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**The Status of Biological Resources in Morocco**

Constraints, and Options  
for  
Conserving Biological Diversity

24 January 1988

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This report would not have been possible without the assistance and initial work that was done by Chris Loggers, professional ecologist. Mr. Loggers, formerly a Peace Corps/ Morocco wildlife volunteer, while working as a consultant for the International Council on Bird Preservation did much of the initial literature review and contacting of people for information.

The views expressed in this report are those of the author and do not necessarily represent the views of the Government of Morocco, the Government of the United States or the US Agency for International Development.

LeRoy Duvall

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## Executive Summary

Morocco is facing serious threats in the areas of environmental quality, maintenance of biological diversity, sustainable resource utilization and management, and a deterioration of the quality of life for the vast majority of Moroccan citizens. The Government of Morocco is concerned. However, developmental pressures, a rapidly growing population, a fixed resource base, and limited financial resources all restrict the Government's ability to aggressively address these issues in a comprehensive manner.

Morocco's system of reserves and parks (two national parks and approximately 13 botanical and wildlife reserves and 80 other permanently-protected areas that are closed to hunting) are supposed to provide protected habitat for a wide variety of indigenous fauna and flora, many species being endemic either to Morocco or to North Africa. In addition to the indigenous species, Morocco's coastal wetlands, extending along the Mediterranean and down the length of the Atlantic coast, are very important for migrating or wintering waterfowl from Europe. The preservation of these wetlands is considered to be crucial for the continued survival of several indigenous and migrating species.

Wildlife and habitat protection efforts have had only marginal success. Most if not all of the large mammals are thought to be threatened or endangered, as are numerous species of birds and plants. The current status of most species is actually unknown. Habitat destruction is occurring at a rapid rate; forests and rangelands are being cleared for agriculture, and overgrazing of the forest and rangelands is altering species composition and regeneration.

Traditional land use rights prevent land managers from controlling the numbers of livestock that can use the forests or rangelands. Such land use rights also promote the conversion of marginal lands to agriculture, as a means of gaining control of land. Limited numbers of personnel and limited funding further reduce the effectiveness of the management agencies in carrying out their management mandates.

Morocco has been the recipient of numerous projects and other assistance which have had an impact on the environment and biological diversity. Relatively few of these projects have been specifically undertaken with biological diversity concerns or environmental quality concerns as major considerations or goals.

The donor community has the opportunity to undertake directed, positive actions in support of programs and needs that have been identified by the Government of Morocco. Properly planned and implemented, conditional support to key activities could be used to ensure the enhancement of environmental quality, maintaining and enhancing of biological diversity, and other positive environmental impacts.

## INTRODUCTION

The objectives of this study are to summarize the status of biological diversity and species conservation in the Kingdom of Morocco, identify the threats to biological diversity and species conservation, identify constraints to dealing with threats to biological diversity and propose options that can be undertaken by the Government of Morocco (GOM), and the donor community.

Information for the study came from interviews with various Government Officials, Donor Representatives, and technicians, and reviews of the available literature.

### The Government of Morocco's Interest in Natural Resources and Environmental Quality

The Natural Resources Management Agencies within the GOM are obviously interested in the questions of environmental protection, resource degradation, biological diversity, and the ultimate impacts on the people and the nation of Morocco if the degradation continues unchecked. This was obvious during discussions with officials, and in the review of background papers and planning documents. These same documents and individuals acknowledge, often in a surprisingly candid manner, the social and technical problems that must be resolved, and the problems they have because of limited staffing and funding.

Various donors and the GOM have prepared various studies and proposals which, if funded, could begin to address many of the environmental problems and threats that currently exist. Actual funding and staffing are much less than what is actually needed to successfully initiate and carry through to completion much of what is proposed.

In part this is due to severe budgetary constraints within the national budget. Natural resources-related activities must compete with other GOM agencies' programs for the limited funding that is available. The GOM is faced with a very serious national debt problem, and must operate within overall conditions of austerity. Because of this, budget resources appear to be allocated to those programs with obvious and quick economic benefits. However, it does not appear that the potential economic loss to the nation's economy from degradation of the environment and the natural resource base is considered in depth when setting the overall national priorities. At this budgeting stage natural resources management, including environmental considerations and biological diversity, begins to become a secondary priority.

Funding for wildlife protection, protection of habitat, range improvement, environmental education, and management of parks and reserves are likely considered to offer a low return on investment, especially given that nature based tourism in Morocco is almost non-existent. Even as late as 1983 the Ministry of

Tourism focused its interests on Morocco's coastal attractions. [28] When faced with budgetary constraints, the technicians within Eaux et Forêts (E&F) who are implementing activities, with limited funds, probably consider the reserves and parks as secondary priorities as well. His Majesty, Hassan II, recently called for greater environmental concern on the part of the Moroccan people and governmental agencies. This should influence the priority given to such activities.

## STATUS AND MANAGEMENT OF PROTECTED AREAS

### Background

Morocco, located in the northwestern corner of Africa, has a total land area of 71,500,000 ha. It is bordered on the east by Algeria, to the south by Mauritania, to the west by the Atlantic Ocean and on the north by the Mediterranean Sea. Its coastline extends for 1,835 km. [30] The 3rd United Nations Conference on Ocean Rights granted Morocco, as well as other coastal states, an exclusive economic zone extending 200 miles out to sea. [30,70]

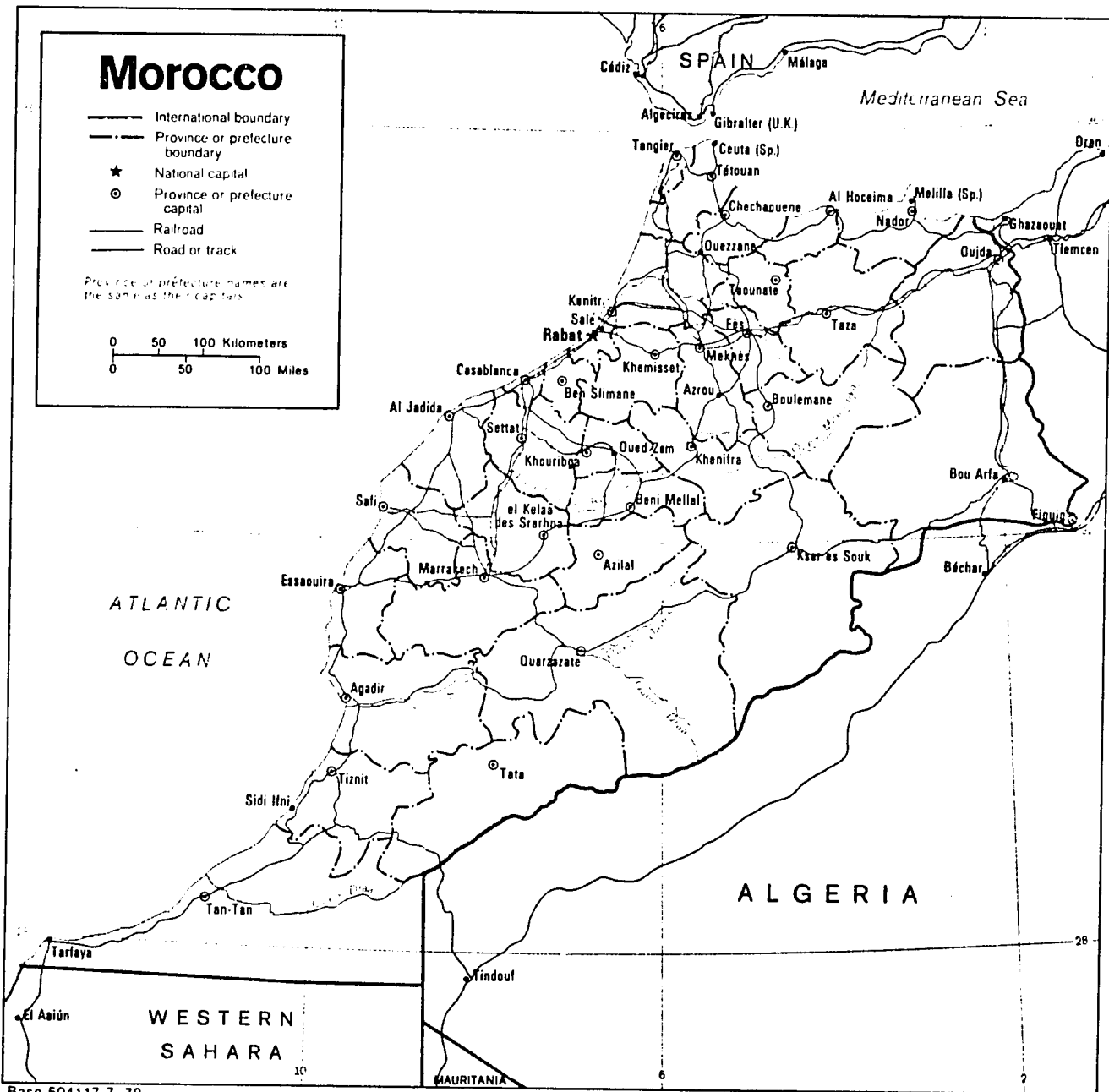
The coastal and northern interior zones, and the Sous valley in the south, are the most productive agricultural areas in Morocco. There are four major mountain systems which influence the country's climate, and serve as environmental barriers separating the interior from the southern and eastern pre-Saharan areas, and from the northern oriental zone. The Rif mountains border on the Mediterranean Sea in the north. The Moyen or Middle Atlas extend in a northeastern-southwestern direction along the eastern third of the country. The Haut or High Atlas extend from the southern limit of the Middle Atlas, toward the Atlantic coast to the West. The Anti Atlas mountains extend in a general east-west direction, to the south of the High Atlas chain.

Of the total land area, approximately 560,000 km<sup>2</sup> are classified as being arid or desert (< 250 mm of precipitation per year), 106,000 km<sup>2</sup> are semi-arid (250 - 500 mm per year) and 51,000 km<sup>2</sup> are sub-humid to humid (> 500 mm per year). Of the sub-humid and humid areas, 1,000 km<sup>2</sup> are mountainous regions. [63]

The National Plan for the Control of Desertification lists land use in Morocco as follows: [63]

Cultivable lands	7,438,000 ha	10.3%
Natural forests	4,393,000 ha	6.1%
Private/public reforested lands	416,000 ha	< .6%
Alfa grasslands		
<u>Stipa tenacissima</u>	3,158,000 ha	5.0%
Rangelands outside of forests	22,749,000 ha	31.8%
Non-productive lands	33,346,000 ha	46.8%

Approximately 10% of the arable land, 760,000 ha, is irrigated.

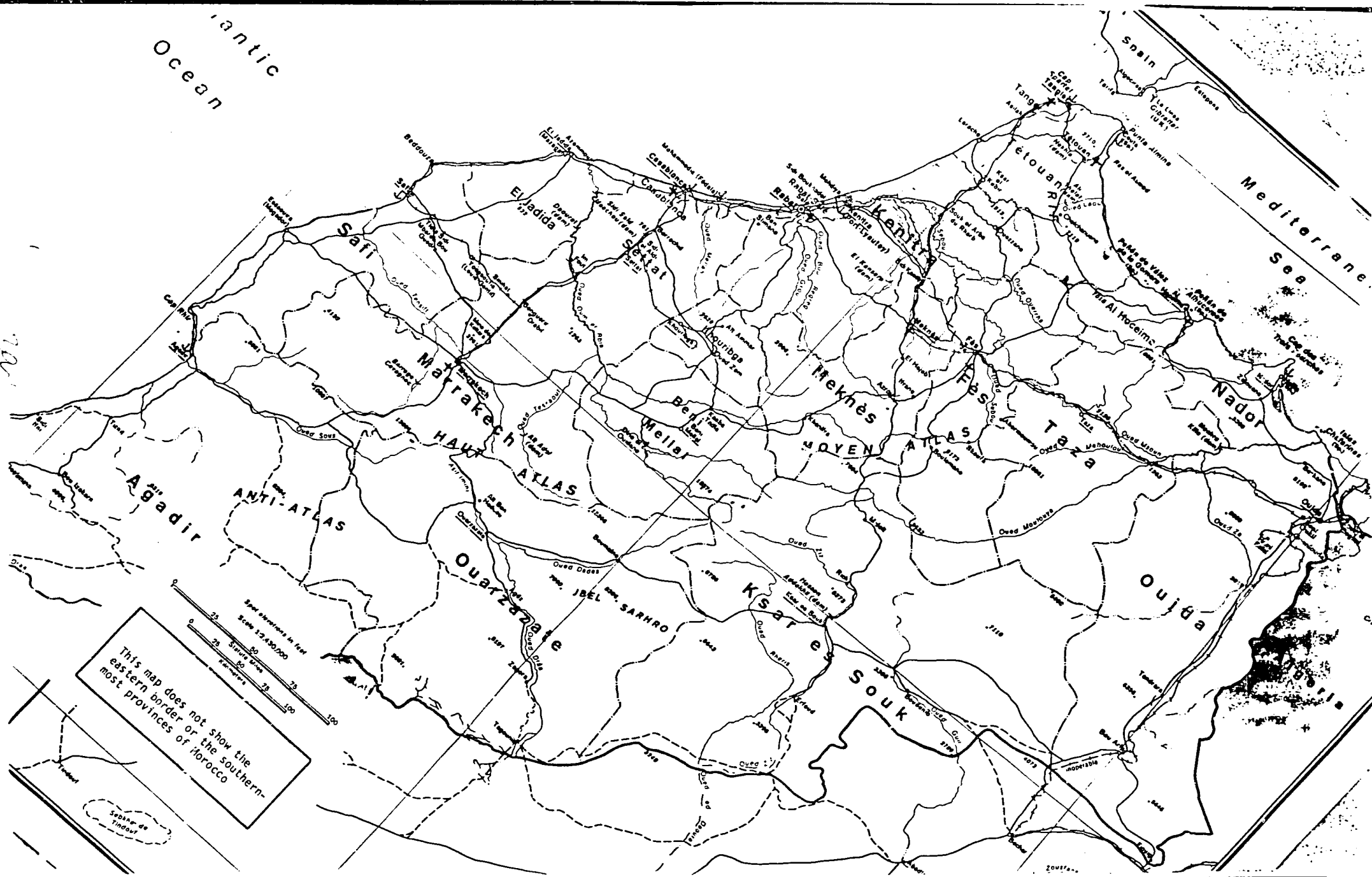


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Atlantic Ocean

Mediterranean Sea



The Moroccan Direction de la Statistique estimated the 1985 population at a total of 21,465,000 inhabitants; 12,142,000 rural and 9,323,000 urban. [1]

The actual distribution of the population varied significantly by region, with 60% of the population concentrated in the coastal plains along the Atlantic. Slightly more than 18% inhabit the Rif and eastern Morocco zones, and less than 8% inhabit the pre-Saharan and Saharan regions. [63]

### Wetlands Summary

The wetlands of the Atlantic coast are considered to be of extraordinary importance as feeding and roosting sites for great numbers of migratory waterfowl moving between their breeding grounds in Northern Europe and wintering areas in west Africa.

The Merja Zerga near the northern end of the coast and the Bay of Khnifiss near the southern end are considered to be the most valuable of the Moroccan coastal wetland sites. The bay of Khnifiss has been reported as a nesting site for the Greater Flamingo, Phoenicopterus ruber. The Iriki wetlands, near where the Oued Draa (River Draa) meets the southern border with Algeria, also provide suitable conditions for the nesting of the Greater Flamingo during wet or high rainfall years.

### Wetlands with Significant Habitat Values

<u>Site</u>	<u>Area</u>
Oued Moulouya estuary	several sq km
Merja Zerga	3,500 ha
Merja Sidi Mohamed Ben Mansour and Merja Daoura	
Douiya Sidi Bou Rhaba	150-250 ha
Merja Douyet	100 ha
Bas Bou-Regregg	15 km of river
Lakes of the Moyen or Middle Atlas: sources for Oued Oumer Rbia	500-800 ha
Lagoon Oualidia and Lagoon Sidi Moussa	1,000 ha
Lac and salines at Zima	600 ha
Lac Iseli	200 ha
Lac Ifni	35 ha

Iriki 0-20,000 ha  
Bay of Khnifiss 6000 - 7000 ha

(Lac = lake, Merja = marsh or wetland, Oued = river)

### The Status of Protected Areas and Habitat Management

The Ministerial Order of 21 May 1921 regulates use-rights to common pasture in state forests. The Royal Decree (Dahir) of 11 September 1934 established national parks as protected areas, while maintaining the use-rights established under the 21 May 1921 decree. This dahir requires ministerial decrees for the establishment of parks, and requires that park specific regulations be prepared for each site. [49,64]

The Ministry of Agriculture (MOA) has administrative responsibility for the protected areas in Morocco. The Direction des Eaux et Forêts (E&F) is responsible for general management and activity coordination, and the Division de la Chasse, Pêche, et Protection de la Nature deals with the day to day activities in the parks, biological reserves and game preserves. The actual day to day activities are run out of the established regional Eaux et Forêts offices. [6,49,64]

### NATIONAL PARKS

There are two established national parks, Toubkal and Tazekka, and 13 other nature and wildlife preserves. There are several other areas on Royal property which are also de facto reserves. Toubkal National Park was established by government decree on 19 January 1942. Tazekka National Park was established under government decree on 11 July 1950. One of the first nature reserves, Sidi Boughaba, was established in 1946. Decrees from the Ministry of Agriculture (MOA) in 1962 and 1978 authorized the establishment of reserve areas that are to be completely protected from commercial exploitation, grazing, building, and hunting. [49]

It should be noted that none of the existing parks or reserves meet international standards. This has reportedly resulted in difficulties in securing donor assistance in support of the parks and reserves [Personal communication]. Efforts are underway to ensure that new parks and reserves will meet international, and there are proposals to bring existing parks into compliance with such international criteria [49].

### Toubkal National Park

Toubkal National Park, located approximately 110 km west of Ouarzazate and 70 km south of Marrakech, has a total area of 36,000 ha. The park supports a wide variety of vegetation within its boundaries; elevations range from 800 meters up to 4,167 meters at the crest of Mount Toubkal, the highest peak in north



Africa. The park reportedly contains the best stand of Holm Oak Quercus ilex, in the High Atlas mountains. [25]

The park is said to contain Barbary Sheep, Ammotragus lervia and a small troupe of Barbary Macaque, Macaca sylvanus [25]. Loggers reported that the Cuvier's Gazelle, Gazella cuvieri, are now extirpated (locally extinct), but may still occur to the south of the park.

In 1986, the Moroccan Ministry of Tourism and US National Park Service Joint Evaluation Team (JET) reported that the park is of international importance as protected habitat for Barbary Sheep and other species of plants and animals. They also believe that there are good opportunities for developing interpretive and environmental education programs within the park. [36]

There are no villages or inhabitants in the park. The main human pressure is from excessive, uncontrolled livestock grazing, mainly between the months of April and September (transhumance). Efforts were made initially to control grazing and to set aside 3,000 ha for scientific research (prohibiting all grazing or passage by livestock). However, these efforts failed. Presently overgrazing is an important problem which E&F acknowledges as being particularly damaging because of the "modifications in the composition of the botanical formations and the degradation of the soil, characteristic of overgrazed range lands." [64]

In an unpublished report, dated April 1987, Posner [68] reported that no staff had been assigned to the park. Responsibility was assigned to two local E&F Chefs de Service whose regions included portions of the park. Therefore, responsibility was split between the Chefs de Service of the Marrakech and Ouarzazate provinces. Posner goes on to report that although hunting and fishing are officially prohibited, frequent infractions occur and that a lack of staff prevents effective enforcement. Another problem is that the local people evidently are either unaware of the existence of the park, or if they are cognizant of it, they do not know what restrictions, if any, exist. Drucker, on the other hand, reported that control was carried out by six E&F technicians and a forest guard, in addition to their other duties. The guards are stationed outside of the park. [49]

#### Tazekka National Park

Located approximately 100 km east of Fez near the village of Bab Azhar, Tazekka National Park has a total area of 480 ha., and an extension of 2648 ha has been proposed. E&F guards patrol the park. [49] The park is located within a larger permanent hunting reserve. Established in 1950, it is supposed to be protected from all forms of use. However, sheep and goat dung were found on the road within the park during a recent visit [Personal communication]. It's main botanical interest is the Cedar forest, Cedrus atlantica. [24] This forest is isolated from the other cedar forests in the Moyen Atlas or the Rif.

As of 1987, Tazekka is the only protected example of the rare Atlas cedar forest in the middle Atlas mountains. Even with its limited size, the forest still possesses a rich assortment of fauna. Mammals are limited, but a number of restricted and endemic species of butterflies occur. The birdlife tends to be palearctic woodland species. [49]

The JET [36] reported that the area had a high diversity of natural resources, with opportunities for interpretive and environmental education being very good. They reported that the Rif-Atlas mountains transition zones were of special interest. [36]

Human pressures on the park consist of illegal grazing and illegal cutting of cedar for construction wood. Because of the park's small size, E&F reports that control has been fairly effective, and infractions are rare. [64]

#### Massa National Park (Proposed)

The proposed Massa Park, on the coastal plains between Agadir and Tiznit, is still in the process of being formally and legally established. It's planned design is based on a three zone protection system; 1) The inner or core zone will be an integral reserve with complete protection; 2) A fringe zone, surrounding the core, will have restrictions preventing building, hunting, and grazing; 3) An exterior buffer zone on the outer limit of the park will permit settlements, but hunting is to be prohibited. The proposed Massa Park will also be the first park in Morocco in which the Government of Morocco (GOM) will attempt to develop, and benefit from, tourism and sports activities. [49,65,66]

E&F reports that the establishment of the park is being used as a test case, with the goal of eventually re-organizing the other existing national parks (Toubkal and Tazekka) under the same form of protection. It is considered to be internationally significant wildlife habitat for birds, with potential for gazelles as well. Over 275 species of birds, both sedentary and migratory, 35 species of mammals, 31 species of reptiles and amphibians, 9 species of fish, and numerous species of butterflies have been documented within the region. [36,49,54] A colony of Bald Ibis, Geronticus eremita, within Massa is the largest and most important of the two remaining nesting colonies in the world. The Massa site is of prime importance to the future of the Bald Ibis. As of 1987 no special protection had been established for the nests, which are reported to be easily accessible. [Personal communication,49]

The delay in establishment of the park has reportedly resulted in an increase in the numbers of people going into the proposed reserve to cultivate and graze livestock. The goal of this being to establish their claims of previous use of the area, with the goal of being compensated by the GOM for having to leave the

land. The fragility of much of the area, however, means that once a site has been cultivated, it may be impossible to restore the natural vegetation. [Personal communication]

## WILDLIFE RESERVES

### Merja Zerga - RAMSAR Site

The Merja Zerga is a 3,500 ha wetland reserve situated near Mouley Bousselham in the Province of Kenitra, 70 km north of Rabat. The site was established as a biological reserve in 1978, and designated as a RAMSAR site in 1980. Reportedly, there has been a proposal to establish the area as a national park. The status of this proposal is unknown.

The reserve includes a tidal lagoon whose size ranges from 1,500 to 3,200 ha, with large areas of mudflats during low tide. The Oued Drater enters the lagoon on the northeastern side and exits at the northwestern side through a deep tidal channel to the sea. [67] Aside from the birdlife, there is little other reported wildlife, except for reptiles, including turtles, snakes and lizards.

Merja Zerga is of international importance for over-wintering and passage waterfowl. [20] It is reportedly the most important Moroccan site for winter migratory birds from Europe, with between 100,000 and 200,000 palearctic wintering waterfowl reported. [49] Beaubrun (1975) considered the Merja Zerga to be a site of extreme biological richness because of the populations of birds, the important migration of fish, and the benthic populations that were particularly well developed. [40]

SOCHATOUR (the Moroccan Hunting Society) has hunting rights on the northern side of the Oued Drater. They may also have permission to use the Merja Mellah, located on the edge of the reserve.

There are problems of local residents killing protected species, both inside and outside the reserve. Grazing within the reserve, especially during the dry season is a problem, with an estimated 13,000 head of livestock using the reserve area [Personal communication]. According to Morgan, grazing was not a significant problem in 1982. [20] However, the increase in herd sizes, the drought, and the continuing degradation of the surrounding range lands may have increased the intensity and the negative impacts of the grazing on the reserve. One international conservation authority was quoted as saying that "this is not a reserve, it is a livestock farm" [Personal communication].

The cutting of reeds and marsh grasses is a problem in the reserve throughout the year and takes place whenever the plant materials have grown large enough to warrant cutting. Reportedly mud or clay is also dug within the reserve, for use in cosmetics

and other uses. These activities result in more or less year-around disturbance of the waterfowl.

Fishing occurs at the outlet of the Merja Zerga into the ocean. This is a legal activity. Drucker felt that traditional fishing did not appear to be affecting the site. [49] However, fishing is also reported to take place within the reserve area whenever the mouth of the stream becomes closed, which occurs approximately every four years. The fishing technique at that time is to set nets within the lagoon and beat the water with paddles, driving fish into the nets. This is reported to be very disruptive for nesting waterfowl. [Personal communication]

The collection of edible mollusks along the mudflats is also an uncontrolled activity. Reportedly people will take all sizes of mollusks, without regard to the possible depletion of the resource.

Severe hunting pressure was reported in the past. However, hunting has been banned since 1978. [49]

The reserve is split between two communes, with the possibility of it being divided between three communes in the future. This complicates the political and management problems greatly.

#### Bokkoyas Marine and Wildlife Reserve

Located near Al Hoceima, the reserve is divided into three areas: 1) an outer hunting reserve; 2) an inner biological reserve; and 3) a marine biological reserve. This is the first marine reserve created by E&F. The permanent hunting reserve is closed to all forms of hunting. It is meant to serve as a buffer to the more protected biological reserve. Farming and grazing are permitted within the hunting reserve. There are also several villages located within the hunting reserve boundaries. Farming practices on steep slopes have resulted in severe soil erosion, with gullies several meters deep in some areas. The only difference between the hunting reserve and the surrounding areas is that in theory no hunting is allowed in the reserve.

The biological reserve is theoretically closed to all forms of human use. However, shepherds and their goats, and women harvesting alfa grass (Stipa tenacissima) were encountered within the boundaries during a recent visit [Personal communication].

The marine reserve consists of all areas to the north of the biological reserve and extends one mile out to sea, between Torres and Cap d'Idssoulyene. It also extends one mile around the isle of Cala Iris.

Access is severely limited and tourism is reported to be negligible. The site has great local, regional and international importance as it is one of the few areas in the Mediterranean basin which is not severely disturbed. It also supports



populations of several important species of birds. Some collecting of eggs by the locals is reported.

All exploitation is forbidden within the limits of the reserve, and it has reportedly been proposed as a national park. It is especially important as a Moroccan refuge for the endangered Monk Seal, Monachus monachus, which until recently occurred all along the coastline. The site has a rich variety of coastal fauna and flora. However, in spite of the official protection afforded the site, livestock grazing, illegal tree cutting, and extensive fishing continue to take place. [49]

As a marine reserve, and as habitat for endangered birds, the site is of potential international interest. The JET found high potential for developing interpretive and environmental education programs in the area. Potential exists for future involvement of international conservation organizations in additional species and habitat protection activities within the area. [36]

Because the reserve includes two ministerial jurisdictions, Ministry of Agriculture (MOA) on the land and the Ministry of Marine Fisheries and Merchant Marine on the sea, conflicts between the two ministries have reportedly delayed the establishment of reserve regulations. [Personal communication]

#### Sidi Boughaba - RAMSAR Site

The Sidi Boughaba site is located at Mehdia, north of the capital of Rabat. The reserve has an area of 5,600 ha. The site is a strict nature reserve where all activities are to be controlled. It was designated as a RAMSAR site in 1980. The reserve encloses a coastal non-tidal brackish marsh of 150-200 ha, separated from the ocean by sand dunes. The marsh is surrounded by dense Juniperus woodland thickets.

Morgan reported that the lagoon was of national conservation importance. [20] The reserve is considered to be particularly important for the passage of large numbers of ducks and wading waterfowl. It is also a waterfowl wintering and nesting site. The endangered Crested Coot, Fulica cristata, is reported to nest there.

171 species, mainly passage winter migrants are reported to use the area. 30 species are reported to breed in the area. Of particular interest are the Marbled Duck, Canas angustinostris, the African Marsh Owl, Osio capensis, and the Crested Coot, Fulica cristata. [12] The site is a proposed national park. [49] Present threats include seasonal grazing by cattle which is having obvious effects on the vegetation on the northern marshes. Sand extraction is a major concern, and there is some threat from future expansion from the town of Mehdia and the town's tourist beach. [49]

The reserve is used as a study site for students and school groups from Rabat. A museum was constructed by E&F in 1976, and is currently being used as a visitor center. A conservation education program is scheduled to begin very shortly. Tourism and in particular campers are adversely affecting the reserve. Much of the area is used extensively by picnickers from Rabat and the Kenitra area.

#### Kniffiss - RAMSAR Site

The 6,500 ha reserve, situated approximately 70 km north of Tarfaya and 120 km south of Tan Tan, consists of a large, coastal, brackish lagoon (20 km long and 3 km wide) which is connected to the ocean via a gully through the littoral zone. There are several marshy areas surrounding the lagoon. Large areas of mudflats are exposed at low tide. It is probably the most important wintering and migration site in Morocco for several species of waterfowl.

The site is considered to be the second most important wetland site in Morocco. It was designated as a RAMSAR site in 1980. Up to 100,000 waders were reported in 1964. 23,000 were reported in 1974. In 1964, 500-800 Slender-billed Curlews were reported, the largest number recorded outside of Russia. [34] The Flamingo sometimes nests here (750 pairs were reported in 1974). It is the only Moroccan nesting site for Sterna hirundo. Larus genei also nests at the site. There is considerable hunting pressure reported. [67] The site is considered to be very important both hydrobiologically and ornithologically. [22]

Concern over possible impacts from oil exploration and possible future development lead the Shell Oil Company to contract with the Institut Scientifique, Mohammed V, to do an environmental assessment of possible impacts that activities would have on the site. A final report on the assessment is forthcoming. [Personal communication]

#### Sidi Chiker

Located near the village of Dar Hanaouate, approximately 20 km from Chemaia, west of Marrakech, the reserve at Sidi Chiker has a total area of 1987 ha. Between 180 and 220 Dorcas Gazelle were counted within the reserve in 1985 and 1986. [4] Numerous rodent species were also observed.

Hunting is forbidden within the reserve, with only rare incursions being reported. Two main deficiencies reported by E&F are 1) a lack of adequate herbage to support a large gazelle population within the reserve, and 2) the gazelles migrate well beyond the limits of the park. Illegal grazing and poaching with leghold traps are a problem. [64] Significant numbers are killed by poachers.

While it was once reported that the population may become unviable if poaching was not brought under control in the areas surrounding the reserve [49], it may well be that a viable population may no longer be present. [Personal communication]

The reserve was established following the establishment of a range improvement perimeter at M'Sabih Talaa in 1952. The reserve is completely enclosed by a barbed wire fence, 1.5 meters tall, 25 km long.

Staffing consists of two guards and their supervisor, a cavalier. In addition to being fenced, there is a road that traverses the reserve, one hand drawn well and watering troughs. There are three mud-brick houses, in ill-repair, for the staff.

Past management activities on the reserve included planting bands of diverse species of eucalyptus and acacia to act as windbreaks. Forage species were established within the protection offered by the windbreaks. Little remains of these windbreaks and related plantings.

Among the improvements that have been proposed, E&F would like to improve the two existing houses for the guards. E&F would like to improve the existing wells, equip them with a windmill, establish a third well in the center of the reserve, with watering troughs. In addition, it has been proposed to establish two guard/observation towers, assign a tractor and 4,000 liter water trailer to the site for fire control, and undertake diverse range improvement activities. [8] A proposal to replace the barbed wire with chain link fence is seen as a protective measure, to prevent the gazelles from leaving the reserve. However, several gazelles have become caught in chain link fences, and then been killed by dogs. [Personal communication]

#### Reserve de Cerf Elaphe d'Espagne

From 1951 to 1953, the Spanish introduced both fallow deer (daim) and red deer (cerf) into the Rif mountains. The fallow deer were exterminated within a few years by the local population. The red deer however have reportedly managed to survive. The herd is estimated to now number between 200 and 250 animals. The reserve has no management, other than having forest guards in the area. [64]

#### Skhirate Island

Skhirate Island, located opposite the town of Skhirate, off the Atlantic coast southwest of Rabat, is known as Bird Island. It was designated a faunal reserve by MOA decree on 2 November 1962. It is a rocky islet of 500 - 3,500 sq meters. It is noted for a number of breeding sea bird colonies that use the island. [49]

## Takherkhort

The permanent reserve at Takherkhort, located within the boundaries of Toubkal National Park, has an area of 1230 ha. It was established to protect the remaining herds of Barbary sheep in the region. Originally set up in the 1940's, it was designated a wildlife reserve by decree in 1967. An estimated population of 350 animals exceeds the carrying capacity of the park, and signs of degradation are reported to be evident. The solution, proposed by E&F is to create another reserve and capture animals at Takherkhort to reintroduce in the proposed new reserve. [64] It is unknown if any actions have been initiated to establish a second reserve. As with Talassantane, special permission is required to enter the reserve. There is one forest guard and two assistants assigned to the reserve. [49]

## BOTANICAL RESERVES

### Talassantane

Immediately to the north of Chefchaouen near Bab Taza, the Forest at Talassantane was classified as a nature reserve in 1972. The reserve comprises 2617 ha. The JET found the forests at Talassantane and Kharbouch to be among the most beautiful in Morocco, containing unique flora and fauna. They felt that Talassantane has enormous potential for visitor use and could be the site to use for developing an important environmental education program. The most significant scenic and natural areas are quite fragile and not readily accessible. [36]

The cedar and fir, Abies pinsapo, forests are relict of forest that once extended to Spain and Algeria. Only two small stands of fir remain in north Africa today, one at Jbel Babor, Algeria, and the one at Talassantane. It is the only reserve that is a refuge for the threatened Barbary Macaque and the Polecat Ferret, Mustela putorius. Reportedly, special authorization is needed to enter into the reserve. Problems reported include illegal logging, burning and grazing. One forest guard is assigned to the reserve. [49]

### La Dora

The La Dora Reserve contains remnants of the biological communities representative of the Tadla plains before the plains were developed for irrigated agriculture. The reserve has a total area of 200 ha. [6] No other information is available.

## MANAGED NATURE RESERVES

### Affenourir - RAMSAR Site

The reserve is located near Azrou, in the province of Meknes. It is one of 36 mountain lakes spread over a fairly large area. The reserve consists of a 380 ha mountain lake. In addition to being

a nature reserve, it has also been designated as a hunting reserve, and the local residents have grazing rights to the area. The site is heavily overgrazed during the short growing season. It is a wintering area and crossroads for migrants and a nesting site for waterfowl. The rare Demoiselle Crane, Anthropoides virgo, may exist in the area. [49]

### Bouarfa

Bouarfa, 108 km north of Figuig and 250 km east of Er Rachidia, is located on the vast alfa grass plains area to the east of the Middle Atlas Mountains towards the Algerian frontier. Rainfall averages 105 mm per year. Pistacia atlantica is the only tree present, although several shrubs grow along the dry river beds, including Retama spp. and Zizyphus lotus. Because of overgrazing, the remaining perennial plants are mainly unpalatable species. The Chef du Service in Bouarfa has proposed that a gazelle reserve be established on the plains between Talsinnt and Bouarfa. No further work had been done as of June 1987. [Unpublished trip report]. No information is available on the present status of this proposal.

### Iriki

Iriki, located near where the Oued Draa meets the southern border of Algeria, was declared as a wildlife reserve in 1967. It is currently classified a permanent biological reserve, with a total area of 10,000 ha. Hunting is forbidden. [49,64]

The Iriki Depression occupies an area of about 20,000 ha, north of the course of the Oued Draa. Although when the rains fail the reserve is often completely dry for several years, it may become flooded after heavy winter rains. It then becomes an important site for birds of passage, and occasionally, as in 1968, it is an important breeding site for species such as Anas acuta, Himantopus himantopus, Marmaronetta angustirostris, Phoenicopterus ruber, Recurvirostra avosetta, and Tadorna ferruginea. It is one of only two breeding sites in Morocco for the Larus genei. [49,67]

### RESERVES CLOSED TO HUNTING

There are approximately 80 permanent hunting preserves (areas permanently closed to hunting) scattered throughout Morocco. Hunting is the only activity which is formally forbidden within these areas. They are established to provide a permanent area for the protection and breeding of the indigenous wildlife, as well as to serve as a source from which the wildlife would spread out into the surrounding areas and ensure on-going viable wildlife populations. Indications are that the hunting restrictions for these reserves are no more respected than elsewhere, and poaching or other illegal activities are having a serious detrimental impact on these areas, as well as in unprotected areas outside of the reserves.

## Other Protected Areas

The Government of Morocco (GOM) estimates that there are approximately 1,200 reserved areas which have been set aside for dune fixation, reforestation, soil erosion control, pasture improvement, protection around forestry posts, national parks, zoologic reserves, and other purposes. These areas are closed to most forms of human use, with a total area of approximately 1,600,000 ha. To this are added 600,000 ha. of permanent hunting reserves. [69]

There are ten hunting reserves that are managed by private hunting societies to provide quality hunting for tourists. They cover a total of approximately 350,000 ha.

There are eight Royal Reserves which are areas closed to the public. Currently four of the eight are used by the Royal Family for hunting.

Merja Douyet, a royal reserve 7 km from Fez, is a 100 ha shallow depression fed by springs and run-off. It is semi-permanent, drying completely during the summer in some years. The lake, as royal property, is protected from public interference. [67] The Merja Douyet is considered to be of international importance for both wintering and passage migrants. An estimated 1,000 crested coots F. cristata use the area.

## The Success of Protection Efforts

The current system of reserve and parks management is of limited success in protecting indigenous plant and animal species. This is evident from examining the literature and from discussions with both administrators and technicians working in the field.

The major impact that the system of reserves and parks is having on the Moroccan economy is probably limited to the value of the forage and fuelwood that are being used, legally or illegally, and the financial or dietary supplements that the illegally cut trees, poached game, and other utilized materials are providing to the local residents. The amount of reserve and parks-specific tourism, and related income that is generated, is very limited. Nature-based tourism is sorely underdeveloped and should receive higher priority. [28,36] Tourism is an important industry in Morocco; there were 189,000 visitors in 1962, 1,300,000 in 1984, and 1,500,000 in 1985. [54] However, the park and reserve system has not yet begun to exploit this potential resource. The GOM is just beginning to realize the potential of this sector.

## STATUS AND PROTECTION OF ENDANGERED SPECIES

### Rare and Endangered Species found within Morocco and Its Territorial Waters

Information on the current status of the fauna and flora of Morocco is very sparse. Overgrazing, poaching, and non-sustainable resource use leading to serious natural ecosystem degradation are known to be rapidly altering the composition and frequency of indigenous species. The actual extent of these changes is relatively rare. Very limited funds are available for any kind of species research. Graduate students, often a major source of research information, generally must fund their own research, especially if the topic is not of main interest to E&F or other government agencies. As a result, unless funded by E&F or another government agency, field work is often done in areas that are relatively inexpensive to get to.

Much of the information on species status that is available comes from voluntary contributions by amateur bird watchers and other scientists who know people with interests in specific areas or species.

Information that is developed often remains in the university department where a student defended a thesis, unknown to the outside world. When information is to be published through government documents, it can often be several years before publication actually occurs, resulting in out-of-date information.

There are numerous criteria that could be used to sub-divide Morocco geographically; rainfall, land uses, vegetative cover type, etc. For the purposes of illustrating known wildlife distributions, it was decided to use physical or geographic features for dividing the country into somewhat homogeneous ecological/geographical units. The 15 resulting zones are shown on the map on page 19. Where possible, zone specific information on species are indicated using this system.

Zone	Description
I	Rif Mountains
II	North Atlantic Plains
III	Central Plateau Region
IV	Middle Atlas Mountains
V	Eastern Morocco (Maroc Oriental)
VI	Middle Interior Plains and Plateaus
VIIa	Atlantic Coast - South

VIIb	Atlantic Coast - Sous
VIIc	Atlantic Coast - Central
VIId	Atlantic Coast - North
VIII	High Atlas Mountains
IX	Pre-Saharan Region
X	Anti-Atlas Mountains
XI	Saharan Region
XII	Mediterranean Coast
XIII	Mediterranean Sea
XIV	Atlantic Ocean
XV	Sous Region (between the Anti and High Atlas)

The following table shows the zonal distribution of the passerine birds of Morocco. There is no solid information for most other birds. [Personal communication, Thevenot, and unpublished data, Moroccan Ornithological Center, Institut Scientifique, Rabat]

<u>Zone</u>	<u># of Species Breeding in Zone</u>	<u>Zone</u>	<u># of Species Breeding in Zone</u>
I	89	VIIc	661
II	74	VIId	64
III	77	VIII	10
IV	89	IX	53
V	90	X	62
VI	61	XI	28
VIIa	51	XII	76
VIIb	65	XV	61





The following table indicates the number of mammal species present in each zone, based upon data from Avlagnier, S. and M. Thevenot, 1986. Catalogue des Mammiferes Sauvages du Maroc. Travaux de L'Institut Scientifique. Serie Zoologie, No. 41. Rabat. 165 pp. (In press) [26].

<u>Zone</u>	<u>Number of Mammals Present</u>	<u>Zone</u>	<u>Number of Mammals Present</u>
I	37	VIId	29
II	34	VIII	43
III	36	IX	48
IV	36	X	47
V	54	XI	26
VI	38	XII	38
VIIa	25	XIII	6
VIIb	29	XIV	11
VIIc	39	XV	31

#### Rare and Endangered Birds

Annex 1 contains lists for zonal distributions of rare and endangered birds of Morocco and a list of passerine birds of Morocco.

#### Rare and Endangered Mammals

Morocco has 108 different species of indigenous mammals. Eight are considered to be threatened globally, i.e. worldwide. [30] There is no exact information on the numbers of mammals that are threatened locally. Loggers [Personal communication] feels that the wild boar Sus scrofa may be the only large mammal in Morocco that is not threatened or endangered. That may change however, since reportedly even the boar is now being poached with greater and greater frequency, in spite of the Muslim edict that they are unclean and not to be eaten. [Personal communication] The status of small mammals is largely unknown.

Lion, Panthera leo, once occurring throughout Morocco, is now extinct. The last lion was shot in the 1940's. Lions at the Temara zoo (and in the Washington zoo) are claimed to be phenotypic of the Barbary lion, but it is debated as to whether they are genotypically pure, or if they had been interbred in the past with other lions. [4, Personal communication]

The Hartebeest, Alcelaphus bucelaphus, was last seen in 1960. It was once common in the interior and on the Saharan side of the Atlas mountains. [4 and personal communication, M. Thevenot] Formerly Zones 5,9.

The Cheeta, Acinonyx jubatus, has not been reported since 1976. It may still occur in what was formerly the Western Sahara, south of the Oued Draa. [4 and personal communication, M. Thevenot]. However, any large mammal in the disputed area is in continual danger because of the fighting and the large numbers of armed men within the region. [4 and personal communication, M. Thevenot] Zones 10,11.

The Monk Seal, Monachus monachus, is an endangered species. The largest population in the world, approximately 60 animals, lives along the Moroccan coasts. A major cause for the seal's decline has been human disturbance, including unrestricted tourism and uncontrolled killing by fishermen. The Atlantic coast of north Africa and the adjacent islands are important habitat regions, although very few remain in the regions north of Morocco [Personal communication, 4,52]. Zones 13,14.

The panther, Panthera pardus, may exist as a relict population, estimated at between 6 and 20 animals, in the Middle Atlas mountains. (The last animal seen was a pregnant female, in the Autumn of 1984. Tracks and dung were also found in a cave on the Oued Ahid west gorge wall in 1984 [Personal communication].) It is believed that they may use the gorges of the Ahid River during part of the year. The panther once ranged throughout the mountains, and possibly on the plains as well. [4 and personal communication, M. Thevenot]. A Peace Corps Volunteer has been working on a panther project, in the gorges, since 1986. Zones 4,8. (Another panther population is thought to exist in Tunisia. However, S. Posner while working in the region where the leopards are supposed to occur could not find any local inhabitants who had observed any sign of panther in recent times [Personal communication].)

According to Dr. Raymond, the Moroccan panther has never been studied in captivity. The only animals studied have been those that have been killed in the wild. It is possible that these animals may be a distinct sub-species, physically larger than those occurring south of the Sahara.

The Barbary Sheep, Ammotragus lervia is an endangered species. It occurs in small populations scattered throughout the High, Middle and Anti Atlas mountains. It is reportedly poached by locals. Feral dogs are a serious problem. Habitat destruction is considered to be a major reason for the population's decline. [33] Zones 4,7,10.

The Barbary Macaque, Macaca sylvanus, a threatened species, is the only non-human primate indigenous to north Africa. A major cause for its decline has been habitat destruction. Estimates

made in 1975 placed the population in Morocco at between 9000 and 17000 animals. Estimates for the Rif were less than 400 animals. Fa reported that unless conservation measures were implemented to protect and manage suitable habitats, the Barbary macaque in the Rif faces extinction in the near future. [23, 29] Zones 1,4,8.

Cuvier's gazelle, Gazella cuvieri, an endangered species, presently exists only as small relict populations scattered throughout the High and Anti Atlas mountains. Habitat destruction is currently a major cause for its decline. [33] Zones 4,6,8,10.

The Dorcas Gazelle, Gazella dorcas, once common throughout Morocco is now endangered. The only free ranging population remaining in the Moroccan interior is a population of approximately 200 animals on the 2000 ha reserve near Sidi Chiker. These animals are threatened by poaching with leg-hold traps, hunting, and feral dogs. The Dorcas Gazelle still exists on the Saharan side of the Atlas mountains. Habitat destruction and poaching are major causes of its decline. [33] Zones 4,6,9.

See Annex 2 for a list of known Moroccan mammals.

#### Rare and Endangered Plants

Morocco's flora is considered to be relatively well inventoried, and the identified species are both rich and diverse. (The past inventories indicated indigenous species that existed, they are not indicative of the current status or distribution of indigenous species [10,18,19,39].) There are 4,200 species and sub-species, with approximately 800 endemics. [53] Nearly 1,000 species are reported to grow in the Atlas mountains. [61]

The impacts of cultivation of marginal lands, the expansion of grazing to almost all available ground, the severe over-grazing that is occurring, and related factors, have resulted in the current state of the indigenous flora being more or less unknown, except possibly in protected areas (if any truly exist) or in the few areas that have been recently studied. Annex 3 contains the International Union for Conservation of Nature and Natural Resources (IUCN) Conservation Monitoring Center's current list of rare and endangered Moroccan plant species, and the IUCN's List of North African Endangered Species. The International Board for Plant Genetic Resources considers Morocco, and the Mediterranean region as first priority areas because of the plant diversity of the region, their economic potential, and the threat of their loss. [9]

Two computerized indigenous-forage-species inventories are available. One, titled COLLECTIONS, identifies the range forage species collected by the AID-funded Range Management Improvement Project (RMIP) in July and August 1985. The second, MORESEED, provides the names of species collected in July and August 1983 and multiplied for seed production at the University of

California, Riverside, by Walter Graves. Both files run with PFS:File. They are available by sending a 5 1/4" floppy diskette to the Cellule Informatique, Direction d'Elevage, Ministere de l'Agriculture et de la Reforme Agraire, Rabat, Morocco. [17]

### Aquatic Species

Formerly common in all the rivers of Morocco, the shad fish, Alose alose is "condemned to disappear". There is only one river where they continue to exist: the Oued Sebou. However, once that river is dammed, the fish will no longer have access to its breeding grounds, and will disappear from Moroccan waters. The sole means to prevent their extirpation is to provide the means for the fish to pass the dams and reach their spawning areas. Fish ladders have been installed on one dam on the Oued Loukkos, but not on other dams upstream. (The problem is the other dams that have already been constructed.) Unless an economical technique is found, installing fish ladders on existing dams is not a possibility. The shad is threatened throughout much of the Mediterranean, mainly because of pollution and dam construction. [Personal communication]

All of the aquatic mammals are considered to be threatened. The Monk Seal is currently the most threatened.

A turtle, Caretta caretta, uses the Atlantic beaches as breeding sites, and is endangered. Three other species of turtles, Chelonia mydas, Dermochelys coriacea, and Eretmochelys imbricata are threatened as well, but they principally frequent the beaches of Mauritania. [Personal communication]

The Broad Sea Fan, Eunicella verrucosa, the Mediterranean Coral, Corallium rubrum, and the Purple Urchin, Paracentrotus lividus are all threatened. One species of fresh water mussel, Spengbis Freshwater Mussel, Margaritifera auricularia Maroccan is threatened as well. Little information on the status of other invertebrates is available.

### CONSERVATION OUTSIDE OF PROTECTED AREAS

An estimated 1,600,000 ha of the public domain are permanently closed to most consumptive human uses. These areas are parks, reserves, and other special management areas. An additional estimated 10,000,000 ha. are closed to hunting every year. Hunting regulations specify which species can be hunted and during what period or periods of the year. They also call for 1/3 of the public domain to be closed to hunting at any one time. (This is in addition to the reserves and parks, which are generally considered to be permanently closed to hunting.)

These closed areas are distributed more or less evenly over the country, and they remain closed for two years. After two years, these areas are once again opened to hunting and new areas, comprising 1/3 of the public domain, are closed for two years.

The remaining areas are closed during the next two year period, and then the cycle starts again. In this way, all of the country is closed for two years out of every six, with the objective of allowing the game to breed and restock the surrounding areas without being subjected to hunting pressures. However, as documented by numerous sources, hunting restrictions are generally ignored. [4,20,25,34,49,58,64]

### Unprotected Wetlands of Biological Importance

#### Oued Moulouya

On the Mediterranean coast, the estuary of the Moulouya river is of international significance as waterfowl habitat. The value of the site is enhanced by the fact that the Spanish Islas Chafarinas, 10 km northwest of the rivermouth, are the breeding place for perhaps 2/3 of the world's population of Audouin's gull Larus audouinii a species in the IUCN Red Data Book "rare" category.

The site is important both botanically and ornithologically, and comprises an area of several square kms. [22]

At the lower reaches of the Oued Moulouya there are a series of lagoons and brackish marshes which are separated from the sea by dunes. The lower part of the valley is subject to flooding in winter. Altogether there are approximately 3000 ha of wetlands close to the river's mouth and in the lower river valley.

#### Nador Lagoon

The site consists of 10,000 ha of open water on the Mediterranean coast. The closest towns are Tanger, 270 km WNW and Nador, on the edge of the lagoon. The lagoon is 22 km long with a maximum width of 6 km. The lagoon opens to the Mediterranean on the northwestern end. Except for a several species of birds that are locally uncommon (Himantopus himantopus, Recurvirostra avosetta, Sterna alabifrons) the site is typical of the Mediterranean coast.

Prior to 1981 the mouth of the lagoon was periodically dredged to facilitate marine and lagoon fishing. Following the construction of a port at Beni Anzar, outside of the lagoon, fishing has been centered around Beni Anzar, and direct human impacts on the lagoon have declined. However, the discharge of irrigation effluent into the lagoon carries pesticides. Since the mouth of the lagoon became closed, pesticide concentrations have begun to build up in the lagoon's food chains. Effluents for a planned iron and steel industry were also to be discharged into the lagoon. [67]

#### Sidi Moussa and Oualidia Lagoons

The wetlands at Sidi Moussa, near El Jadida, are considered to be of international importance. The site is actually a series of

wetlands, including salinas at Sidi Rahat, El Holba and El Merja, which make up a wetland complex stretching some 35 kilometers along the coast. When considered as a wetland area rather than as individual units, the area is second only to Merja Zerga and Kniffiss, in terms of importance for avifauna. Bird species reported to use the area include the majority of waders of the western palearctic. [20] The site has an area of 1000 ha. The nearest towns are El Jadida, 50 km NE and Safi, 50 km S.

The marshes grade into agricultural lands on the landward side. Reportedly there is heavy pressure from hunting, livestock grazing and cutting of reeds for thatching and mat making. Some artificial ponds have been constructed for oyster culture, and parts of the Oualidia lagoon has been drained for development purposes. [67] These sites were classified as hunting reserves in 1984. Intensive grazing, local fishing for mollusks, tourism, and salt production are problems.

The Lagoon of Oualidia, with an area of approximately 1,000 ha, is considered to be of national importance. No other information is available. [22]

#### Merja Daoura and Merja Sidi Mohammed Ben Mansour

The Merja Daoura, located close to the Merja Zerga has been severely degraded: the site was drained. Formerly 13 km long and up to 4 meters deep, it is now 2.5 km long and 30 cm deep. Prior to drainage, it was considered to be of international importance. It is now classified by Morgan to only be of local interest. [20]

The Merja Sidi Mohammed Ben Mansour is connected to the Merja Daoura by a drainage canal. Prior to drainage it was considered to be of international importance. It is now considered to be only of local importance. [20]

The combined sites have an area of 8000 ha. The nearest towns are Kenitra, 25 km SW and Larache, 80 km NE. The two lagoons are behind the barrier beach just north of Kenitra. They are no longer connected to the sea, rather, they receive water from the flooding of the Sebou River. Following drainage operations they ceased being permanent water bodies. They now dry up each summer. They are important as wintering and passage sites for wading birds. [67]

#### Rio Martine Lagoon

The site has an estimated area of 3,000 ha, of which 500 ha is open water. The nearest towns are Sebta, 30 km N and Tanger, 55 km NW. It is a group of small lakes on the floodplain of the Oued Martine, on the Mediterranean coast. None of the lagoons are fully tidal, but all are brackish. [67]

### Sebkhet Zima

Sebkhet Zima, near Chemaia in Safi Province, is considered to be of local importance. Some experts believe that if the area were protected, especially from egg thieves, flamingos, Phoenicopterus ruber, would once again nest there.

### Oued Loukkos

The seasonal marshes along the lower reaches of the Oued Loukkos are considered to be of national importance. Extensive draining activities have severely reduced the value of the area. It is one of the two areas in Morocco where the Purple Gallinule, Porphyry porphyrio, breeds, and it is the only place where the Reed Bunting, Emberiya schoeniclus, and the Moustached Warbler, Luscinola melanopogon, breed. [20]

A wetland occurs at the Oued Loukkos, upstream from its mouth at Larache to the confluence with the Oued Mekhasene, some 13 km. From here the wetland continues up the Oued Loukkos for 7 km and up the Oued Mekhasene for 15 km, and up one of the minor affluents for 7 km. In the region of the confluence of the Oued Loukkos and Mekhasene the wetland is over 12 km wide. Saline and tidal at the river mouth, it grades into brackish and then freshwater marshes upstream. There are a total of 18000 ha of wetlands. Some areas away from the river have recently been drained. [67]

### Oued Chebeika

The Oued Chebeika is one of two major wetlands in southwestern Morocco. It is considered to be of greater importance for migrating rather than wintering birds. It is used by the Slender-billed Curlew, Numenius tenuirostris. [41]

The draft Plan d'Orientation 1988-1992, prepared by the Sub-commission on Natural Resources of the National Commission on Agriculture and Dams, proposes a study of coastal lagoons to evaluate their value for aquaculture. This particular proposal is especially disturbing in that it could very well result in the further degradation of areas that have not yet been protected. There is also the possibility that it could result in changes in the management options within already established reserves.

### Mountain Lakes of the Middle Atlas

Morgan investigated several mountain lakes in the Middle Atlas in 1982, where he found several lakes to be of limnological interest. Many in the Moyen Atlas offer suitable habitat for waterfowl and have important populations of the rare and now possibly threatened crested coot. Only one of the lakes, Lac Affenourir, is protected. [20]



The lakes are permanent, with abundant submerged and emergent vegetation. In addition to their hydrobiological interest, they are of great importance for passage and wintering waterfowl, except when the lakes are frozen over. The lakes contain interesting flora, as do the nearby springs for the Oued Oumer Rbia.

Dayat Agoulman (Annoceur) is considered to be of international significance. With a surface area of 141 ha, it had the greatest diversity of waterfowl of the mountain lakes visited. Over 2000 Crested Coot were counted. The site is threatened by a causeway crossing the middle of the lake which may increase disturbance and reduce the number of wintering birds.

Lac Iseli is considered to be of international significance. A rare Rhodophyceae, Chroothece rupestris Hang. was reported in 1954.

Lac Tislit is considered to be of national importance. The area is considered to have tourism potential. The Black-necked Grebe, Podiceps nigricollis, of rare status in Morocco, has been recorded here.

Aguelman Azigzla is of national significance. The Moroccan authorities have designated it a historic monument. The lake is alkaline and especially rich in phytoplankton [67].

Dayat Aaoua is considered to be of local significance. It has high tourist value. A road passes around the lake, and a hotel exists on one side. It contains diverse zooplankton.

Dayat Afougha is of local interest. It reportedly has conservation interest because of physical structure and microbenthos composition. It has high tourist value.

Aguelman Tifounassine is of national significance. It is a nesting site for the Ruddy Shelduck Tadorna ferruginea and the Crested Coot.

Aguelman Sidi Ali is of national importance. It contained a new species of salmo, Salmo pallaryi Pellegrin. This species is now believed to be extinct following the introduction of carp. The lake is a nesting site for the Ruddy Shelduck.

Dayat el Hachlaf is of international significance. It is a shallow lake with an area of 202 ha. It is a wintering site for the Crested Coot and the Ruddy Shelduck.

Dayat Ifrat is of national significance. It includes rare zooplankton, Eucyclops speratus ifniensis as well as a pelagic rhabdocoel, Mesostoma spp. which has been recorded only a few times in the tropics.

Lac d'Ifni has an area of 40 ha. The nearest towns are Marrakech, 60 km NNW, and Ouarzazate, 100 km WSW. It is a high montane lake, elevation 2300 m, near the western end of the High Atlas, on the slopes of Mount Toubkal. It has a maximum depth of 65 m. The lake developed behind a landslide blocking a stream. The lake is used for sport fishing. No information was available on its flora or fauna. [67]

### Agricultural Lands

Morocco has a total cultivable area of between 7,438,000 [55] and 8,300,000 ha. [57] Of this, between 40 and 50% received erratic precipitation averaging less than 400 mm per year.

Irrigated agriculture occurs on 10% of the arable land, producing 65% of the agricultural exports. [57] The GOM's goal is to expand the irrigated areas to about 12.5% of the total available arable land, and is expected to reach this goal by 1990. The main source of irrigation water is from dams. [6].

Land ownership, according to the National Plan for the Control of Desertification, is distributed as follows:

Private holdings	5,373,600 ha	72.2%
Collective lands	1,009,900 ha	13.6%
Guich	319,200 ha	4.3%
Habous	83,700 ha	1.1%
Others	651,900 ha	8.8%

Communal lands are those lands which belong to the community as a whole, rather than to any one individual. Guich lands are hereditary lands permanently conceded by the state to individuals within a tribe. The state can transfer control to other individuals within the tribe. Habous lands belong to religious foundations. They are frequently leased as a means of generating income for the religious group. [57]

Lands under private ownership are reported to generally be managed with the goal of maintaining or improving productivity, and generally are viewed as sites for investment, depending on the means of the individual owner. The other land categories, especially the collective and habous lands, do not receive the same inputs or care. [63]

The dramatic growth in the human population is resulting in continuing fragmentation of land holdings into smaller and smaller parcels, each parcel being divided for inheritance purposes, from one generation to the next. This is further aggravated by the continual push of dryland farming onto more and more marginal lands, which are more appropriate for grazing or

forestry, rather than agriculture. [17,55] This expansion of agriculture onto the marginal areas is resulting in irreparable loss of topsoil and the local disappearance of many indigenous forage species. [17]

Studies in 1983 found that 180,000 ha of alfa grasslands had disappeared since 1950. These were mainly lands had been cleared for cereal production. Having very low productivity, they were often abandoned after 2 or 3 years. [63] The expansion of cereal production onto marginal lands, which are often totally unsuited for cultivation, and other inappropriate land management practices are continuing to degrade the land resource base. The degradation of the land resources is considered to be one of the most serious problems threatening the future of agricultural productivity in Morocco. [57]

The abuse of the land base, along with the negative impacts of the drought of the early 1980s, is resulting in increased desertification throughout much of Morocco, but especially in the more arid eastern and southern portions of the country. [55, 63] Wind erosion has become especially severe in the south, with agricultural lands being lost to invading sand at an estimated 500 ha per year in Ouarzazate Province. Annual losses of palm groves are estimated at 50 ha per year. [31] Windblown sands have been invading agricultural fields and palm groves, filling in irrigation systems, and threatening towns and transportation systems. [Personal communication,31,63]

This destruction of the agricultural land base will continue to require significant financial and human resource inputs from both the GOM and the donor community targeted for the rehabilitation of degraded areas, the protection of watersheds, and the control of wind erosion. [2,13,17,55,63] In addition, the destruction of the land base and its associated decline in agricultural productivity will weigh heaviest on the poorest sector of the Moroccan society, the rural farmers. The World Bank estimated that 45% of the rural population are absolutely poor (unable to provide a minimal nutritionally-adequate diet and purchase necessary non-food items). This is a group of approximately 5,400,000 people. Furthermore, the highest concentrations of rural poor are in the highlands and the more arid regions [57], the very areas that are most subject to environmental degradation, increased soil erosion, and falling agricultural productivity.

### Grazing Lands

There are an estimated 30,300,000 ha of rangelands in Morocco. The distribution is 4,393,000 ha of forest rangelands, 3,158,000 ha of alfa grass range, and 22,749,000 ha of rangelands outside of the forestry domain. Alfa grass production is estimated at 18,000 metric tons per year, with a harvest of nearly 30,000 metric tons per year [55]. (The forest range and alfa grasslands are both administered by E&F.)

These lands are categorized as either private, public domain, or communal. The collective lands are owned communally, with all members of the group (usually tribal) having equal right to use the land, according to custom or tradition. Public domain lands within the forest domain are managed by E&F. Outside of the forest domain, management is the responsibility of the Division de l'Elevage, Service des Parcours (DE/SP), the GOM's range management service which was created in 1981. In addition to DE/SP, there are some public domain lands that are managed by parastatal societies. [63] Almost no private lands are managed as range because private lands are usually cultivated. [51]

The World Bank estimated that the livestock sector provided 17% of Morocco's total agricultural employment in 1981. Approximately 95% of the population that is directly dependent on agriculture are involved in livestock husbandry; 18% rely solely on livestock production; 51% are involved in both cultivation and livestock. Most livestock raising is in small to medium sized operations. It is a particularly important activity for low income households. [57]

Livestock raising depends upon the use of the natural grazing lands. The livestock are expected to survive on what is available naturally, during much of the year. Every 5 to 10 years prolonged droughts can reduce the size of the national herd significantly. In order to protect themselves against the periodic droughts, herders build up the size of their herds during favorable years. In combination with the conversion of rangelands to cropping, this leads to severe over-grazing and degradation of the rangelands. This results in changes in the floral composition, with the more productive perennial species being replaced by annuals, and eventually by unpalatable species, of little or no forage value. [63]

Productive rangeland can often be converted to marginal croplands, which can provide stubble for forage. The RMIP team reported that because of cereal crop subsidies and GOM tenure laws, people would sow cereals, which provided a minimal harvest, in order to provide a stubble forage crop for their animals, and to maintain control of the land for their personal use. With the conversion of rangelands to cereal culture, remaining pastures becomes more and more scarce, and over used, often without any use-management or control. Continual grazing throughout the year prevents seed set and formerly common and palatable forage species eventually disappear. Erosion, soil compaction, and degradation of the range can become so severe that even during years of greater than average rainfall, moisture does not penetrate sufficiently to establish forage plants. [17]

Unless animal numbers and the timing of their access to grazing can be controlled, there is little chance in improving the productivity of the rangelands. [17] Because of the inability of GOM agencies to manage communal land use, (they have very limited authority, limited experience in working with local

groups, and are sometimes mistrusted by the locals) much of the rangeland has been and continues to be severely overgrazed.

The law of 25 July 1969, included in the investment code, specifies the procedures for improvement of collective rangelands. These are a) delimitation of the areas to be treated, b) creation of local rangeland improvement committees, c) drawing up lists of the beneficiaries, and techniques for financing, compensation and cost repayment. Management of state owned lands is largely based upon a law dated 10 October 1917. Among other problems, this law does not provide for community organizations or local participation.

E&F has had limited success in developing and implementing range improvement programs, in part because in the past they have tended to design and implement projects, without seeking local participation. Instituting range rehabilitation projects on communal lands has also had mixed results. However, evidence would indicate that when there is active local participation, improvements can sometimes be initiated. [51]

The GOM recently approved the High Plateau Project for the Provinces of Oujda, Figuig, Boulemene, and Taza. This is an area of over 2,000,000 ha of rangelands. The project was initiated because of a request made by the leadership of the Ouled Sidi Abdelhakim tribe to the Minister of Agriculture for a major range management project. The request followed a visit by the tribal leaders to look at range improvement activities at Ain Beni Mathar that had been undertaken by the RMIP project [unpublished project status reports]. There is hope that the approach used in this project may be successful because it relies heavily on the involvement of local herders who are organized into cooperatives, and it has the active participation of agencies from several ministries, both at the national and local levels.

A major constraint that may be a barrier to establishing sound grazing practices in many areas could be that not only are the poorest farmers trying to minimize hazards by maximizing their herd size (to the detriment of the resource base), but also that all sectors of society be may using the common rangelands as an investment site.

There is evidence to indicate that people from all levels in Moroccan society are grazing herds of sheep and other livestock on the common pastures, even people who no longer live in the rural areas. This and the resulting overgrazing are among the reasons for the breakdown of the traditional systems of range management. [63, Personal Communication]

Expatriate Moroccans, working in Europe or elsewhere, and people who have moved off of the land to the cities (including influential people working in both the private and public sectors) reportedly prefer to invest their money in sheep rather than relying on banks or other investment opportunities.

Evidently the local herders are paid according to the final profits, and there are no or minimal maintenance costs since the pasture is free. So, there is minimal investment required with the maintenance of livestock on the communal lands.

If this is the case, it may be very difficult to bring about any significant reforms in land management in the near future.

### Forest Lands

The forest areas of Morocco comprise approximately 5,200,000 ha, of which 360,000 ha are plantations. Natural forests can be delineated by their dominant species as follows [21]:

Chene vert ( <u>Quercus ilex</u> )	1,430,000 ha
Thuya ( <u>Tetraclinis articulata</u> )	950,000 ha
Argan ( <u>Argania spinosa</u> )	740,000 ha
Cork oak ( <u>Q. suber</u> )	450,000 ha
Cedar ( <u>Cedrus atlantica</u> )	140,000 ha
Juniper ( <u>Juniperus</u> spp.)	240,000 ha
Pines	80,000 ha
Cypres ( <u>Cupressus sempervirens</u> )	6,000 ha
Fir ( <u>Abies pinsapo</u> )	3,000 ha
Chene zeen ( <u>Q. faginea</u> ) and other species	25,000 ha

Approximately 7% of the nation is forested. The main forested regions are as follows:

Rif	15% forested
Middle Atlas	25%
Atlantic region	25%
Rabat - Oulmes	25%
High Atlas	28%
Sous Region	23%

Deforestation for fuelwood, construction wood and to create agricultural land has occurred since the time of the Romans. [16,27] Deforestation is continuing at a rapid rate, due to the

combined effects of clearing for agriculture and grazing of livestock.

The forestry sector provided 2% of the agricultural Gross Development Product (GDP) in 1982, with over 160,000 people relying directly on forestry as an important source of income. Another 38,000 people are employed in forestry related sectors. [57]

Domestic wood production is able to meet 70% of domestic needs (excluding fuelwood). Forestry related imports in 1982 amounted to 3% of Morocco's total imports, at a total cost of 626,000,000 Dirhams (DH), while wood products exports only amounted for 195,000,000 DH. Wood is the most important fuel source, providing an estimated 40% of the total energy consumed. (In eastern Morocco alfa grass and sage brush, in addition to being the most important forage species, are the most important sources of fuel.) [57]

The FAO estimated annual fuelwood consumption at 0.8 m<sup>3</sup> in rural areas and 0.1 m<sup>3</sup> in urban areas, with a total estimated fuelwood consumption in 1980 of 10,500,000 m<sup>3</sup> per year. Total forest production is estimated at only 3,000,000 m<sup>3</sup> per year. Because of the differences in population distributions relative to the location of wood sources, it is believed that the indicated deficit is an over-estimate. However, there is no more specific information available. [57]

As mentioned above, there are an estimated 4,393,000 ha of forest rangelands and 3,158,000 ha of alfa grass range administered by E&F. The forest rangelands are estimated to produce approximately 15.8% of the annual Moroccan livestock food requirement. According to the World Bank, an estimated 1,000,000 cattle, 3,500,000 sheep, and 4,000,000 goats graze the forest rangelands for more than six months per year. [57]

Deforestation and degradation is occurring over large areas annually. By law, 20% of the forested areas are supposed to be closed to grazing at any one time, [3] but this is not the case. An estimated equivalent of 29,000 ha are deforested each year by overgrazing and human pressures. A 1985 study found that 6,000 ha are lost each year - irreversibly - mainly in the Provinces of El Hocima, Azilal, Agadir and Taza. [63] If this continues unabated, by 2020 30% of the existing forest may have been lost. Destruction of the biological base is particularly serious in the dryer regions. In Oujda province people are uprooting perennial forage species, mainly sagebrush, for use as fuelwood.

### Marine Resources

Morocco has the largest fisheries industry in Africa. [6] With an exclusive economic zone of 200 miles, in some of the richest waters in the world [31,57], its fisheries are a very important resource for economic development. [6,57,70] Reliable estimates

of the sustainable yield and the annual catch are unavailable. Indications are however that the resource is being fully exploited, if not over exploited. [31]

A total of 80,000 people are employed in the fisheries sector; 35,000 directly and an additional 45,000 in support industries such as construction, boat maintenance, fish processing, etc. The total value of the fisheries catch in 1985 amounted to 1,997,000 DH. This rose to 2,388,100 DH in 1986. The total catch in the exclusive economic zone amounted to 1,100,000 metric tons, 43% of which was taken by the Moroccan fleet. Fishing ranks third in export earnings for Morocco, after phosphates and diverse citrus products.

The Ministry of Maritime Fisheries and Merchant Marine is responsible for developing and executing the GOM policy on marine fisheries and merchant marine activities. The Marine Fisheries Scientific Institute is responsible for basic and applied research on the marine fisheries. They are also responsible for tracking the fisheries; the size of the fleet, the catch, and other information that will permit the government to properly manage the resource. [70]

Among the various threats to coastal and marine resources are sediments, heavy metals, oil spills, pesticides, sewage, and other agricultural, industrial and domestic effluents. [70] Water pollution is reported from effluents from sugar refineries, tanneries, wood pulp plants, and sewage. Urban sewage is reported to be the major source of water pollution, with the existing sewage systems being outdated and inadequate. Sewage drains directly into rivers or the ocean without treatment. [6] Because of the ocean currents along the Atlantic coast, pollution has not yet become a problem, except in lagoons and at the mouths of rivers. Littoral species are most threatened by pollution in these areas. [Personal communication]

The construction of dams, which prevent the migration of shad, Alose alose, up the rivers, is the main cause of the disappearance of the shad fishery. Formerly common in most rivers of Morocco, it is now threatened with extinction. [Personal communication] Pollution is also blamed for the degradation of the trout fisheries, further degradation of the shad fisheries, and the gradual disappearance of eels, which were formerly very common and an important source of foreign exchange. [55]

### Special Management Issues

E&F managers have the discretion to close up to 1/6 of any management area to human use at any one time. [Personal communication] The authority also exists to establish special protection areas, areas that are considered to be in need of special management, to prevent uncontrolled degradation of the land resource. Examples include areas subject to soil erosion or



waterlogging, known respectively as Soil Conservation and Land Reclamation Areas, and as Drainage Areas.

When areas of overwhelming public concern are identified, the authority exists to proclaim "Perimetres d'Interet National" (PIN) or Perimeters of National Interest. These are limited to well defined areas of priority concern, such as the watersheds upstream from dams or areas threatened by sand encroachment. These areas can then be protected and managed for the greater public good. There have been 20 small PINs declared, ranging in size from 100-1000 ha. [Personal communication]

Such areas are declared by decrees from the Ministry of Agriculture, after consultation with the Ministries of the Interior and Finance. Land and water use within such areas are to be regulated by ministerial order. [6]

#### Dams

There are 15 large dams that were built for irrigation purposes. There are an additional 10 small dams that serve for watering livestock, irrigation, flood control, etc. Approximately 500 additional areas have been identified as possible sites for small dam construction. [63] The GOM has proposed the construction of one large dam a year until the year 2000.

The silting in of existing dams is occurring at a much faster rate than was originally anticipated, and is of major concern to the GOM. Studies have shown that some dams, built as late as the 1960s, have already lost half of their designed water-holding capacity because of siltation. Others are losing between 3 and 5% of their water-holding capacity per year. Because of the excessive erosion rates and subsequent sedimentation of dams, GOM has undertaken a program of watershed management and protection. The results to date have been mixed. [63] If management efforts were successful, i.e. grazing and other uses either eliminated or controlled, an increase in the presence of local vegetation species can be anticipated.

Three major watersheds have been declared to be PINs since 1980: 1) the Loukkos in the western Rif - 180,000 ha; 2) the Nickor in the eastern Rif - 70,000 ha; and 3) the Tleta near Tanger - 18,000 ha. All three areas were established as special watershed management areas in order to protect dams that were being constructed. Both the Nickor and Tleta reportedly have had significant implementation problems - questions of land ownership, administrative problems, and inadequate funding were cited as key problems. [63]

The N'Fiss watershed was studied as a possible PIN watershed management area in 1981, but no follow-up occurred. The only other watershed management study since then was for the Oued Issen in Agadir Province, an area of 130,000 ha. [63] No information is known on the follow-up on this study.

## Protective Function of Vegetation

The maintenance of vegetative cover, important for reducing runoff and increasing the infiltration of the water into the soil, contributes to the control of soil erosion while improving soil structure and fertility. Vegetative cover, whether grasses or a combination of grasses, trees, shrubs, and surface litter, acts as a barrier to wind and water erosion.

The vegetation improves the soil structure both by protecting the soil from erosion and by providing organic matter as the litter and senescent root systems are reincorporated back into the soil. This organic matter is important in promoting improved soil structure and retention of nutrients.

Vegetation improves nutrient cycling. The trees and shrubs, with their deeply penetrating root systems are able to reach and utilize nutrients that are too deep to be reached by the more superficial root systems of grasses and forbs. These nutrients are then deposited at the soil surface through leaf and litter fall.

When the vegetation is removed, the soil is subject to more extremes in temperature as it is exposed to the direct rays of the sun. The bare dry soil surface is more easily eroded by wind and running water. If there is over-grazing, livestock will tend to compact the soil, further reducing water infiltration and making it more difficult for vegetation to become re-established on the site. More water will be lost to runoff, rather than infiltrating into the soil. Water standing on the soil surface has no obstructions from litter, etc., so water will flow unimpeded on any slope. Water erosion will quickly become evident.

## Status of Ex-situ Species Conservation Efforts

### Zoos

The Parc Zoologique at Temara is the main zoo in Morocco, and is supported by the GOM. Established in 1969, it was opened to the public in 1973. There are approximately 1,800 animals (approximately 220 different species) in the zoo's current collection, less than 1/4 of which are species indigenous to Morocco.

There is a second much smaller zoo in Casablanca. Formerly a private venture, this zoo is currently run by the local commune in Casablanca.

In the past, the zoo at Temara has focused primarily on becoming established and functional. It is anticipated that from this point on, the zoo will be able to direct more of its efforts towards other activities, such as developing conservation education programs (with the assistance of Peace Corps

Volunteers) at the zoo and providing assistance to other organizations, such as Eaux et Forêts, in developing conservation education programs.

Dr. Raymond, the former director of the zoo, reported that there has been little exchange between Morocco and foreign zoos in the past; as a result, relatively few Moroccan species are believed to exist in collections outside of Morocco.

The zoo staff anticipates becoming actively involved in future programs for the reintroduction into the wild of certain species raised in captivity, such as the bald ibis.

#### Botanical Gardens, Arboreta, and Other Sites

At least ten sites or organizations have collections of plants and germplasm of indigenous forage plant species from Morocco [Bounejmate 1986, 17]. These include: 1) the Commonwealth Scientific and Industrial Research Organization (CSIRO), Division of Agricultural Production; 2) the Welsh Plant Breeding Station, Aberystwyth, Wales; 3) the Institut Agronomique et Veterinaire Hassan II, Rabat, Morocco; 4) the International Center for Agricultural Research in the Dry Areas, Alep, Syria; 5) the Station Centrale des Plantes Fourragères, INRA, Rabat, Morocco; 6) the University of California, San Diego, California; 7) Utah State University, UMC 63, Logan, Utah; 8) Station d'Amélioration des Plantes Fourragères, Lusignan, France; 9) the Centre de Production des Semences Pastorales, Khemis M'touh, Province d'El Jadida, Morocco, and 10) Kyushu National Agricultural Experiment Station, Nishigoshi, Kumamoto, Japan.

In 1984 the IUCN circulated a list of 488 rare and endangered plant species from north Africa and the Middle East to botanical gardens throughout the world. Only 34 species from the master list were located in one or more botanical gardens. A total of 57 botanical gardens and other institutions reported having one or more of the 34 species, most often one of the more commonly known species [5]. (See Annex 3.) It is unknown how many of the 57 gardens listed actually possess plant materials from Morocco, or how many other gardens possess materials that were not on the original list of 488 species.

There were 40 arboreta in Morocco in 1978 [56], however current figures are 30 arboreta [Personal communication]. These however are generally arboreta of exotic species that were established for species trial research, not for conservation of local or indigenous species.

The Plant Materials Center at El Jadida, established under the Range Management Improvement Project (RMIP), was established to test and produce seed of forage plants used for range improvement. This center works with both indigenous and exotic species.

The National Agronomic Research Institute in Rabat has long-term cold storage facilities. They are actively involved in range management and forage research.

#### Game and Fish Production

E&F has four game bird hatcheries. They are located at Chefchaouen, Oujda, Mehdia, and Meknes. However, the bulk of the production actually comes from the Royal hatchery at Bouznika, which raises birds for the royal reserves. They also provide birds to E&F and other organizations. Among the birds bred, are pheasant, partridge, frankolin, guinea fowl, and ducks. There are four fish hatcheries in Morocco. One at Beni Melall and three at Azrou. The fish raised are trout and carp. The carp are mainly for food production, though there are plans to introduce carp into irrigation systems and possibly reservoirs, in an attempt to reduce eutrofication. The question is what hazards does this involve in terms of the possibility of the carp "escaping" and becoming a problem.

### MAJOR ISSUES IN BIOLOGICAL DIVERSITY AND FOREST CONSERVATION

#### Human Population and Related Pressures

The major threats to the maintenance and protection of biological diversity within Morocco are a combination of factors, including a fixed resource base, an increasing population (Morocco has one of the fastest growing population rates in the world [28]) and a tradition of essentially unrestricted use of public resources coupled with the breakdown of the traditional control mechanisms. (Public resources are either those found on communal lands or those not specifically protected by law.)

Uncontrolled use of non-protected resources has degenerated into a situation where the population often will ignore restrictions on use, especially if there are no effective operational means to enforce the restrictions. All too often, because of limited manpower and financial resources, such control mechanisms have not been present.

#### Traditional Uses of Indigenous Species in Morocco

Detailed information is lacking on the role and importance that many indigenous plant and animal species may have in the Moroccan economy. The economic importance of certain species, such as the argan tree or cork oak is well known. Other species, while probably locally very important, are only partially documented or may be completely unknown outside of specific regions. There is some documentation available which would indicate that there are many species of plants which have a role in the traditional culture, and in particular in the area of medicinal uses. [58,71]

In addition to the argan and cork oak mentioned above, the following are a sampling of some of the species known to

presently have economic value, or to have had economic value in the recent past:

*Chamaerops humilis* (doum palm) - fiber used as stuffing for mattresses, etc.

*Quercus* spp. - the acorns of some species (*Q. ilex*) are eaten

*Arbutus unedo* - fruits eaten

*Mentha* spp. (mint) - flavoring in tea

*Artimesia* spp. (wormwood) - flavoring in tea

*Aloysia* spp. (verbina?) - flavoring in tea

*Ceratonia siliqua*

*Rosmarinus officinalis* (rosemary)

*Thymus* spp. (thyme)

*Lavandula* spp. (lavender)

The actual economic value or importance of these and other "secondary products" is unknown.

It is likely that wildlife may be an important component either in the market economy (the selling of birds eggs was reported by several observers to be common in the markets during the nesting season) or in the economies of individual households. The role or significance of wildlife in other traditional sectors, as in the use of animal parts for medicinal or mystical purposes, if any, is unknown.

#### The Legal Basis for Biological Resource Protection

There have been several reviews of the existing legislative authority for the system of parks and reserves as well as a review of traditional usage rights and the mechanisms to protect the natural resource base. [28,36,49,54,58,63,64]

Several studies and reports have determined that the legislation concerning the national parks is insufficient and ineffective. [25,28,36,49,54,68] The administrative structure for parks is very diffuse and too imprecise for good park management. [28] Many of the decrees regulating usage rights for grazing and forest lands are obsolete. [17,63]

The ministerial order of 21 May 1921 regulates the rights to common pasture in state forests and is also the basis for establishing protected areas. The dahir of 11 September 1934 first authorized national parks. However, each park was to be

established by ministerial decree with rules and regulations being made for each site. [49]

During the January 1986 reconnaissance study by the JET, a review was done by the Moroccan counterpart team of the existing parks legislation. They found that the existing legislation was outdated and inadequate. As part of the review, recommendations were prepared to update the legislation to make it more effective. [36,54] As of February 1987, no action had been taken on the recommendations. [54]

The National Plan for Controlling Desertification calls for updating the laws and regulations related to grazing, forest lands, and usage rights. The objective would be to make the laws compatible with GOM goals and to organize and rationalize usage rights. [63]

There is at least some resistance within the GOM to the idea of initiating new regulations or updating old regulations. In the undated mimeograph entitled "Situation actuelle de la Faune Sauvage au Maroc Mesures prises pour assurer sa protection" distributed by E&F, two pages are used to explain the current situation concerning the rapid disappearance of wildlife, the reasons for its disappearance, and the applicable laws and legislation. In reference to the question of updating of legislation, the memo states that 'it does not appear necessary to search for new legislation to improve the situation'. [38] (No recommendations are made on how to correct the current problems.)

Efforts are underway to initiate some forms of legislative change, specifically that needed for the establishment of the proposed Massa National Park, and to give the Range Management Service of the Direction d'Elevage (DE/SP) the legal authority to work with communal groups to improve the common rangelands.

#### The Institution Constraints to the Effective Management of the Resource Base

##### Non-Protected Lands

The same societal constraints limit the protection and management of both state lands and the communal land base outside of the reserves and parks areas.

Leading issues are the GOM's inability to institute the effective proper management, protection, and utilization of the resource base. This is in part because of the unrestricted traditional rights-of-usage of grazing lands and forests, and the lack of a national long-term strategy for the development of the livestock sector and the protection of the country's grazing resources. [50]

The project team for the Range Management Improvement Project (USAID Project #608-0145) felt that the existing GOM policies concerning cereal crop subsidies and land-tenure, which benefit those converting rangelands to cereal production, are detrimental to overall productivity and to communal rangeland users, and "the continual push of dryland farming into more and more marginally productive areas has accounted for an irreparable loss of topsoil and the local extinction of many plant forage species." They also went on to say that "the continued emphasis on dryland farming by the Moroccan Government and USAID without a balanced effort in the rangeland sector is a policy which encourages environmental degradation." [17]

Poupon, M'Hirit and Elaichouni [63] identified several major constraints to effective range management. First was the lack of a decision making and coordinating organization that could define, establish, and execute a range utilization policy. They found that the Direction de l'Elevage, Eaux et Forêts, the Direction de la Production Vegetale, the Direction de la Vulgarisation et de la Reforme Agraire, and the Ministry for the Interior all had responsibilities in range management. However, there was no coordination of activities, training, or exchange of information.

Secondly, the legislation and regulations concerning usage rights are out-dated. This was further aggravated by overly slow identification and delimitation of the public domain rangelands, resulting in the continuing uncontrolled conversion of range and forest lands to cultivation. This is presently the case in many of the forested areas of the Rif.

From a technical point of view, Poupon, M'Hirit and Elaichouni [63] identified a lack of suitable technical inputs that could be used, a lack of trained, experienced technicians to undertake range management activities, and a lack of training (extension) of the herders. Among the socio-economic problems identified are conflicts between groups and individuals concerning territorial rights, privatization of collective lands which results in increased degradation of the communal lands that remain, and the impossibility of limiting the number of livestock being grazed on the forest rangelands.

Finally, Poupon, M'Hirit and Elaichouni [63] reported that for the period 1981-1985, only 1.26% of the E&F budget (by 11,315,000 DH) and 8% of the budget for the Direction de l'Elevage (77,421,440 DH) went to range improvement and management activities, sums they felt were completely inadequate given the important role of grazing and rangelands in Morocco's economy. It is unknown what proportion of the extension service budget went towards rangeland or forest protection activities. Funding limitations probably result in the reduction of all activities, be it extension efforts, initiation of projects, or in the case of E&F the ability to effectively patrol large expanses of forested areas.

## Protection of Wildlife

The existing wildlife management strategies and managing organizations are currently unable to protect the wildlife resources of Morocco [11,14]. Significant legislative and institutional change will probably be necessary to remedy this situation.

## Parks and Reserves Management

A single administrative unit with the authority (and responsibility) to manage and enforce all rules and regulations for a given park or reserve, across all local jurisdictional boundaries within the protected area, is vital to the effective management and protection of a park or reserve. The managing organization should also be mandated to advise and comment on all development actions and activities in adjacent areas that might influence the protected area. Fragmented authority and responsibility can result in competition both within and between organizations, management confusion and rivalries, and limited effectiveness with higher associated management costs. [54] There should be a budget dedicated specifically for the management of parks and reserves. There is resistance to the idea of providing an autonomous budget for the operation and management of the parks and reserves. However, an autonomous budget is necessary to ensure that 1) there is money specifically targeted for parks and reserves management, and 2) that the money specifically targeted for parks and reserves is actually spent on their management.

E&F's mandate is to protect and manage the various parks, reserves and protected areas in Morocco. It is also charged with the development, management and utilization of the forest resources outside of the protected areas, for the economic development and well-being of Morocco. These are conflicting roles for E&F which, while not necessarily impossible to fulfill, must present difficulties in planning and decision making concerning the parks and protected areas.

Among the roles identified for E&F in the Plan d'Orientation for the period 1981-1985, were 1) improve the level of production to satisfy the wood needs of the country; 2) contribute to exports through cork, alfa grass, and paper pulp production; 3) develop/provide grazing for livestock; and 4) protect the soil against erosion and protect dams against siltation. [55] Park and reserve management did not appear in that list.

Various proposed activities outlined in the Plan d'Orientation 1988 - 1992 would clearly be in the realm of protection of biological diversity. These include delimiting the forest domain, regenerating natural forest areas with indigenous species, establishing several new programs for wildlife protection, creating a national research laboratory for wildlife, setting up and executing a nation-wide extension program for the



protection of nature, and drafting management programs for the proposed Massa and Toubkal national parks, and the reserves at Boukoya, Sidi Boughaba, Sidi Chiker, Takherkhort, Missouri, Bouarfa, and Errachidia.

The question is if E&F, with continuing limited financial resources and personnel, can correct the problems that occurred in the past and bring new life into Morocco's parks and reserves management. This will be very important for the long-term development and installation of a strong tourism industry, based upon wildlife and other environmental resources.

#### Competition Between Agencies

There appears to be a lack of cooperation between various agencies within the GOM.<sup>1</sup> E&F indicates that a framework for environmental education lessons has been sent to the Ministry of Education for use in promoting environmental conservation and nature protection. [38] Environmental education at present is still a topic that is not presented in schools, except at the individual initiative of the teachers concerned. [Personal communication]

The process of establishing the proposed Massa National Park has been going on for several years. All the while people continue to move into the region, causing more and more damage to what is considered to be a very important site for both ecological services and tourist potential. [Personal communication]

The regulations for the reserve at Boukkoyos still have not been established. Two ministries, the Ministry of Agriculture and Ministry of Marine Fisheries and Merchant Marine, apparently cannot decide on which regulations to apply. [Personal communication]

#### **ACTION NEEDS**

##### Institutional Changes

**Clearly identify national priorities for natural resources management, environmental protection, the preservation of**

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<sup>1</sup> The Moroccan Association for the Protection of the Environment (ASMAPE), is an NGO involved in natural resources activities. Established in 1986, the organization has a professed interest in all areas of the environment and natural resources, and is seeking to collaborate with GOM agencies and the donor community on environmental education, the establishment of protected areas, and other related efforts.

As this organization develops and evolves, it may be able to function as a coordinating/overseeing organization and assist in overcoming such interagency competition.

**biological diversity, and indigenous species protection.**

Participants in the prioritization effort should come from all of the ministries and research institutions, including MOA, MOI, MOF, MOT, Institut Scientifique, Mohammed V, Institut Agronomique et Veterinaire, Hassan II, INRA, ISPN, Parc Zoologique at Temara, and ASMAPE. The roles and responsibilities of the various government ministries, agencies, and local governments in achieving the priorities that are identified should be clearly defined.

The effort to establish priorities should include identifying constraints to successful implementation of the identified goals and priorities. This should include, but not be limited to, assessing whether there is a lack of trained, experienced technical personnel in key technical areas, any lack of adequate socio-economic information on implementation techniques or barriers to implementation or change, and budgetary constraints. Key constraints should be addressed by the best means available so as to avoid having further efforts or activities blocked.

Much of the groundwork for the above has no doubt already been done. There have been numerous international seminars and conferences in Morocco during the last year concerning relevant topics, and others are planned for the near future; the Regional Conference on Conservation of Nature and the Utilization of Vegetation Resources, 22-26 April 1987; Environmental Study Days 15-16 January 1987; the Watershed Management Conference planned for January 1988. There have been many planning and programming efforts, including the Plan d'Orientation 1988-1992, prepared by the Sub-commission on Natural Resources of the National Commission on Agriculture and Dams, the National Plan for Controlling Desertification, the National Plan for Development of Energy Resources, and others. Projects in all sectors have developed reports and evaluations identifying constraints and priorities for further efforts. (Much of the necessary information is already available.)

Once the priorities and constraints have been identified, every effort should be made to work with the donor community to solicit their support in implementing appropriate activities in support of the GOM and its environmental priorities.

**When planning new activities or projects, regardless of funding source, the GOM should require an assessment of how the project or activity will affect the resource base, and how the anticipated effects relate to the GOM's priorities on natural resource use and environmental concerns.** Such an environmental assessment should look at alternative implementation strategies and their respective impacts, both positive and negative. It should also include assessing what the impacts would be if no action was taken. The assessment team should include representatives from the various ministries and departments, as well as include sociologists, ecologists and environmental specialists from the various universities and faculties. The

goal of such assessments should be to ensure that the GOM's environmental priorities have been followed.

**Every effort should be made to undo the defacto institutionalization of the uncontrolled and unmanaged exploitation and destruction of both state and communal resources.** This will be difficult socially as well as politically and will require strong support for such efforts at the highest levels of government. Until this is undertaken, there is no hope for altering the continued deterioration and destruction of the natural resource base, and no hope for turning around the decline in biological diversity within Morocco. This is a priority problem. The longer it is allowed to continue, the more difficult it will be to change.

A first step (working through the local communes) could be made to identify who, traditionally, does and who does not have user rights on public or communal lands. Does (or should) an individual in Tanger/Meknes/Rabat have unlimited use-rights in the province or commune in which he grew up? Could or should communal use-rights be restricted to only those people who continue to reside in the douar or commune? What restrictions, necessary for the greater public good, are needed concerning such use-rights? What alternatives exist or might be developed for

those people who might eventually be deprived access? Does a legislative or religious basis for such restrictions exist?

**The management and protection of the various biological reserves and parks should be the responsibility of one organization whose sole responsibility is the management and protection of parks and reserves.** This is presently not the case. In addition to managing of the various reserves, the Division of Hunting, Fishing and Protection of Nature, within Eaux et Forêts, is responsible for the management and improvement of hunting and fishing, game law enforcement, and other activities. Frequently the people called upon to manage the parks and reserves are the same people who are responsible for all of the other activities within the local E&F domain. (Many of these other activities are production oriented, not protection.)

While coordination between agencies is highly desirable, every effort should be made to ensure that such attempts at coordination do not result in fragmented responsibility, lack of authority, indecision, and inaction. (Under some circumstances it is desirable and necessary to consolidate authority and responsibility within a very limited number or even one organization. A case in point is national defense and the military.)

Ideally, park and reserve management should either be the sole responsibility of a Division within Eaux et Forêts, or be assigned to a completely separate entity (Direction des Parcs et Reserves Nationaux?). Such an organization should only be

concerned with the management, preservation and protection of the various reserves and parks. They should not have direct involvement in forest management and utilization activities beyond the boundaries of the reserves, such as grazing, exploitation, or hunting. The Parks and Reserves Management Unit should be mandated to make recommendations on programs or activities outside of the reserves and parks which might influence the parks and reserves.

One clear advantage that could arise from having a separate Direction rather than a Division within Eaux et Forêts would be that as technicians moved to different assignments during their careers, they would not be moving back and forth between forest exploitation responsibilities and protection. They would have a clear mandate throughout their careers as environmental protection professionals who were given responsibility for protecting an important national resource.

The management of the parks and reserves should be done using a separate budget specifically for parks and reserves. An autonomous budget for the parks and reserves is the only way to ensure that expenditures for park and reserve management are not curtailed in order to increase expenditures on other production-oriented activities.

**Existing legislation should be revised, in all areas.** The unrestricted use-rights accorded rural inhabitants have been identified as one of the major causes of the over-grazing that is occurring throughout Morocco. Out-of-date legislation has been identified as a major cause for the inability to adequately protect the existing parks and reserves. Uncontrolled destruction of the resource base cannot be stopped until there is a legal basis to do so.

The means has always existed to punish those individuals who break laws concerning national parks, reserves, poaching, etc. However, because of long-term inadequate enforcement and general disregard of the existing statutes, it would appear that ignoring the game laws and other regulations pertaining to natural resources has become "institutionalized". If that is the case, it may be necessary to discipline or penalize those technicians and officials that continually disregard or condone such infractions.

**The donor community, in collaboration with representatives of the GOM, should review and clarify their own commitments and concerns relating to biological diversity and environmental quality. Then an attempt should be made to focus their combined efforts (donors and GOM) on the problems at hand.** The representatives of the donor community should review the priorities established by the GOM (if these priorities are established in a timely manner and are available for consideration), and determine how their various organizational mandates, sectoral interests, and project activities can be used in support of Moroccan development while

supporting efforts to address priorities identified by the GOM and the respective donors in the domain of environmental quality and species protection.

**Once the donors have examined their respective positions, they should ensure that future projects and proposals reflect their positions, both in theory and substance.** They should work with the GOM to ensure that future projects and assistance continue to take into consideration the priorities established by both parties, and that their actions reflect these priorities.

There are not an adequate number of guards to effectively patrol and protect reserves, parks, and the natural forest areas. The GOM must increase its staffing in these areas.

The GOM should provide clearly dedicated, separate budgets for the operation and management of park and reserve systems, and begin working towards establishing an autonomous unit whose sole responsibility is the management and protection of parks and reserves.

E&F should seek the legal authority to prepare and sell conservation education and promotional materials, and to charge user fees for parks and reserves, and other activities. Various taxation options, as proposed in the JET report, should be instituted as well. These funds should be placed in a special fund dedicated to continued development of educational and extension materials, and for the management and development of a parks and reserves system.

Given the extent of DE/SP's responsibilities, and the vast areas they are responsible for, the Service des Parcours should be upgraded to a division.

#### Training and Extension

**Attempt to re-establish and reinforce the traditional land management control mechanisms on communal lands.** The GOM should ensure that efforts to involve the local inhabitants in activity planning and implementation continue, and that they become **voluntary participants whenever possible.** When undertaking activities on communal or state lands, which will require the participation of the local residents, the GOM and its administrative organizations should focus their limited staff and funds on those communes and individuals who show a willingness to invest their own time and effort into activities.

**Efforts should be made to develop the active support and participation of local and regional political leaders and other influential people in protecting the environment.**

The GOM should assign extension responsibility to the technicians within each of the services involved in land management activities. Training should be provided to these technicians to

enable them to undertake more effective extension efforts within their different areas of responsibility.

**The GOM should intensify conservation education and awareness activities nationwide.** It should increase efforts to educate the Moroccan public on how the adverse impacts of environmental deterioration, as reflected in deforestation, increased soil erosion, and the destruction of communal and state lands, are reducing the quality of life and overall social well-being for the Moroccan public, and reducing the overall productivity within the agricultural sector in Morocco. This should include instituting mandatory environmental awareness and conservation related coursework, in biology and science courses and in other subjects as appropriate, in the schools and universities. Such awareness activities should also be directed at all segments of society, using the press, radio, and television, and any other means that are available.

While there are professionally trained foresters and forest ecologists, there is only one professional wildlife management specialist in E&F. One technician has received training at the wildlife school in Cameroon. A third individual will begin training in the US shortly. More Moroccan technicians should receive training in parks management and wildlife management.

Provide short and long-term training to E&F staff, DE/SP staff, and staff from other agencies who have appropriate professional responsibilities, both in-country and overseas, in range improvement, extension techniques, wildlife management, park management, and related topics.

The GOM should have natural resources awareness extension and conservation education programs as required topics within the schools, especially in biology and science classes. Such classes should be required throughout the academic career of all students. Integrating conservation education into language classes (the topic is very relevant to Morocco and Morocco's needs) and other courses is feasible. Work with the donors to fund and develop the materials needed for the environmental education programs, and train teachers in environmental education.

Technicians from DE/SP, E&F and other agencies having natural resource management responsibilities should receive periodic, programmed retraining in extension techniques, environmental education and awareness, and other topics, in order to maintain technical competence, and keep their staff current with the latest information and developments.

### Research

Funding should be provided to support the placement of an expert in forest/wildland ecology. This person could split his/her time

between the Royal Forestry School at Sale, the University, the Scientific Institute, and other faculties in Rabat.

Funding should be made available to look at the status of the larger mammals. Their distributions have been studied and reported [26], but their current status is unknown.

Population and distribution studies are needed for the large raptors, as well as for the Bustards and other endangered birds.

An inventory of the plant and animal species, and their current status, should be made for each of the national parks and reserves. This information would be of value in developing management priorities and plans for these protected areas in the future.

An inventory of the coastal resources, pollution levels, and related marine studies is needed. This should exclude commercial fisheries which are being studied by the GOM, the FAO and other donors.

The Plan d'Orientation 1988-1992 contains a proposal for the establishment of up to 15 new arboreta, with a total area of 750 ha. and 50 experimental sites with a total area of 250 ha. Every effort should be made to ensure that valuable indigenous species are included in the planting programs for these new arboreta and experimental sites.

Ensure that the information developed in research (grad student or other) is disseminated quickly. Prepare and distribute the bulletins for the various research institutions in a timely manner. Such information can help in planning and developing of future activities. Ensure that information is distributed between institutions and organizations.

Distribute information of wider interest (thesis on environmental topics and concerns) to appropriate international institutions - the International Council for Bird Preservation? The World Wildlife Fund? IUCN? ORSTOM? Library of Congress? The French and Belge equivalents to the Library of Congress? Dissertation center in Michigan for PhD dissertations?

Strengthen on-going, long-term collaboration between all of the various administrative and research organizations.

Ensure that local species are included in experimental trials and arboreta plantings of trees, shrubs and forage species. Promote the use of local species whenever possible in erosion control and watershed protection efforts.

Provide support for field studies by graduate students and professors in ecology, zoology, and related environmental fields. Select topics from within the priorities established by the GOM and the donor community. Such support could include support for

transportation and limited equipment (to remain with the institution). This could be provided at very low cost. See Annex 4.

The donors should insert environmental studies within larger projects. Use local expertise wherever possible. The studies could be directly related to the specific project goals, or they could be targeted at priority questions within the geographic region, etc.

Develop umbrella projects that would permit funding multiple small projects through a single organization, such as the ICBP, WWF, IUCN, etc. This would be an excellent way to provide research support to zoological or botanical studies through the universities and research centers.

The GOM and the donors should investigate the feasibility of initiating a study to install fish ladders for future dams, and the feasibility of retrofitting existing dams with ladders to permit the migration of shad to their spawning grounds.

The GOM and the donors should expand applied research on appropriate species and agroforestry techniques, throughout Morocco. The research should go beyond fruit tree and fodder species. In other regions of the world, agroforestry activities have often been found to be successful in increasing overall productivity, from the combined return on agricultural and wood products, in humid as well as semi-arid regions. Agroforestry interventions with appropriate species can benefit agricultural productivity by reducing soil erosion, improving soil structure, increasing soil organic matter, increasing soil fertility and by providing a wider variety of products, such as fruit, fodder, construction wood, and fuelwood.

Moroccan - French Cooperation is funding a nationwide study on wildlife. The first year will be dedicated to background and general information gathering studies. On-the-ground activities are expected to begin the following year. Every effort should be made to follow the information developed by this effort, and either fund additional studies to develop information that is found to be lacking (probably will be a lot of opportunities here) or fund individual projects that are found to merit funding.

#### Private Sector

Work with the private sector to begin developing the tourism potential, and related cash returns, of the various national parks and reserves. Identify and institute various means for capturing and keeping a portion of the tourism dollar within the local communities and economy, and within the parks and reserves system, to provide at least partial external financial support to the park system.



## **AREAS OF OPPORTUNITY FOR POTENTIAL DONOR SUPPORT**

Several areas of opportunity exist for potential donor support. In addition to providing support to the activities outlined in the draft Plan d'Orientation 1988-1992 (see Annex 6), other priority areas that are evident include; 1) Human Resources Development, 2) the Parks and Reserves System, 3) Developing Basic Ecological-Status Information, and 4) Environmental Education. Additional work is needed to develop appropriate interventions in each of these areas, but all are inter-related, and worthy of outside support.

### Human Resources Development

Human resources development, or training, in ecology and environmentally-related fields could be supported. Such training should be available both for technicians currently within the government service and for university students. Technicians could be awarded scholarships to support advanced degree training as well as short-term training in selected areas, whereas university students could be supported through both scholarships and research fellowships. Such training support should be directed towards the environmental/ecology domains, not the more traditional range or forest management sectors.

One hazard to be avoided is training people who would not subsequently be employable, either by the civil service or within the private sector. If necessary, support should be provided to these institutions to ensure that the expertise being developed was fully utilized at the completion of training.

### Parks and Reserves Management

The system of existing and proposed parks and reserves could be supported by the donor community. Through conditions precedent and other agreements usually associated with donor support, such collaboration could be instrumental in advancing such efforts as the establishment of the proposed Massa Park or for addressing some of the short-comings that have been identified in assessments of the existing system of existing protected areas.

Support to the parks and reserves also offers the unique possibility of assisting the GOM while supporting development of the private sector.

### Basic Research

The present status of many of the indigenous species of Morocco and the Maghreb is unknown. It is difficult to identify priority species and areas of special concern without such basic information. By supporting the development of this information, the donor community would be assisting the GOM and donors by both quantifying what is happening to the environment and assisting in identification of priority concerns that should be addressed.

The support for training mentioned earlier could be used in developing this basic information, through research fellowships and other similar activities.

Priority topics include assessing the status of the species within the existing parks and reserves, and investigations into the status of the large mammals, raptors and other endangered birds. An assessment of the coastal resources should also be undertaken.

#### Environmental Education

E&F, the National Zoo at Temara, the Moroccan Association for the Protection of the Environment (ASMAPE), and other agencies and organizations are working at developing nation-wide conservation education programs. Support could be directed towards these efforts, both to increase the actual capabilities of the relevant organizations and to increase the actual extension activities undertaken.

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ANNEX 1

Endangered Birds

Rare and Endangered Birds of Morocco - Personnel Communication  
from M. Thevenot and P. Beaubrun, 1987

<u>Common Name</u>	<u>Scientific Name</u>	<u>Breeding Zones</u>
(Wintering zones indicated within parenthesis)		
Tawny or Steppe Eagle	<i>Aquila rapax</i>	9, 10,15
Golden Eagle	<i>A. chrysaetos</i>	1,3,4,5, 8,10 (6)
Griffon Vulture	<i>Gyps fulvus</i>	3,4,8,10 (15,2)
Eleonora's Falcon (numbers of nearly all raptors are reduced due to persecution)	<i>Falco eleonora</i>	7c,7d
Osprey	<i>Pandion haliaetus</i>	12 (7 all)
Andouin's Gull	<i>Larus audouinii</i>	12 (7a)
Slender-billed Gull (only breeding record in 7a; not endangered, just uncommon)		
Cormorant	<i>Phalacrocorax carbo marrocanus</i>	7a-c
(a Moroccan sub-species, rare along the coast)		

Birds Listed in the IUNC Red Data Book [35]

<u>Common Name</u>	<u>Scientific Name</u>	<u>Breeding Zones</u>
(Wintering zones indicated within parenthesis)		
White Stork	<i>Ciconia ciconia</i>	1-3,5, 6,7c,7d, 8,9,12
Marbled Teal	<i>Marmaronetta angustirostris</i>	2,7b,7d,15 (4)
White-headed Duck	<i>Oxyura leucocephala</i>	Last seen in zone 3
Red Kite	<i>Milvus milvus</i>	1,2,4,5,12 (3)
Bearded Vulture or Lammergier	<i>Gypaetus barbatus</i> 1	5,8,10
Black Vulture	<i>Aegyptius monachus</i>	4 (12)
Spanish Imperial Eagle	<i>Aquila adalberti</i>	(1,2,7c,7d,12)

Peregrine Falcon	Falco peregrinus	All zones
Demoisselle Crane	Anthropoides virgo	4
Little Bustard	Tetrax tetrax	1-4,7d
Great Bustard	Cotis tarda	1,2,7d
Houbara Bustard	Chlamydotis undulata	5,9-11,15
Slender-billed Curlew	Numenius tenuirostris	(2,7a-d)
Red-necked Nightjar	Caprimulgus ruficollis	1-6,8,10,15
Double-spurred Francolin	Francolinus bicalcaratus	3,15
Dark Chanting Goshawk	Melierax metabates	10,15
Bald Ibis (Waldrap Ibis)	Geronticus eremita	5,7b,7c,8

Birds Listed in Preliminary List of Mediterranean Birds in Need of Special Protection, UNEP/IG.20/INF.7. [7]

<u>Common Name</u>	<u>Scientific Name</u>
Ostrich	Struthio camelus (extirpated)
Manx shearwater	Puffinus puffinus
Cory's shearwater	P. diomedea
Cormorant	Phalacrocorax carbo
Squacco heron	Egretta gularis (Ardeola ralloides)
Little bittern	Ardea goliath (Ixobrychus minutus)
Spoonbill	Platalea leucorodia
Bald ibis	Geronticus eremita
Flamingo	Phoenicopterus ruber
Ruddy Shelduck	Tadorna ferruginea

Passerine birds of Morocco - Personal Communication of M. Thevenot and information from the Moroccan Ornithological Center, Rabat, 1987

<u>Scientific Name</u>	<u>Zones of Occurance</u>
<i>Ammomanes deserti</i> RB	5,8,9,1,11,7a
<i>Ammomanes cincturus</i> RB	5,8,9,10,11,7a
<i>Alaemon alaudipes</i> RB	9,11,10,7a
<i>Eremopterix nigriceps</i> RB	11
<i>Chersophilus duponti</i> RB	5,8
<i>Melanocorypha calandra</i> RB	2,3,4,5,6,8,7c,7d
<i>Rhamphocorys clot-bey</i> RB	5,8,9,10,11
<i>Calandrella ' achydactyla</i> MB	all zones
<i>Eremophila alpestris</i> RB(MB)	4,8,9,10
<i>Alauda arvensis</i> RB	2,3,4,5,7 all
<i>Alauda arvensis</i> WV	1,2,3,4,5,6,7 all,8,10
<i>Eremophila bilopha</i> RB	5,7a,9,11
<i>Calandrella rufescens</i> RB	5,6,7a,7b,8,9,10,14
<i>Lullula arborea</i> RB	1,2,3,4,5,7b,8,12
<i>Galerida cristata</i> RB	all zones
<i>Galerida theklae</i> RB	all zones
<i>Ptyonoprogne fuligula</i> RB (or MB)	9,11
<i>Hirundo rupestris</i> WV	all zones except 7a and 11
<i>Riparia paludicola</i> RB	2,6,7b,7c,7d,8,9,10,15
<i>Hirundo rupestris</i> RB	1,5,8,9,12
<i>Hirundo rustica</i> MB	all zones except 9 and 11
<i>Hirundo daruica</i> MR	1,2,3,6,7b,7c,7d,8,12,15
<i>Delichon urbica</i> MB	all zones except 7a and 11

RB = Resident Breeder; MB = Migrant Breeder; WV = Winter Visitor  
WV = Winter Visitor OB = Occasional Breeder AV = Accidental Visitor

<i>Anthus campestris</i> MB	1,4,5,8,12
<i>Motacilla alba</i> subpersonata RB	1,2,3,4,6,7b,7c,7d,8,9,10,15
<i>Motacilla alba</i> WV	all zones
<i>Motacilla cinerea</i> RB	1,2,3,4,8,12
<i>Motacilla flava</i> MB	1-8,10
<i>Pycnonotus barbatus</i> RB	all zones
<i>Prunella collaris</i> RB	4,8
<i>Cinclus cinclus</i> RB	1,4,10,12
<i>Troglodytes troglodytes</i> RB	1,2,3,4,5,7c,8,12
<i>Anthus spinoletta</i> WV	1,2,3,4,7b,7c,7d,8,12,15
<i>Luscinia svecica</i> WV	2,5,6,7b,7d,8,15
<i>Turdus iliacus</i> WV	all zones except 9 and 11
<i>Motacilla flava</i> WV	1,2,3,7b,7c,7d,12,15
<i>Cercotrichas galactotes</i> MB	1,2,3,5,6,7 all, 8,9,10,12
<i>Erithacus rubecula</i> RB	1,3,4,7d,8
<i>Luscinia megarhynchos</i> MB	1-6,7c,7d,8,12
<i>Erithacus rubecula</i> WV	all zones except 11
<i>Phoenicurus ochruros</i> WV	all zones except 11
<i>Phoenicurus phoenicurus</i> MB	1,4,8
<i>Phoenicurus moussieri</i> (RB) (WV)	1,4,5,7b,7c,8,12,15
<i>Saxicola torquata</i> RB	1-6,7 all,15
<i>Saxicola torquata</i> WV	all zones except 11
<i>Oenanthe oenanthe seebohmi</i> MB	1,4,5,8
<i>Oenanthe hispanica</i> MB	all zones except 9 and 11
<i>Oenanthe deserti</i> MB	5,7a,9,11

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<i>Oenanthe lugens</i>	9,10
<i>Oenanthe moesta</i> RB	5,7a,9,10,11
<i>Oenanthe leucopyga</i> RB	9,10
<i>Oenanthe leucura</i> RB	all zones except 9 and 11
<i>Monticola solitarius</i> RB	all zones except 11
<i>Monticola saxatilis</i> MB	1,4,8,12
<i>Anthus pratensis</i> WV	all zones except 11
<i>Turdus torquatus</i> WV	4,5,8
<i>Turdus merula</i> RB	all zones except 11 south
<i>Turdus philomelos</i> WV	all zones except 11
<i>Turdus viscivorus</i> RB	1,3-5,8,12
<i>Locustella luscinioides</i> MB	4,5,7d,8
<i>Acrocephalus arundinaceus</i> MB	1,2,4,5,7d,12
<i>Acrocephalus scirpaceus</i> MB	1,2,3,5,6,8,9,12
<i>Hippolais pallida</i> MB	all zones
<i>Cettia cetti</i> RB	all zones except 7a and 11
<i>Cisticola juncidis</i> RB	1,2,3,6,9,12,15
<i>Scotocerca inquieta</i> RB	7a,15
<i>Acrocephalus melanopogon</i> RB	RB - 7c; OB - 7b,12; WV - 7b,7c,12
<i>Hippolais polyglotta</i> MB	1,2,3,4,5,8
<i>Sylvia undata</i> RB	11,5,12
<i>Sylvia undata</i> WV	all zones except 9 and 11
<i>Sylvia deserticola</i> MB	5,8,9,10
<i>Sylvia deserticola</i> WV	5,8,9,10,11,15
<i>Sylvia conspicillata</i> MB	1-8,10,11,15
<i>Sylvia conspicillata</i> WV	1-11,15

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<i>Sylvia cantillans</i> MB	1,4,5,8,12
<i>Sylvia melanocephala</i> RB	all zones
<i>Sylvia melanocephala</i> WV	more into the eastern desert
<i>Sylvia nana</i> RB	9,11
<i>Sylvia hortensis</i> MB	1,2,3,5,7a,7b,8,10,12
<i>Sylvia communis</i> MB	1,2,3,4,7d,8,12
<i>Syvia atricapilla</i> RB	1-6,7c,7d,8,12
<i>Syvia atricapilla</i> WV	all zones except 7a and 11
<i>Phylloscopus bonelli</i> MB	1,3,4,5,7c,7d,8,12
<i>Phylloscopus collybita</i>	RB - 1,12, WV all zones
<i>Regulus ignicapillus</i> RB	1,4,8
<i>Regulus ignicapillus</i> WV	1-6,7b,7d,8,12
<i>Locustella naevia</i> WV	1,2,6,7c,7d,12
<i>Muscicapa striata</i> MB	all zones except 7a and 9-11
<i>Parus caeruleus</i> RB	all zones except 9 and 11
<i>Ficedula hypoleuca</i> MB	1,3,4,5,8
<i>Turdoides fulvus</i> RB	9,10,11,15
<i>Parus major</i> RB	all zones except 9 and 11
<i>Parus ater</i> RB	1,4,8,12,15
<i>Parus ater</i> WV	1-6,7b,7c,7d,8,15
<i>Sitta europaea</i> RB	1,3,4,8,12
<i>Certhia brachydactyla</i> RB	1,3,4,5,7d,8,12
<i>Oriolus oriolus</i> MB	1,2,3,4,7c,7d,8,12
<i>Tchagra senegala</i> RB	1,2,3,5,7,7b,7c,8,12,15
<i>Lanius senator</i> MB	all zones except 9 and 11
<i>Lanius excubitor</i> RB	all zones

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<i>Garrulus glandarius</i> RB	1,3,4,5,8
<i>Pica pica mauritanica</i> RB	2,3,4,5,7a,7b,8-11
<i>Pyrrhocorax pyrrhocorax</i> RB	1,4,5,8,10,12
<i>Pyrrhocorax graculus</i> RB	1,4,8,12
<i>Fringilla coelebs africana</i> RB	1-6,7b,7c,7d,8,12,15
<i>Serinus serinus</i> RB	all zones except 7a and 11
<i>Carduelis chloris</i> RB	1-6,7b,7c,7d,8,9,10,12,15
<i>Carduelis cannabina</i> RB	all zones except 9,10, and 11
<i>Loxia curvirostra</i> RB	1,4,5,8
<i>Rhodopechys sanguinea</i> RB	4,8
<i>Bucanetes githaginea</i> RB	1,3-6,7b,8-11,15
<i>Coccothraustes coccothraustes</i> RB	1,2,3,4,5,8
<i>Passer domesticus</i> RB	all zones
<i>Passer hispaniolensis</i> MB	1-6,7b,7c,7d,15
<i>Passer hispaniolensis</i> RB	all zones
<i>Passer simplex</i> RB	all zones
<i>Petronia petronia</i> RB	1,4,5,8,10,12
<i>Corvus monedula</i> RB	1,2,4,5,8,12
<i>Corvus ruficollis</i> RB	9,11
<i>Corvus corax tingitanus</i> RB	all except Saharan zones
<i>Sturnus unicolor</i> RB	1,2,3,4,7 all, 8,12
<i>Emberiza cirrus</i> RB	1-5,7a-c,8,12,15
<i>Emberiza cia</i> RB	1,3,4,5,8,12,15
<i>Emberiza striolata</i>	2-6,7a-c,8-11
<i>Emberiza schoeniclus</i> RB	2,7c
<i>Emberiza calandra</i> RB	all zones except 7a,9,11

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Sturnus vulgaris WV	all zones except 11
Carduelis carduelis RB	all zones except 11
Fringilla montifringilla AV	
Carduelis spinus WV	
Geronticus eremita	5,6,7b,7c,8,15

RB = Resident Breeder; MB = Migrant Breeder; WV = Winter Visitor  
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**ANNEX 2**

**Endangered Mammals**

## MAMMALS OF MOROCCO

<u>Scientific Name</u>	<u>Common Name</u>	<u>Zones of Occurrence</u>
<b>INSECTIVORS</b>		
Erinaceus algirus	Algerian hedgehog	1-10,12,15
Paraechinus aethiopicus	Desert hedgehog	7a,9,10
Crocidura whitakeri	North African Lesser white toothed shrew	2-7,9,10,12,15 *
Crocidura tarfayaensis	Tarfaya's shrew	7a,7b,11,15
Crocidura lusitania		7a,7c,10 **
Crocidura russula	Greater white toothed shrew	1-6,7b-d, 8-10,12,15
Crocidura bolivari		7a,7b,8,9,10,15
Suncus etruscus	Pigmy white toothed shrew	1,5
Elephantodus rozeti	N. African Elephant shrew	3,5,6,7a-c, 8-11,15 *
Rhinopoma microphyllum	Greater Rat-tailed Bat	9,10
Rhinopoma hardwickei	Lesser Rat-tailed Bat	9,10
Nycteris thebaica	Egyptian Slit-faced Bat	2,3,6,7b,7c, 8,10,15
Rhinolophus ferrumequinum	Greater Horseshoe Bat	2,4,5,7c,8,12,15
Taphozous nudiventris	Naked-rumped Bat	11 (extreme southern Sahara)
Rhinolophus hipposideros	Lesser Horseshoe Bat	1-3,5,6,7c,7d, 10,12
Rhinolophus emyale	Med. Horseshoe Bat	1,2,4,5,7c, 8,10,12

\* thought to be endangered; \*\* thought to be rare

Rhinolophus mehelyi	Mehely's Horseshoe Bat	3-6,7c,7d,12
Rhinolophus blasii	Blasius' Horseshoe Bat	5,6,10
Hipposideros caffer	Sundevall's African Leaf-nosed Bat	7c,12
Asellia tridens	Trident Leaf-nosed Bat	5,9,10
Myotis mystacinus	Whiskered Bat	3-6
Myotis emarginatus	Geoffray's Bat	5,9
Myotis mattereri	Matterer's Bat	5,12 **
Myotis capaccinii	Long-fingered Bat	4,7c **
Myotis blythi	Lesser Mouse-eared Bat	1-6,7c,7d,8, 9,12,15
Pipistrellus pipistrellus	Common pipistrelle	1,2,3,5,12
Pipistrellus kukli	Kukl's pipistrelle	1,2,3,4,5,7c,7d, 8-10,12
Pipistrellus savii	Savi's pipistrelle	1,4,5,12
Pipistrellus rueppelli	Ruppell's Bat	9,10
Nycatalus noctula	Noctule	no information
Nyctalus leisleri	Lesser noctule	no information
Nyctatis lasiopterus	Greater noctule	7d
Otonycterus hemprichi	Hemprich's Long- eared Bat	8,10
Eptesicus serotinus	Serotine	3,5,6,7c,7d,8,9
Barbastella barbastellus	Barbastelle	4
Plecotus austriacus	Grey Long-eared bat	1,4-6,7c,8,9
Miniopterus schreibersi	Schreiber's Bat	1,3-6,7d,8,12
Tadarida teniotis	Tree-tailed Bat	5,10,12

\* thought to be endangered; \*\* thought to be rare

**PRIMATES**

Macaca sylvanus	Barbary Macaque	1,2,4,8,12 *
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**LAGOMORPHA**

Lepus capensis	Brown Hare	1-12,15
Oryctologus arniculus	Rabbit	1-6,7c,7d,12
Lepus saxatillis	Scrub Hare	11 (far south)

**RODENTIA**

Atlantoxerus getulus	Barbary Ground Squirrel	1,5,6,7a-c, 8-10,15 *
Xerus erythropus	Geoffroy's Ground Squirrel	15
Gerbillus campestris	Large N. Africa Gerbil	1-10,12,15
Gerbillus nanus	Baluchistan Gerbil	5,7a,9,10
Gerbillus henleyi	Pigmy Gerbil	7a,9,10
Gerbillus gerbillus	Lesser Egyptian Gerbil	7a,9
Gerbillus pyramidum	Greater Egyptian Gerbil	9,11
Gerbillus hesperinus		7c RE
Gerbillus hoogstraali		7b,15 RE
Gerbillus riggenbacki		11
Dipodillus simoni	Lesser Short-tailed Gerbil	2 **
Dipodillus maghrebi	Greater Short-tailed Gerbil	5 **
Pachyuromys duprasi	Fat-tailed Gerbil	5,9-12
Meriones shawi	Shaw's Jird	1,6-7b-d, 8-10,12,15
Meriones libycus	Lybian Jird	5,7a-b,8-11,15
Meriones crassus	Sundevall's Jird	7a,9-11
Psammomys obesus	Fat Sand Rat	4,5,7a,8-11

\* thought to be endangered; \*\* thought to be rare

<i>Apodemus sylvaticus</i>	Wood Mouse	1-6,8,10,12
<i>Lemniscomys barbarus</i>	Barbary Striped Mouse	1,2,3,5,6,7b-d, 8,12,15
<i>Rattus rattus</i>	Black Rat	1-3,5,6,7b-d, 12,15
<i>Rattus norvegicus</i>	Brown Rat	1-3,5,6,7b-d, 12,15
<i>Mus musculus</i>	House Mouse	1-10,12,15
<i>Mus spretus</i>	Algerian Mouse	1-6,7b-d,8,9, 12,15
<i>Mastomys erythroleucus</i>	Western Multimammate Rat	6,7b,7c,8,15
<i>Acomys cahirinus</i>	Spiny Mouse	9-11
<i>Eliomys quercinus</i>	Gorden Door Mouse	1-10,12,15
<i>Jacuhis jacuhis</i>	Lesser Egyptian Jerboa	5,8-11
<i>Jaculus orientalis</i>	Greater Egyptian Jerboa	2-5,12 *
<i>Hystrix cristata</i>	Porcupine	1-6,7c,7d, 8-10,12 **
<i>Ctenodactylus gundi</i>	Gundi	5
<i>Ctenodactylus vali</i>	Thomas' Gundi	9
<i>Etenodactylus spp.</i>	(not differentiated)	5,8,9
<i>Felovia vae</i>	Felou Gundi	11 RE
<b>CARNIVORA</b>		
<i>Canis aureus</i>	Jackal	1-11,15
<i>Vulpes vulpes</i>	Common Red Fox	1-6,7b-d,8-12,15
<i>Vulpes ruppelli</i>	Ruppell's Sand Fox	9,11 **
<i>Fennecus zerda</i>	Fennec	7a,9,11
<i>Mustela nivalis</i>	Weasel	1-6,7b-d,8-10, 12,15
<i>Mustela putorius furo</i>	Ferret	(domesticated)

\* thought to be endangered; \*\* thought to be rare

Poecilictis libyca	Saharan Striped Weasel	1,5,10-12
Mellivora capensis	Ratel	7b,10,11,15
Lutra lutra	Otter	1-6,7b-d,8,10, 12,15 (may no longer exist in zone 11)
Genetta genetta	Genet	1-6,7b-d,8,10, 12,15
Herpestes ichneumon	Egyptian Mongoose	1-4,6,7b-d,8,10, 12,15
Herpestes sanguines	Slender Mongoose	(far southern Morocco)
Ursus arctos	Brown Bear	Extinct
Hyaena hyaena	Striped Hyaena	1,4,5,9,10 *
Felis libyca	African Wild Cat	1-4,7a11,8-12,15
Felis margarita	Sand Cat	9
Felis caracal	Caracal	1-5,7a,7c,8-12 *
Panthera leo	Lion	Extinct
Panthera pardus	Leopard	1,4,8 *
Acinonyx jubatus	Cheeta	5,9,11 (no sightings since 1974) *
<b>PINNIPEDIA</b>		
Monachus monachus	Med. Monk Seal	7a (south),12 *
<b>HYRACOIDEA</b>		
Procavia capensis	Rock Dassie	
<b>ARTIODACTYLA</b>		
Sus scrofa	Wild Boar	1-6,7b-d,8,10, 12,15
Oryx gazella dammah	North African or Scimitar-horned Oryx	in sub-sahara (no recent infor- mation) *

\* thought to be endangered; \*\* thought to be rare

Addax nasomaculatus	Addax	in sub-sahara (no recent information) *
Alcelaphus buselaphus	Hartebeest	Extinct
Gazella dorcas	Dorcas Gazelle	5,6,7a,9,11 *
Gazella cuvieri	Cuvier's Gazelle	1,8,10 *
Gazella dama	Dama Gazelle or Aoudad	formerly 9,11, recently in 11 *
Ammotragus lervia	Barbary Sheep	4,5,8,10,11 */**

#### CETACEA

Delphinidae stenella-coeruleoalba	Observed in Atlantic, Straits, Med.
Delphinus delphis	Frequent in Atlantic, Straits, Med.
Tursiops truncatus	Frequent in Atlantic, Straits, Med.
Pseudorca crassidens	Observed in Atlantic and Straits
Orcinus orca	Frequent in Atlantic and Straits
Grampus grisens	Observed in Atlantic
Globicephala melaena	Frequent in Straits, rare in Atlantic and Med.
Phocoena phocoena	Often observed in Atlantic south of Agadir
Ziphius cavirostris	Observed in Atlantic
Hyperoodon ampullatus	Observed in Med.
Physeter macrocephalus	Rare in Atlantic and Med.
Balaenoptera borealis	Formerly observed in Straits
Balaenoptera physalus	Formerly observed in Straits
Balaenoptera muscus	Formerly observed in Med.
Megaptera novaeangliae	Observed in Atlantic

\* thought to be endangered; \*\* thought to be rare



**ANNEX 3**

**Endangered Plants**



INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES  
UNION INTERNATIONALE POUR LA CONSERVATION DE LA NATURE ET DE SES RESSOURCES

Conservation Monitoring Centre – Centre de surveillance continue de la conservation de la nature

c/o The Herbarium, Royal Botanic Gardens,  
Kew, Richmond, Surrey, TW9 3AE, U.K.

BOTANIC GARDENS CONSERVATION CO-ORDINATING BODY

REPORT NO. 17

THE BOTANIC GARDENS LIST OF  
RARE AND THREATENED SPECIES OF  
NORTH AFRICA

COMPILED BY THE THREATENED PLANTS UNIT  
OF THE IUCN CONSERVATION MONITORING CENTRE  
AT THE ROYAL BOTANIC GARDENS, KEW

FROM INFORMATION RECEIVED FROM SUBSCRIBERS TO THE  
BOTANIC GARDENS CONSERVATION CO-ORDINATING BODY

IUCN would like to express its warmest thanks to all the specialists,  
technical managers and curators who have contributed information.

KEW, August 1986

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## INTRODUCTION

This report catalogues the results of the survey of rare and threatened plants of North Africa in cultivation among subscribers to the IUCN Botanic Gardens Conservation Co-ordinating Body.

A list of 488 species was circulated to Gardens in August 1984. It was derived principally from the list of threatened plants for North Africa and the Middle East prepared by TPU in 1980\*. This was itself prepared as a result of a detailed survey by TPU using the existing Floras and Checklists as a taxonomic basis and asking country and regional experts to provide data on the degree of threat to each taxon.

In the Botanic Gardens survey, a disappointing total of only 34 taxa were located in cultivation. Most of them are fairly well known species, such as the famous rarity Cupressus dupreziana, covered in The IUCN Plant Red Data Book (1978). The fascinating plant Nymphaea lotus just gets in, since sadly it is now an endangered species in Egypt, the only part of its range to be within the region considered here, though of course it is by no means a threatened species over much of Asia.

IUCN has been aware for some time that far more attention needs to be paid to research, conservation and sustainable utilization of the flora of North Africa. For this reason we are extremely pleased to be associated as one of the sponsors for a conference in Rabat, Morocco, next April on 'Conservation de la nature et utilisation des Ressources Vegetales'. This will cover the North African region, with particular emphasis on Morocco, which has much the richest flora and the most endemics.

IUCN Threatened Plants Committee Secretariat (1980). First Preliminary Draft of the List of Rare, Threatened and Endemic Plants for the Countries of North Africa and the Middle East. Mimeo, IUCN, Ke v. 170 pp. (Covers Algeria, the Azores, the Canaries Cypress, Egypt, Israel, Jordan, Lebanon, Libya, Madeira, Morocco, Salvage Islands, Syria and Tunisia.)

The objective is to bring together people from different disciplines - in pure conservation, in agronomy, in medicinal plants, in taxonomy, in protected area management, for example - and chart a way forward in genetic resource conservation. The conference is being organised by Monsieur Mohammed Rejdali, Département d'Ecologie, Végétale et Pastoralisme, Institut Agronomique et Veterinarie Hassan II, Le Rabat, Morocco; please write to him for details. Papers at the conference include assessments of the current state of taxonomy and conservation, and reviews of protected areas, gene banks and Botanic Gardens in the region. There will also be a round table on improving the threatened plant list for the region; already Monsieur Rejdali is working on the Moroccan part of the list and the Cairo Herbarium has started on a plant Red Data Book for Egypt. The conference will surely be a splendid opportunity to exchange views and make progress in this important area.

This report gives the information we have to date. It is in two sections.

The first part is the list that gives the names of rare and threatened plants of North Africa that have so far been located in one or more botanic gardens. After each name is given the codes of those gardens known to be holding material of the species.

Second are the names and addresses of the botanic gardens which hold material of the listed species, with their codes.

The aim is that those members which would like to grow the plants concerned can then make direct contact with the gardens who have material to spare. We hope this feature will be of especial use to managers and curators of botanic gardens in planning and building their collections, and help remove pressure on wild collections.

The Royal Botanic Gardens, Kew (Code K) will be pleased to propagate and distribute to other members on request any species marked on the list as growing at Kew.

### Key

Upper case underlined (e.g. ABCD) indicates plants from a known wild source.

Upper case alone (e.g. ABCD) indicates plants from a known cultivated source.

Lower case (e.g. abcd) indicates plants from an unknown source.

+ following the code indicates that duplicate material is available.

Where a garden holds both wild and cultivated source material, the code to indicate known wild source is used as, clearly, the wild source material is the more valuable.

RARE AND THREATENED PLANTS OF NORTH AFRICA

PTERIDOPHYTA

MARSILEACEAE

Marsilea minuta L.

MACF+

GYMNOSPERMAE

CUPRESSACEAE

Cupressus atlantica Gaussen

AD+, BRES, DBN, E, K, YALT

Cupressus dupreziana A.Camus

AAU, AD+, B, DBN, K, LE, M, NICE,  
RNG

EPHEDRACEAE

Ephedra ciliata Fischer & C.A.Meyer

B, E, TASH+

PINACEAE

Abies numidica de Lannoy

AD+, amd, B, BR, cgg, E, K, KIEL,  
LE, nice, sdap, TASH+, U, yalt+

ANGIOSPERMAE

ASCLEPIADACEAE

Caralluma joannis Maire

AAU, b, BERN, K, KIEL, MB, MIL,  
NCY, ort, ZSS

Caralluma sinaica (Decaisne) A.Berger

MTJB, ZSS

BERBERIDACEAE

Epimedium perralderianum Coss.

amd, cgg, dbn, E, k, UBC+, WSY+

CARYOPHYLLACEAE

Dianthus guessfeldtianus Muschler

KIEL

Dianthus rupicola Biv.

hal, YALT

COMPOSITAE

Leucanthemum hosmariense (Ball) Font  
Quer

AD+, dbn, harr, RNG+

<u>Onopordum algeriense</u> (Munby) Pomel	BRES, NCY
CRASSULACEAE	
<u>Kalanchoe faustii</u> Font Quer	AAU, BRES, DTSK, DUSS, K, KPABG, KUIB+, MEL, NCY, RV, YOSH+, ZSS
<u>Sedum multiceps</u> Coss. & Durieu	AAU, BID, <u>BR</u> , dbn, E, K, kiel, mb+, mel, MIL, <u>MTJB</u> , <u>NICE</u> , pac+, U
<u>Sempervivum arboreum</u> L.	<u>E</u> , nice
CRUCIFERAE	
<u>Alyssum flahaultianum</u> Emberger	<u>BRES</u>
<u>Brassica spinescens</u> Pomel	<u>BRES</u>
<u>Crambella teretifolia</u> (Battand.) Maire	<u>BRES</u>
<u>Hemicrambe fruticulosa</u> Webb	<u>BRES</u>
<u>Iberis semperflorens</u> L.	AAU, bmbg, <u>CGG</u> , <u>E</u> , gent, harr, K, le, <u>LIVC</u> , mb+, msk, prc, tall, wsy, YALT
CYPERACEAE	
<u>Cyperus papyrus</u> L. subsp. <u>hadidii</u> Chrtek & Slavikova	AA, MB+, sdap
ERICACEAE	
<u>Arbutus pavarii</u> Pampan.	k
EUPHORBIACEAE	
<u>Euphorbia nereidum</u> Jahand. & Maire	<u>BRES</u> , <u>K</u>
LABIATAE	
<u>Salvia interrupta</u> Schousboe	DBN, K, NGOET, NICE
LEGUMINOSAE	
<u>Acacia gerrardii</u> Benth.	<u>BR</u>
<u>Lotus drepanocarpus</u> Durieu	HLIJ

LILIACEAE

Scilla latifolia Willd.

AAU, BERN, K, LPA+

NYMPHAEACEAE

Nymphaea lotus L.

AAU, amd, b, bern, besn, br, bres,  
CGG, E, gent, IAGB, K, LE, LECB,  
mb, prc, tash, z

OLEACEAE

Olea laperrinei Battand. & Trabut

rng

PRIMULACEAE

Cyclamen rohlfsianum Aschers.

BERN, boch+, BRES, CGG, DUSS, E,  
K, kiel, MB, NIJ, WSY+

Primula boveana Decaisne

MTJB

ROSACEAE

Cotoneaster orbicularis Schlecht.

CGG, RV

Rosa arabica Crepin

AAU, MTJB

THYMELAEACEAE

Daphne jasminea Sibth. & Smith

BERR, CGG, DUSS, E, K, wsy



INDEX OF CODES

CODE	INSTITUTION
AA	Main Botanical Garden, Kazakh Academy of Sciences, 480070 ALMA-ATA, Kazakh S.S.R., U.S.S.R.
AAU	University of Aarhus Botanical Institute, 68 Nordlandsvej, DK-8240 RISSKOV, Denmark.
AD	Adelaide Botanic Garden, North Terrace, ADELAIDE 5000, Australia.
AMD	Hortus Botanicus of the University of Amsterdam, Plantage Middenlaan 2, 1018 DD AMSTERDAM, The Netherlands.
B	Botanischer Garten und Museum Berlin-Dahlem, Konigin-Luise-Strasse 6-8, D-1000 BERLIN 33, Federal Republic of Germany.
BERN	Botanischer Garten der Universitat Bern, Altenbergrain 21, CH-3013 BERN, Switzerland.
BERR	The Berry Botanic Garden, 11505 S.W. Summerville Avenue, PORTLAND, Oregon 97219, U.S.A.
BESN	Jardin Botanique de la Ville et de la Universite, Place Marechal Leclerc, F-25000 BESANCON, France.
BID	Flevohof Biddinguizen, c/o Department of Plant Taxonomy, Agricultural University, 37 Generaal Foulkesweg P.O. Box 8010, 6700 ED WAGENINGEN, The Netherlands.
BMBG	Birmingham Botanical Gardens, Westbourne Road, Edgbaston, BIRMINGHAM B15 3TR, U.K.
BOCH	Botanischer Garten Ruhr-Universitat Bochum, Universitatstrasse 150, Postfach 102148, D-4630 BOCHUM 1, Federal Republic of Germany.
BR	Jardin Botanique National de Belgique, Domaine de Bouchout, B-1860 MEISE, Belgium.
BRES	Conservatoire Botanique du Stangalarc'h, F-29200 BREST, France.
CGG	Cambridge University Botanic Garden, 1 Brookside, CAMBRIDGE CB2 1JF, U.K.
DBN	National Botanic Gardens, Glasnevin, DUBLIN 9, Ireland.
DTSK	Donetsk Botanical Garden, Elevatornaya Street 19, 340079 DONETSK 3, Ukraine S.S.R., U.S.S.R.
DUSS	Botanischer Garten der Universitat Dusseldorf, Universitatstrasse 1, D-4000 DUSSELDORF 1, Federal Republic of Germany.
:	Royal Botanic Garden, Inverleith Row, EDINBURGH EH3 5LR, U.K.

- GENT Plantentuin der Rijksuniversiteit, K.L. Ledeganckstraat 35, B-9000 GENT, Belgium.
- HAL Botanischer Garten der Martin-Luther-Universität, Am Kirchtor 3, 402 HALLE/SALLE, German Democratic Republic.
- HARR Harlow Car Gardens, The Northern Horticultural Society, HARROGATE, N. Yorkshire HG3 1QB, U.K.
- HLU University of Hull Botanic & Experimental Garden, 57, Thwarte Street, Cottingham, N. Humberside HU16 4QX, U.K.
- IAGB Gradina Botanica a Universitatii, "Al. I. Cuza" din Iasi, Str Dumbrava Rosie nr 7 - 9, 6600 IASI, Romania.
- K Royal Botanic Gardens, KEW, Richmond, Surrey TW9 3AB, U.K.
- KIEL Botanischer Garten der Universität Kiel, Olshausenstrasse 40-60, Biologiezentrum, D-2300 KIEL, Federal Republic of Germany.
- KPABG Polar-Alpine Botanic Garden, The Kolsky Branch of the Academy of Sciences, 184230 KIROVSK 6, Murmansk Region, U.S.S.R.
- KUIB The Botanical Garden, Pedagogical Institute, Moscovskoe Shosse 36, 443086 KUIBYSHEV, U.S.S.R.
- LE Botanical Garden, Komarov Botanical Institute, Academy of Sciences, Professor Popov Street 2, 197022 LENINGRAD 22, U.S.S.R.
- LECB Botanical Garden, Leningrad State University, Universitetskaia nab. 7-9, 199164 LENINGRAD B-164, U.S.S.R.
- LIVC City of Liverpool Botanic Gardens, Greenhill Nursery, Nursery Lane, Garston, LIVERPOOL 19, U.K.
- LPA Jardin Botanico "Viera y Clavijo", Apartado de Correos 14, Tafira Alta, LAS PALMAS, Gran Canaria, Islas Canarias, Spain.
- M Munich Botanic Garden, Menzingerstrasse 63-67, D-8000 MUNCHEN, Federal Republic of Germany.
- MACF Fullerton Arboretum, California State University, FULLERTON, California 92634, U.S.A.
- MB Botanischer Garten der Philipps-Universität, Auf dem Lahnbergen, D-3550 MARBURG, Federal Republic of Germany.
- MEL Royal Botanic Gardens of Melbourne, Birdwood Avenue, SOUTH YARRA, Victoria 3141, Australia.
- MIL Mitchell Park Conservatory, 524 South Layton Boulevard, MILWAUKEE, Wisconsin 53215, U.S.A.
- MSK Botanical Garden, Central Academy of Sciences, 2a Surganova Street, 220072 MINSK, Byelorussia, U.S.S.R.

- MTJB Jardin Botanique de Montreal, 4101 est, rue Sherbrooke, MONTREAL, Quebec H1X 2B2, Canada.
- NCY Jardins Botaniques de Nancy, 100, rue du Jardin Botanique, F-54600 VILLERS-LES-NANCY, France.
- NGOET Neuer Botanischer Garten der Universitat Gottingen, Grisebachstrasse 1a, D-3400 GOTTINGEN, Federal Republic of Germany.
- NICE Jardin Botanique de la Ville de Nice, 20, Traverse des Arboras, F-06200 NICE, France.
- NIJ University of Nijmegen Botanic Garden, Department of Botany, Toernooiveld, NIJMEGEN, The Netherlands.
- ORT Jardin de Aclimatacion de la Orotava, Puerto de la Cruz, TENERIFE, Canary Islands, Spain.
- PAC The Buckhout Greenhouse, 202 Buckhout Laboratory, Department of Biology, The Pennsylvania State University, Pennsylvania 16802, U.S.A.
- PRC Botanicka zahrada University Karlovy, Benatska 2,4, 128 01 PRAHA, Czechoslovakia.
- RNG University of Reading Plant Science Botanic Garden, Plant Science Laboratories, University of Reading, Whiteknights, READING RG6 2AS, U.K.
- RV The Botanical Garden, Molotov State University, Department of Botany, Engels Street 105, 344006 ROSTOV ON DON, U.S.S.R.
- SDAP San Diego Wild Animal Park, 15500 San Pasqual Valley Road, ESCONDIDO, California 92027-9614, U.S.A.
- TALL Botanical Garden, Academy of Sciences, Kloostrimetsa Street 44, 200019 TALLINN, Estonia, U.S.S.R.
- TASH The Botanical Garden, Uzbek Academy of Sciences, Dshacas Abidovoi Street 272, 700053 TASHKENT, Uzbek S.S.R., U.S.S.R.
- U Botanical Gardens of the State University, Harvardlaan 2, Postbus 80-162, 3508 TD UTRECHT, The Netherlands.
- UBC Botanical Garden, University of British Columbia, 6501 N.W. Marine Drive, VANCOUVER, British Columbia V6T 1W5, Canada.
- WSY The Royal Horticultural Society's Garden, Wisley, WOKING, Surrey GU23 6QB, U.K.
- YALT State Nikita Botanical Gardens, 334267 YALTA, Crimea, Ukraine S.S.R., U.S.S.R.
- YOSH Dendrarium of the Maryiski Polytechnic Institute, Sovietskaya Street 152, 424024 JOSHKAR-OLA, Maryiski A.R., U.S.S.R.
- Z University of Zurich Botanic Garden, Zollikerstrasse 107, CH-8008 ZURICH, Switzerland.

ENDEMIC TAXA

GYMNOSPERMAE

CUPRESSACEAE

Cupressus atlantica Gaussen I

ANGIOSPERMAE

AMARYLLIDACEAE

Leucojum fontianum Maire R

Marcissus broussonetii Lag. I

ASCLEPIADACEAE

Caralluma joannis Maire I

BORAGINACEAE

Echium canum Emberger & Maire R

Myosotis macrosiphon Font Quer & Maire R

Solenanthus atlanticus Pitard R

CAMPANULACEAE

Campanula antiatlantica Maire M.Weller  
& Wilczek R

CARYOPHYLLACEAE

Lychnis lagrangei Coss. I

Minuartia senneniana Maire & Mauricio R

Petrohragia rhiphaea (Pau & el) P.W.Ball  
& Heywood R

Silene barbara Humbert & Maire R

Silene dissecta Litard. & Maire R

Silene reeseana Maire E

Silene rhiphaena Pau & Font Quer R

Silene vidalifera Pau & Font Quer R

Silene volubilitana Braun-Blanquet &  
Maire I

CISTACEAE

Helianthemum grosii Pau & Font Quer I

COMNELINACEAE

Commelina rupicola Font Quer R

COMPOSITAE

Achillea maurea Humbert I

<u>Anacyclus capillifolius</u> Maire	R
<u>Anacyclus exalatus</u> Murb.	I
<u>Anvilleina platycarpa</u> Maire	R
<u>Artemisia flahaultii</u> Emberger & Maire	R
<u>Asteriscus pinifolius</u> Maire & Wilczek	R
<u>Bubonium longiradiatum</u> Maire	R
<u>Calendula vidalii</u> Pau	I
<u>Carthamus rhiphaeus</u> Font Quer & Pau	R
<u>Centaurea ducellieri</u> Battand.	R
<u>Centaurea eriosiphon</u> Emberger & Maire	R
<u>Centaurea guilhelmi</u> (Pau & Sennen) Maire	R
<u>Centaurea maireana</u> Emberger	R
<u>Centaurea tananica</u> Maire	R
<u>Centaurea theryi</u> Emberger & Maire	R
<u>Chrysanthemum nivellei</u> Braun-Blanquet	R
<u>Cirsium ducellieri</u> Maire	R
<u>Crepis fontiana</u> Bab.	R
<u>Crepis hookeriana</u> Ball	R
<u>Crepis litardierei</u> Emberger	R
<u>Evax longilanata</u> Maire & Wilczek	I
<u>Filago bolivari</u> Caballero	I
<u>Filago evaxiformis</u> Maire & G. Samuelsson	I
<u>Fontquera paui</u> (Font Quer) Maire	R
<u>Heliocauta atlanticus</u> (Litard. & Maire) Humphries	I
<u>Jasonia hesperia</u> Maire & Wilczek	R
<u>Launsea viminea</u> (Battand.) Maire	I
<u>Leontodon eriopus</u> Emberger & Maire	R
<u>Leontodon garnironii</u> Emberger & Maire	R
<u>Leucanthemum hosmeriense</u> (Ball) Font Quer	R
<u>Onopordum mesatlanticum</u> Emberger & Maire	R
<u>Ormenis flahaultii</u> Emberger	R
<u>Phagnalon iminoukense</u> Emberger	R
<u>Phagnalon latifolium</u> Maire	R
<u>Picris pitardiana</u> Gandoger	R

<u>Ptilostemon abylenis</u> (Maire) Greuter	R
<u>Ptilostemon leptophyllus</u> (Pau & Font Quer) Greuter	R
<u>Pulicaria glandulosa</u> Caball.	I
<u>Santolina ascensionis</u> Sennen	R
<u>Senecio chaluzeaui</u> Humbert	R
<u>Volularia belouini</u> (Humbert) Maire	R
CONVOLVULACEAE	
<u>Cuscuta maroccana</u> Trabut	R
CRASSULACEAE	
<u>Kalanchoe faustii</u> Font Quer	R
<u>Sedum gattefossei</u> Battand.	R
<u>Sedum maurum</u> Humbert & Maire	R
<u>Sedum wilczekianum</u> Font Quer	R
<u>Sempervivum arboreum</u> L.	I
CRUCIFERAE	
<u>Alyssum antiatlanticum</u> Emberger & Maire	R
<u>Alyssum flahaultianum</u> Emberger	R
<u>Arabis wernerii</u> Emberger & Maire	R
<u>Brassica desnottesii</u> Emberger & Maire	R
<u>Crambella teretifolia</u> (Battand.) Maire	R
<u>Hemicrambe fruticulosa</u> Webb	R
<u>Lepidium alluaudii</u> Maire	R
<u>Malcolmia heterophylla</u> Caball.	R
<u>Matthiola masquindalii</u> Pau	R
<u>Rytidocarpus moricandioides</u> Coss.	I
<u>Sisymbrium maurum</u> Maire	R
<u>Trachystoma ephanoneurum</u> Maire & M. Weller	R
EUPHORBIACEAE	
<u>Euphorbia briquetii</u> Emberger & Maire	R
<u>Euphorbia malvina</u> Maire	R
<u>Euphorbia mazicum</u> Emberger & Maire	R
<u>Euphorbia nereidum</u> Jahand. & Maire	I

GENTIANACEAE

- Centaureum barrelleroides Pau R  
Gentiana tornezyana Litard. & Maire R

GERANIACEAE

- Erodium atlanticum Coss. R  
Erodium masquindalii Pau R

GRAMINEAE

- Agropyron embergeri Maire R  
Bromus maroccanus Pau & Font Quer R  
Catapodium mamoraem (Maire) Maire & M.Weiller R  
Festuca humbertii Litard. & Maire R  
Koeleria embergeri Quezel R  
Leptochloa ginae Maire R  
Oropetium hesperidum Maire R  
Sporobolus lanuginellus Maire R

HYPERICACEAE

- Hypericum andjerinum Font Quer & Pau R  
Hypericum metroi Maire & Sauvage R

IRIDACEAE

- Romulea antiatlantica Maire R

LABIATAE

- Marrubium atlanticum Battand. R  
Marrubium fontianum Maire R  
Marrubium wernerii Maire R  
Mentha gattefossii Maire V  
Phlomis antiatlantica Peltier R  
Pitardia nepetoides Battand. R  
Salvia gattefossii Emberger R  
Salvia interrupta Schousboe R  
Satureja brivesii (Battand.) Murb. R  
Satureja monantha Font Quer R  
Satureja peltieri Maire R  
Satureja welleri Maire R  
Sideritis imbricata H.Lindb. R

<u>Sideritis maireana</u> Font Quer & Pau	R
<u>Stachys grantii</u> Battand.	I
<u>Teucrium dealianum</u> Emberger & Maire	R
<u>Teucrium faurei</u> Maire	R
<u>Teucrium gattefossel</u> Emberger	R
<u>Teucrium gypsophilum</u> Emberger & Maire	R
<u>Teucrium serpylloides</u> Maire & M.Weiller	R
<u>Teucrium tananicum</u> Maire	R
<u>Teucrium wernerii</u> Emberger	R
<u>Teucrium zaianum</u> Emberger & Maire	R
<u>Thymus alar</u> (Pau & F.Quer) Mug. del-Vill.	R
<u>Thymus hesperidum</u> Maire	R
<u>Thymus mentagensis</u> Battand.	R

LEGUMINOSAE

<u>Astragalus antiatlanticus</u> Emberger & Maire	R
<u>Astragalus font-queri</u> Maire & Sennen	R
<u>Astragalus froedini</u> Murb.	P.
<u>Astragalus tachdirtensis</u> Andreanszky	R
<u>Astragalus weillei</u> Emberger & Maire	R
<u>Benedictella benoistii</u> Maire	I
<u>Calycotome grosii</u> Pau & Font Quer	I
<u>Cicer atlanticum</u> (Coss.) Maire	R
<u>Genista nociva</u> Pau & Font Quer	R
<u>Medysarum zeluanum</u> Pau	R
<u>Lathyrus fiscus</u> Ball	R
<u>Ononis jahandiezii</u> Maire	R
<u>Ononis pedicellaris</u> (Battand.) Sirj	K
<u>Ononis pseudocintrana</u> Andreanszky	R
<u>Ononis zygantha</u> Maire & Wiczek	R
<u>Ornithopus uncinatus</u> Maire & G.Samuelsson	R
<u>Trifolium acutiflorum</u> Murb.	R
<u>Trifolium tastetii</u> Font Quer	R
<u>Vicia fairchildiana</u> Maire	R



<u>Vicia garbiensis</u> Font Quer & Pau	R
LILIACEAE	
<u>Allium regneri</u> Maire	R
<u>Allium valdecallosum</u> Maire & M.Weller	R
LINACEAE	
<u>Linum subsperifolium</u> Humbert & Maire	R
<u>Linum villarianum</u> Pau	R
MALVACEAE	
<u>Lavatera maroccana</u> (Battand. & Trabut) Maire	I
<u>Lavatera microphylla</u> Baker f.	R
<u>Lavatera vidali</u> Pau	R
ONAGRACEAE	
<u>Epilobium psilotum</u> Maire & G.Samuelsson	R
OROBANCHACEAE	
<u>Orobanche fuscovinosa</u> Maire	R
<u>Orobanche hookeriana</u> Ball	R
<u>Orobanche humbertii</u> Maire	R
PLUMBAGINACEAE	
<u>Armeria alpinifolia</u> Pau & Font Quer	R
<u>Limonium cudayense</u> Sauvage & Vindt	I
<u>Limonium pujosii</u> Sauvage & Vindt	R
<u>Limonium rungsii</u> Sauvage & Vindt	R
RANUNCULACEAE	
<u>Delphinium cossonianum</u> Battand.	V
RESEDACEAE	
<u>Neseda battandieri</u> Pitard	R
ROSACEAE	
<u>Potentilla asinaria</u> Maire	R
<u>Potentilla guillemontii</u> Emberger & Maire	R
RUBIACEAE	
<u>Asperula litardierei</u> Humbert	R
SALICACEAE	
<u>Salix antiatlantica</u> Maire & Wilczek	R

<b>SAXIFRAGACEAE</b>	
<u>Saxifraga embergeri</u> Maire	R
<u>Saxifraga luzetiana</u> Emberger & Maire	R
<u>Saxifraga maireana</u> Lutzet	R
<u>Saxifraga maweana</u> Baker	R
<u>Saxifraga wernerii</u> Font Quer & Pau	R
<b>SCROPHULARIACEAE</b>	
<u>Antirrhinum chrysothales</u> Font Quer	R
<u>Celsia mairei</u> Murb.	R
<u>Lafuentea jeansperiana</u> Maire	R
<u>Linaria arenicola</u> Pau & Font Quer	R
<u>Linaria gattefossei</u> Maire & M.Weiller	R
<u>Linaria weilleri</u> Emberger & Maire	R
<u>Scropularia trisecta</u> Pau	R
<u>Verbascum tetrandrum</u> G.Barratte & Murb.	R
<b>THYMELAEACEAE</b>	
<u>Thymelaea putorioides</u> Emberger & Maire	R
<b>UMBELLIFERAE</b>	
<u>Amiopsis daucoides</u> Boiss.	I
<u>Bupleurum antonii</u> Maire	R
<u>Bupleurum subspinosum</u> Maire	R
<u>Carum asinorum</u> Litard. & Maire	R
<u>Carum lacuum</u> Emberger	R
<u>Carum proliferum</u> Maire	R
<u>Elaeoselinum exinvolucratum</u> Coss. & Balansa	R
<u>Elaeoselinum humile</u> Ball	R
<u>Eryngium atlanticum</u> Battand. & Pitard	V
<u>Eryngium caespitiferum</u> Font Quer & Pau	R
<u>Ferula bolivari</u> Pau	R
<b>ZYGOPHYLLACEAE</b>	
<u>Fagonia malvana</u> Maire & Weiller	R

DOUBTFULLY ENDEMIC TAXA

ANGIOSPERMAE

GRAMINEAE

Avenula levis (Höckel) Holub

?

NON-ENDEMIC TAXA

COUNTRY  
CATEGORY

WORLD  
CATEGORY

GYMNOSPERMAE

PINACEAE

Abies pinsapo Boiss.

V

V

ANGIOSPERMAE

LILIACEAE

Scilla latifolia Willd.

V/R

V/R

OLEACEAE

Olea laperrinei Battand. & Trabut

?

V

ANNEX 4

Illustrative Budget to Fund a Field Study

## Illustrative Budget

The study, from which the figures below were developed, is examining the littoral, benthic marine life of the Nador Lagoon. Minimal equipment is needed; hand nets, tools to sample and collect specimens of the bottom mud and associated fauna, etc. Such materials are generally available from the university. The high cost of formaldehyde and alcohol needed for the study, were not included in the illustrative budget because they would not necessarily be an expense that would be common to most field studies.

It is occasionally necessary to transport equipment and materials to and from the study site, using a landrover or pick-up truck. However, most trips to the field can be made using public transportation. One week of field work per month is the norm. The total length of the study is 18 months.

Round-trip transportation to haul equipment and bulky materials cost 1000 DH for fuel. Bus transport is 600 DH round trip. Nightly lodging and food costs are 100 DH per day. The wage for a day laborer is 30 DH per day. Assume that a trip with a vehicle is necessary every three months; bring materials to or from the site, and a day laborer is necessary once every two weeks.

Vehicle trips	$6 \times 1000 \text{ LH} = 6,000 \text{ DH}$
Bus trips	$12 \times 300 \text{ DH} = 3,600 \text{ DH}$
Food and lodging	$18 \times 100 \text{ DH} = 1,800 \text{ DH}$
Day laborer	$2 \times 18 \times 30 = 1,080 \text{ DH}$
Total	$12,480 \text{ DH} = \$1,560.00$

**ANNEX 5**

**Contacts**

I. Government of Morocco

- Mr. KARMOUNI - Head of the Direction des Eaux et Forets
- Mr. ALAOUI - Head of the Division for Hunting, Fishing, and Wildlife Protection, E&F
- Mr. BENJALLOUN - Head of the Section for Hunting, E&F
- Mr. RAZADE - Section for Fishing, E&F
- Mr. OURMANI - Head of the Section for Reforestation, E&F
- Mr. MORASLI - Forestry Research Station, E&F
- Mr. ALAMINE - Forestry Research Station, E&F
- Mr. ANCHOUM - Ministere de l'Agriculture et Reforme Agraire
- Mr. GARBOUI - Head of the Range Management Section, MOA
- Dr. SEDRATI - Director, Institut Agronomique et Veterinaire, Hassan II (IAVH2)
- Mr. BENCHEKROUN - Head of the forestry department, IAVH2
- Mr. KHATOURI - Professor, Forestry Department, IAVH2
- Mr. HRACHERRASS - Professor, Forestry Department, IAVH2
- Mr. NARJISSE - Professor, Department of Ecology and Grazing, Range management, IAVH2
- Dr. JOHNSON - IAVH2/Leader, Minnesota Project
- Mr. HAMZAOUI - Eaux et Forets
- Dr. DAKKI - Director, Zoology Department, Scientific Institute, University Mohammad V
- Dr. THEVENOT - Zoology Dept., Scientific Institute, University Mohammad V
- Dr. BEAUBRUN - Zoology Dept., Scientific Institute, University Mohammad V
- Mr. BERRASO - Institut Scientifique de la Peche Maratime, Casablanca
- Mr. BOUNJMATE - INRA
- Mr. JARITZ - GTZ - INRA
- Mr. HADOUY - Director, National Zoo at Temara

II. NGO

Mr. BELGACMI - Country Rep, CRS

III. OTHER

Dr. RAYMOND, Coop Maroco-Francais - former director of National Zoo at Temara

Mr. CORTAS - FAO Resident Representative

Mr. JAEGER - UNDP Resident Representative

Mrs. CAVASH - UNDP Program Officer

IV. Peace Corps Morocco

Mr. BLACK - APCD

Mr. LOGGERS - ex PCV/M, ICBP consultant

Mr. McCUSKER - PCV, Reserve at Sidi Bourhaba

Mr. KITTS - PCVL

Mr. KOCH - PCV, Reserve at Merja Zerga

Mr. SHANKS - PCV, Rabat, National Zoo at Temara and Recreational Forest

Mr. FREDRICK - Director

Mr. PARKENSON - APCD/TEFL

V. USAID

Dr. STRYKER - A/ADO

Mr. KHAN - Energy and Natural Resources

Mr. EHMER - Population and Health Officer

Mr. SCHOLFIELD - Program Officer

VI. US EMBASSY

Mr. CULVER - AG COUNSEL

(Except where indicated, all meetings took place in Rabat.)



ANNEX 6

Eaux et Forets Activities That Could  
Be Supported by the Donor Community

The draft Plan d'Orientation 1988-1992, prepared by the Sub-commission on Natural Resources of the National Commission on Agriculture and Dams presents activities proposed for the natural resources sector for the next five year period. Many of the activities have potential impacts on the status of biological diversity, species composition and abundance, and the quality of the environment.

The plan does not provide detailed implementation recommendations or other information, therefore it is impossible to actually assess how the activities are to be implemented or what the impacts will be from the various proposals. However, the items in the list below are considered to have the potential of being very beneficial for species diversity and environmental quality, if properly planned, funded, and implemented.

Delimitation of the forestry domain - 600,000 ha total. Clearly establishing the boundaries of the forest domain are necessary if efforts to control or stop the illicit clearing of forest lands is to ever be successful.

Maintain and re-establish forest boundary markers - 1,150,000 ha total. The delimitation that has been done in the past must be maintained.

Fire control. (Support could be provided in the form of equipment, training in fire control, planning and similar activities.)

Regeneration by direct seeding, using natural forest species - 50,000 ha.

National forest inventory - 4,000,000 ha. This could provide useful information on the actual extent, species composition, and state of the remaining natural forest areas.

Sylvo-pastoral study - 200,000 ha. Integrated study - 500,000 ha. Forest range improvement - 25,000 ha. Production of 75 metric tons of seed for pasture improvement. These activities could provide useful information on the state of existing range lands and indigenous range species, as well as favor the re-establishment or improve the condition of local species on rangeland areas.

Improvement of arid pasture - 50,000 ha. Again this could be an important factor in protection and re-establishment of indigenous forage and non-forage species, if properly planned and implemented.

Studies on management options for dam protection. Such studies should include a heavy emphasis on local species utilization, and effective protection of existing

vegetation.

Dam protection. Stabilization of the watersheds above the various dams necessitates adequate ground cover. Local

species could and should be an important component of such protection efforts.

Dune fixation. Again, local species should be considered.

Establish 10 "groupes de chasse" to improve the protection and surveillance of hunting preserves and the protection of game. This will probably be an important step in the series of activities that will be needed to begin to implement actual wildlife protection and habitat improvement efforts.

Reintroduction of indigenous species in selected areas. Such efforts should include floral as well as faunal species. I would suspect that the planned emphasis is on game and other protected animals.

Creation of a national wildlife research center. This could be a very valuable institution. It would establish a national center whose whole emphasis would be, or should be, the fauna of Morocco. If adequately funded, it could develop up-to-date information and be a source of information on the status of species that are relatively unknown at this time. (If foreign biologists are hired, it should be mandated that they work with Moroccan counterparts.)

Support for the proposed Massa Park.

Support for Toubkal Park.

Develop and run a national extension program on the value of protecting nature.

Funds for 8 wildlife reserves.

National Zoo Management. Funding sought for zoo infrastructure and facilities for breeding & raising wildlife.

Creation of 15 arboreta - 750 ha. total and 50 experimental sites of 250 ha. These arboreta and experimental sites should be designed to include local species, both for research purposes and as germplasm banks.

Grazing improvement project, including 370,000 ha closed to all public use.

Mapping of forest and steppe vegetation of eastern region.

Teledetection of desertification - pilot study.

Arid grazing lands study, including evaluation of local spp.

Research on pastoral systems in steppe zone.

Range management training course.

Evaluation of techniques to control sand encroachment in the south.

Program for pollution control from sugar refineries. Could be important for protection of the marine ecosystems adjacent to rivers and streams that risk to become, or already are, contaminated.

Given the realities of budget limitations, the GOM will not be able to implement all of the above activities on its own. It would be possible for the donor community to provide financial support, and technical guidance, to ensure that priority activities on the above list are implemented.

ANNEX 7

Legislative and Institutional Structure

## LEGISLATIVE AND INSTITUTIONAL STRUCTURE, INCLUDING MAJOR DONORS

### Legislative Background

The following laws and regulations provide the basis for the land use rights, protection of wildlife, forests and other resources. A more complete listing is available from the sources in the citation.

The Ministerial Decree of 21 May 1921 regulates the use of common pastures in state forests.

The Dahir of 21 July 1923 governs the control of hunting.

The Dahir of 11 September 1934 established the protected status of natural parks. A decree dated 26 September 1934 stated that parks were to be established by Ministerial decree, with regulations being established for each site. The forest code and hunting regulations are to be followed in national parks. Under the ministerial order of 21 May 1921, grazing of livestock and timber exploitation are permitted activities.

The Ministerial decree of 3 November 1962, replacing a decree of 6 August 1949, seeks to conserve not only game animals, but also rare and "useful" species. It enumerates the species of animals that can be destroyed because they are considered harmful.

Each year a decree is issued indicating which species can be hunted, hunting requirements and conditions, and limitations.

The Dahir of 2 December 1922, and decrees dated 20 March 1923, 26 May 1928, 1 March 1930, 27 January 1939, 9 November 1953, and 30 November 1966, restrict the usage of toxic substances and pesticides.

Vizirial decrees of 26 September 1934 and 20 March 1946 refer to the establishment of national parks.

Numerous regulations prohibit using baits, poisons, lamps, nets, traps, attractants, hunting around watering holes, etc.

It is forbidden to offer for sale, sell, buy or serve in hotels and restaurants, certain species of wild game, especially protected species. Forest officers can inspect gamebags, nets, sacs, pockets in clothing, baskets, vehicles, and all containers that can be used to transport game. They can also search for animal skins and hides at taxidermists, furriers, and tanners.

The killing or capturing of a protected animal, destruction of nests, destruction, transporting, selling, exporting, and buying of eggs, broods, and young animals of all wild animals, that have not been declared harmful, are subject to a fine of 2,400 DH (\$300) and 3 months in prison. [69]

The Dahir of 20 September 1976 - Commune Rurale - establishes three councils, the Communal Council, Provincial Council, and National Council of Forestry. This law provides for communal participation in the management and exploitation of forest resources on communal lands. 80% of the revenues generated from forest lands within the communes are to be returned to the commune, with 20% being dedicated to reforestation of collective lands, improvement of grazing lands, and other activities within the commune.

Decrees from the Ministry of Agriculture, dated 3 November 1962 and 6 March 1978 established the first biological reserves. These Biological Reserves are to be provided complete protection from commercial exploitation, grazing, building, and hunting.

Efforts have been undertaken to strengthen the designation of protected areas. There is currently a proposal for the establishment of Massa National Park, which is using new legislation that would provide more protection to such areas. E&F plans to use this legislation, once it is passed, to reformulate the management and protection of the other existing parks. [49] The GOM is also a signatory to the CITES and RAMSAR treaties. Four wetlands have been included under the RAMSAR conventions. The Medina at Fes is protected under the UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (1972).

#### Government of Morocco Institutions

There are numerous GOM institutions that have at least administrative if not managerial interests and responsibilities in natural resources management and related activities. Given the multiple interests within each individual agency, this can lead to immense problems in actual on-the-ground management, and decision making. The bureaucratic barriers to issue solving appear to be significant. The following are the major institutions.

Direction des Eaux et Forêts. There are four divisions; 1) Division for Hunting, Fishing, and Protection of Nature; 2) Division of Public Domain; 3) Division of Erosion Control and Reforestation; and 4) Division of Forest Economy. The different divisions do not appear to be represented individually on the ground. Rather, the technicians at the Sub-division level and below are responsible for all E&F activities. In 1987, 15% of the Ministry of Agriculture's budget went to E&F; 8% of the E&F budget went to the parks and reserves.

The Forestry Research Station, in Rabat, Agdal, has five sections: 1) Ecology; 2) Silviculture and Production; 3) Tree Improvement; 4) Range Management; and 5) Entomology.

Direction of Livestock Rearing, Division of Animal Production - arid areas and wetlands, agriculture, and rangelands.

Direction of Extension - all extension activities are handled by extension agents from this direction. They are expected to provide extension support in all technical fields and specialties.

Direction of Livestock Rearing, Range Management Section

Aquarium at Casablanca - impacts of water pollution, and preservation of marine mammals.

Veterinary Research and Analysis Laboratories, Casablanca - impacts of water pollution on fisheries, livestock, wildlife.

National Research Center for Hydrobiology and Fish Culture, Azrou

National Agriculture School at Meknes - impacts of water pollution and chemical wastes, threats to the environment posed by industrial development, agriculture.

Ministry of Tourism - tourism; not parks or reserve management.

Ministry of Energy and Mining Research.

National Agronomic Institute - all areas of agriculture, including range management, local forage species research.

Ministry of Marine Fisheries and Merchant Marine.

Scientific Institute for Marine Fisheries - all phases of production and monitoring research.

The Ministry of Interior - anytime communal, local or regional government, communal lands or use rights are involved.

Ministry of Finance and Budget.

The Royal Forestry School, Sale - Training of forestry technicians and bachelor level foresters.

Agronomic and Veterinary Institute, Hassan II - research in all domains, training in ecology, forestry (MS and PhD programs), marine science, all areas of agriculture, including range management and plant science.



Scientific Institute, Hassan II - research and university training in zoology, ecology, and related fields.

There appear to be only two NGOs currently involved in natural resources related activities in Morocco. These are the Moroccan Association for the Protection of the Environment (ASMAPE) and Catholic Relief Services.

ASMAPE was established 1986. The organization is interested in all areas of the environment and natural resources. It is seeking to collaborate with GOM agencies on the establishment of protected areas. It plans to sponsor field work for students from different disciplines, and is involved in public environmental education.

It's objectives include to: a) understand the natural and the human environment, become aware of their problems, and understand the interactions; b) protect the environment and ensure a rational utilization of the natural resources, both renewable and non-renewable, to ensure their continuity; c) promote natural environment preservation; d) increase the understanding of the role of a healthy environment in global social and economic development; d) organize activities promoting actions and attitudes that reflect an awareness that man and the environment are inter-related.

ASMAPE, in collaboration with the MAB National Committee of UNESCO, was instrumental in organizing the Environmental Study Days, 15-16 January 1987, in Rabat. They have also been working with Peace Corps in developing a program to help educate the public about the important role that trees play in the environment, and to prepare educational material on the biology of trees and their importance for the environment and economy of the local community and the country as a whole.

A good percentage, if not most of ASMAPE's members are from the various government services that are involved in natural resources management. Therefore, it is unlikely that ASMAPE will evolve into a completely impartial organization that will aggressively challenge decisions or actions taken by the various GOM organizations.

Most recently, Catholic Relief Services, in collaboration with the World Food Program, Eaux et Forêts, and Promotion Nationale, has been working to start a fruit tree planting and employment generation program. Other CRS activities included a green belt establishment project around Figuig in or around 1974-1976.

#### International Donors

There have been numerous internationally-funded projects and activities in Morocco that have impacted the quality of the environment and biological diversity, either directly or indirectly, as well as positively or negatively. However, with

rare exception, most projects have not been developed with biological diversity considerations in mind.

The most recent figures available, detailing technical assistance for Morocco, are for 1986. They come from the Rapport Annuel sur l'Assistance au Developpement pour l'Annee 1986 Royaume du Maroc, [59]. According to this document, at that time technical assistance to Morocco was comprised of 75% in bilateral aid, and 21.7% from the United Nations system. The listing did not include World Bank projects, or those from other donors who had not provided information on their respective assistance activities.

Italy - construction of small scale hydro-electric dam at Tanger - not yet started. \$1,500,000.

Italy - Mining research. 4 year project, \$3,526,000.

USA/USAID - Development of Renewable Energy. 1980-1989. \$9,200,000.

UNDP/FAO - Estimation and control of marine fisheries resources. 1982-1986. \$1,559,000.

UNDP/FAO - Development and management of mountainous areas. 1982. \$401,000.

FAO - Development of forage production. 1984-1987. \$74,000.

FAO - Assistance in water legislation. 1985-1987. \$60,000.

FAO - Improvement of "circuit physique " of pesticides and updating of legislation. 1985-1987. \$72,000.

WFP - Rehabilitation of Palm Groves in the south. 1987-1989. Estimated \$9,000,000.

WFP - Integrated Agricultural Development in the Rif. 1986-1989. \$17,714,000.

WFP - Forestry Development and Erosion Control. 1985-1990. \$27,400,000. Presently awaiting WFP approval on a redesign that had been requested by GOM.

Belgium - Study on soil evolution at Tadla. 1983-1986. \$1,239,000.

France - Development of the central High Atlas. 1983-1988. \$358,000 per year.

France - Cooperation with the National Institute for Agronomic Research. \$47,000.

France - Cooperation with the Agronomic and Veterinary Institute, Hassan II. \$734,000.

France - Cereal Production in the Meknes Region. 1985-1989. \$92,000 per year. Project identification.

France - Marine Studies Institute. 1985-1989. \$233,000 per year.

R.F.A. - Forest Protection; control of moineaux nuisibles (harmful sparrows?). \$320,000.

USA/USAID - Dryland Agriculture Research. 1978-1988. \$26,323,000.

USA/USAID - Cooperation with the Agronomic and Veterinary Institute, Hassan II. 1980-1990. \$28,508,000.

UNDP - Cooperation with the Maritime Studies Institute. 1983-1987. \$697,000.

Italy - Loan - Dam at Dakhla. \$900,000.

Saudi Arabia - Loan - Dam at Ait Youb. \$38,180,000.

Kuwait - Loan - Dam at Ait Youb. \$23,960,000.

EEC - Loan - Dam at Ait Chouarit. \$332,000.

Saudi Arabia - Loan - Irrigation System, Middle Haouz. \$5,870,000.

Arab Funds? - Loan - Irrigation of the Basse Tassaout. \$17,120,000.

WB - Loan - Development of High Plateau, Middle Atlas? No information.

The only projects that could be found that were specifically aimed at the preservation of indigenous natural resources and biological diversity were:

FAO - 1983. Development of a proposal for establishing a new national park.

GOM/MOT - USA/NPS National Parks and Tourism Evaluation - 1986.

USA/Peace Corps - Parks and Reserves and Conservation Education 1985 through 1995, upon the request of E&F. \$250,000 per year. - Current involvement in development of Environmental Education programs and various studies and management plan designs for the system of National Parks, proposed parks and reserves. Working with the Government of Morocco, the Peace Corps has the most active on-site program in conservation education and reserves.

The World Wildlife Fund, International Union for the Conservation of Nature, and the International Council for Bird Preservation have all been working closely with the GOM, Peace Corps, the Institut Scientifique, Mohammed V, and other organizations in monitoring the status of indigenous plant and wildlife species, the management and development of parks and reserves, the development of conservation education and extension materials, and other activities.