pumping of underground and surface water and a decline in its quality. The results are a lower water table, increased salinity, dried-out ponds and a general decline in biological systems.
- *Agricultural expansion*: Many species lose their burrows or dens when rocks and boulders are removed and previously natural land is deep-ploughed for farming. Agriculture also over-exploits water sources, forcing the species that depend on them to move on or die out. In other cases, ecological changes brought by spreading agriculture have led to increased populations of some species, such as the elapid viper.
- *Inappropriate agricultural practices*: Pesticides and fertilizers have contaminated the soils and water sources around farms. Some of the machinery used on marginal lands is also not appropriate for arid conditions as it encourages soil erosion by wind and water.
- *Overgrazing*: Grazing animals eat and trample plants, preventing many of them from regenerating. Goats are particularly damaging because they strip the bark from trees and consume other plants that wild animals such as tortoises depend on for food. Overgrazing also contributes to desertification, one effect of which is an increase in atmospheric dust. Such dust creates a health and safety hazard to both humans and wildlife. Dramatic increases in farm animal populations are exacerbating this already desperate situation.
- *Destruction of the green mantle in semi-arid lands*: Land left bare by misuse or excessive fuelwood collection can deteriorate rapidly, especially as vehicles tend to cross bare land indiscriminately, without sticking to specific tracks or trails. This breaks the soil's protective surface crust and leaves it vulnerable to erosion.
- *Land tenure and fragmentation*: Land tenure practices based on inheri-

tance traditions have led to the fragmentation of landholdings into excessively small parcels, which often lie down the sides of slopes. Ploughing these small, sloping fields causes gulying and land deterioration, but attempts to encourage farmers to consolidate landholdings by exchanging plots have not been successful. In addition, more and more nomads are becoming sedentary farmers but are not included in traditional land tenure systems. People with unsure tenure over the land that they farm are unlikely to take a long-term view of protecting and improving that land. (However, the increasingly sedentary lifestyle of the area's nomads—often supported by government policies—has meant that grazing pressure on rangelands is being reduced).

- *Traffic and vehicle movements:* Road traffic is increasing rapidly in Jordan, and not only do vehicles moving freely across the land cause damage, but traffic also takes a significant toll of animal species. Amphibians, tortoises and snakes are particularly likely to be run over as they cross or bask on asphalt roads.
- *Hunting and shooting:* Although Jordan adheres to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), a certain amount of illegal hunting and trapping is still carried out, particularly of birds of prey, which puts several species at risk. Large num-

bers of snakes, too, are killed by people out of fear and antipathy.

- *Localized distributions:* Jordan has several small populations of relict species that have survived in isolation in remote mountainous areas where the conditions on which they depend are particularly fragile. These animals are at particular risk of extinction as their own habitats are destroyed or as ecological changes elsewhere force other competing species into their areas.

In order to tackle these issues, a management plan for the Azraq Basin has been devised. The plan is based on the World Conservation Union (IUCN) concept of knowledge, empowerment, governance and operation (KEGO) for integrating inputs from both scientific specialists and stakeholder farmers. Among the problems put forward by farmers, for example, were crop selection, including a lack of information on alternative crops and varieties of currently grown crops tolerant to water stress, and water-saving irrigation techniques. Livestock owners, on the other hand, expressed their need for services such as forage production, grazing reserves, herd vaccination and infrastructure for marketing milk and other products.

Therefore, a multidisciplinary approach was developed using geographic information system (GIS) analysis and remote sensing techniques to devise a sustainable land use plan. The plan is scientifically based and involves various stakeholders, including the government, representatives of local communities, research institutions and universities.

The main objectives of the Azraq Basin management plan are to:

- monitor water quality, quantity and adequacy for plant and animal biodiversity;
- design water supply models that address the issue of periodical fluctuations in supply;
- involve the local community in decision-making regarding water use, grazing, hunting and how to deal with violations;
- exploit the area's rich archaeological, recreational and environmental features;
- develop the site as an international arena for ecotourism and scientific research; and
- implement national and international policies and guidelines for the sustainable development of arid areas.

Among the initiatives involved are the establishment of separate areas for biodiversity conservation, grazing, etc. and the monitoring of the status of biodiversity in those areas; sensitizing local people and raising their awareness of the value of diverse habitats; adopting measures to prevent harmful land-use systems and practices such as overgrazing or excessive water extraction; introducing sustainable farming systems, including biological pest and disease control and crops that help to regenerate soils; upgrading tourist facilities and encouraging ecotourism so that the potential negative impact is limited; establishing links with local communities, government agencies and the private sec-

tor; and collecting fees from the users of resources and fines from those that abuse them and using some of the funds raised for further conservation efforts.

## LESSONS LEARNED

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Agriculture in the Badia area faces several threats, including increasing water salinity, over-exploitation of soil resources and habitat alteration due to changes in soil properties and in the composition of the indigenous vegetation. Additional constraints include difficulties associated with marketing the excess production of crops such as watermelon that need to be sold fresh. The production of forage using Sudan grass (*Sorghum vulgare var. sudanese*), which is better adapted to the dry conditions and can be stored and marketed for several months after harvest, is being put forward as an alternative to watermelon production.

## IMPACT

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As a result of applying these principles to nature reserves across the eastern desert, several areas are already seeing dramatic improvements in their ecosystems.

The Azraq oasis itself has staged a remarkable recovery. A US\$6 million rehabilitation programme funded by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) has helped to restore the mosaic of critical wetland habitats. Over 160 of the bird species for which the oasis

was once renowned have now returned and there is a breeding programme in place for the killifish, which has also been reintroduced to several ponds. New jobs, including reserve management positions, rangers, community liaison officers and craft workshop managers, have been created, a sign that the local community is benefiting from the environmental improvements. A series of workshops, for example, have helped to train young women to produce a variety of handicrafts and foods made from locally grown dates that are offered for sale in the reserve's shop.

It has also been apparent that the Badia's farmers are keen to adopt new policies and, when given appropriate support and encouragement, took the initiative to adopt new practices. Several large farms have successfully adopted water-saving irrigation techniques; there has been a small-scale move to planting date palms, a more sustainable crop; and honey production is being pioneered on two farms.

In addition, close by the Azraq oasis is the Ash Shawmari Wildlife Reserve, a site selected for the reintroduction of the locally extinct Arabian oryx. A breeding programme for this globally endangered species now exists at Ash Shawmari.

## FUTURE PLANS

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Even though the restoration of the Azraq oasis succeeded in recreating critical habitats for the fauna and flora in the region and in building community support, a long-term solution will require fun-

damental changes in national water policy to ease pressure from the growing urban demand. To this end, the Government of Jordan has announced a large-scale water management project that will supply 100 million cubic metres a year of additional water to Amman. The project involves building a 325-kilometre pipeline from the Disi aquifer in southern Jordan to Amman, which should relieve pressure from pumping water from the Azraq wetlands.

Future plans for the wider Badia area include investing in basalt blocks to enclose fields and reduce wind erosion; promoting the planting of salt-tolerant fodder crops in salinized areas where such crops can restore soil fertility; and establishing seed banks for the conservation of and research into the local flora, including important rangeland species, and indigenous crops.

### PREPARED BY

Ahmad M. Disi and  
Said A. Damhoureyeh  
Department of Biological Sciences  
Faculty of Science  
University of Jordan

amdisi@ju.edu.jo,  
saidd@ju.edu.jo  
[www.ju.edu.jo/faculties/science/biological](http://www.ju.edu.jo/faculties/science/biological)

Ibrahim A. Al-Khader  
and Sharif Al-Jboor  
BirdLife International, Middle East  
and Central Asia Division

ibrahim.khader@birdlifemed.org  
[www.birdlife.net/worldwide/regional/middle\\_east](http://www.birdlife.net/worldwide/regional/middle_east)