

## Chapter Eleven

### **THE INTEGRATED MANAGEMENT APPROACH FOR A BIOSPHERE RESERVE**

This chapter includes an overview of the proposed integrated management methodology and approach of the current study associated with the plan of work throughout the forthcoming years. The plan of work is designed to be as consistent as possible with that of the concept of the UNESCO's Man and Biosphere Program.

#### **11.1. Location and Size of the Biosphere Reserve**

The Wurayah Biosphere Reserve embraces an area from Dibba in the north and the northeastern side of the Khor Fakkan City. The area includes thirteen rural villages in the northern part of the Fujairah Emirate.

The size of the biosphere reserve is (59,000) hectares of which the core zone is (11,300) hectares, the buffer zone is (19,100) hectares and the transition area is about (28,600) hectares. Figure 7.5 refers to the location of the proposed Biosphere Reserve.



Picture 11.1 General view for the Gateway to the proposed Wurayah Biosphere Reserve



Picture 11.2 The gateway to the core and buffer zones of the Wurayah Biosphere Reserve on the Tarmac Road toward the coastline.



Picture 11.3 One of the roads leads to the Wurayah Biosphere Reserve.

## **11.2. Criteria for Designation the Study Area as a Biosphere Reserve.**

A statutory framework for the World Network of Biosphere reserves has been formulated with objective of enhancing the effectiveness of individual biosphere reserves and strengthening common understanding, communication and cooperation at regional and international levels. The Statutory Framework is further intended to contribute to the widespread recognition of biosphere reserves and to encourage and promote good working examples of conversation, rather than forming islands in the world. Increasingly affected by severe human impacts, they can become theaters for reconciling people and nature. In short, biosphere reserves are much more than just protected areas (UNESCO, 1996).

Article 4 of the Statutory Framework of the Seville Strategy presents seven general criteria for an area to be qualified for designation as biosphere reserve. Information pertaining to the Wadi Wurayah and its hinterlands was used and applied accordingly.

**Criterion 1: the area should encompass a mosaic of ecological systems representative of major biographic regions, including a gradation of human intervention.**

### **a. Topography**

The most noticeable topographic feature of the biosphere reserve is the Oman Mountains. The elevation of the range above sea level within the Wurayah Biosphere Reserve varies between 956 m (highest point) and 10 m (lowest point). Alluvial and coastal plains are also noticeable at the area, where the most low land areas have alluvial forms and the narrow coastal plain is composed of sand and gravel. The area is characterized by numerous streams, rook-pools, salt marsh and wetlands at the coastal plain and other features associated with the high rainfall of the rocky areas of the mountains.

### **b. Vegetation**

As mentioned in Chapter 6 the only aquatic vegetation present was algae. For terrestrial vegetation woody perennial is the most prevalent plants species in Wadi

Wurayah. A distinct vegetation habitats and associations have been easily recognized, such as the species present in the deep shaded wadi gorges or nearby temporary and/or permanent fresh water sources.

Abandoned date palms (*Phoenix dactilifera*) were located in the lowest wadi elevations especially in villages down stream of the wadis catchments constitutes areas of intensive cultivation of economically important crops.

#### **d. Drainage System, Wetlands and Sabkhas**

The following seven catchments areas exists within the area, namely, Al Ghel, Al Wurayah, Al Kiwed, Al Bidyah, Sharm Al Helah and Lihwebit (Figure 7.2).

According to what has mentioned in chapters 8 and 10 the analysis of the hydrological characteristics of the drainage basins data showed that the eastern drainage basins discharge, on average, 70% of the total precipitation in the form of sharp peaks.

There are two examples for the development of surface water resources that have been achieved through constructing of dams in the core zone represented by Wurayah Dam and buffer zone represented by Zit Dam. On the other hand, another two small basins are also dangerous, Sharm and Lihwebit, since a flash flood has hit the first (Figure 11.1) and affected many human activities due to the broken of the Sharm's sandy dam.



Picture 11.4 Impact of flash flood on the commercial activities in Sharm village

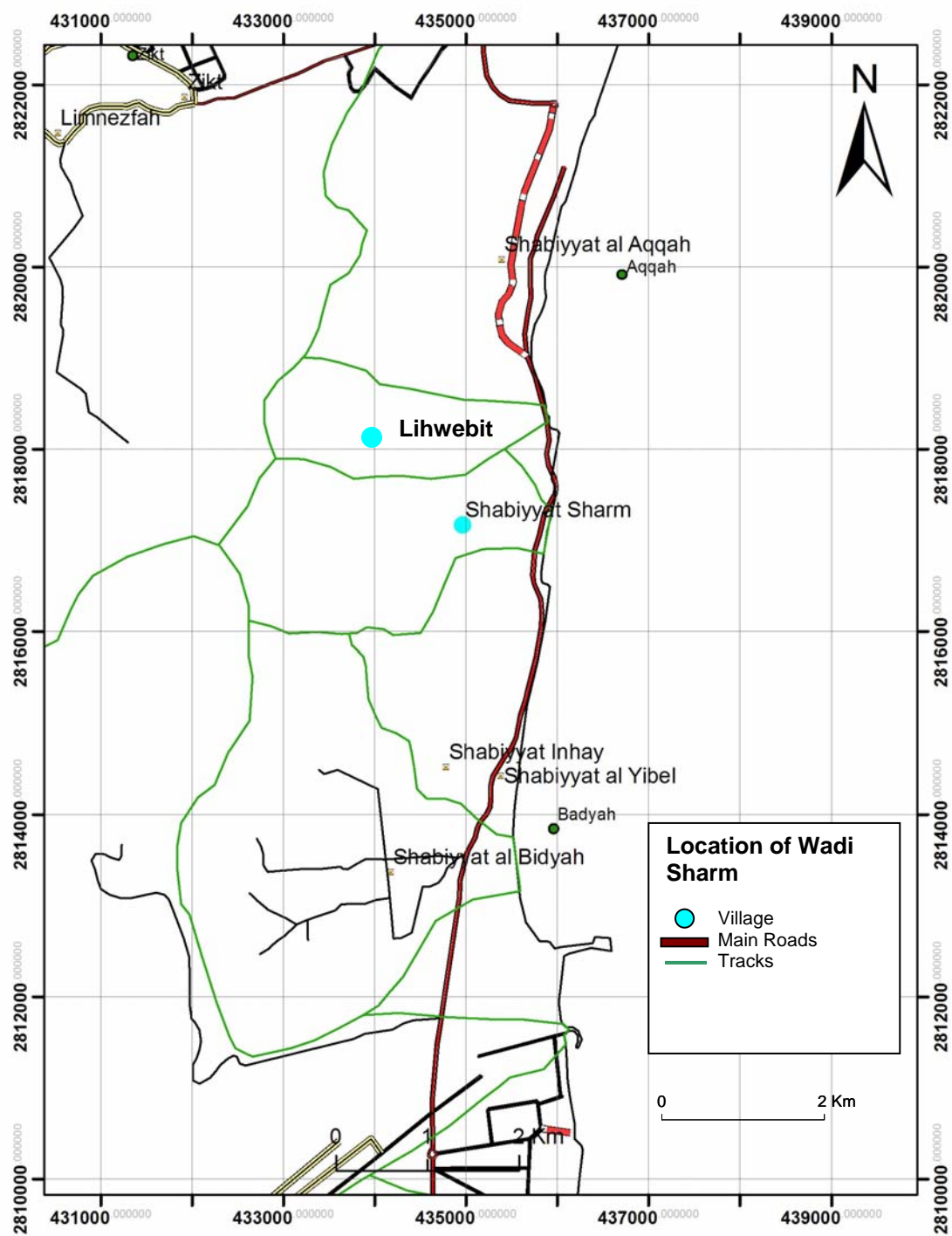


Figure 11.1 Location map of Sharm village (ALHOGARATY).





Picture 11.5 The impact of flash flood on the life style of Sharm village.



Picture 11.6 A channel constructed by the government near the coastal villages to control the sea level rise.



Picture 11.7 The impact of flash flood on the farms at the Sharm village.



Picture 11.8 The impact of flash flood on natural vegetation of Sharm village.





Picture 11.9 Overview of the Sharm village.



Picture 11.10 Sandy dam of the Sharm village after the flash flood event.



Wetlands play an important hydrological and ecological role, because they performing a number of functions, such as water storage, stream flow regulation, flood attenuation, water purification, nutrient assimilation, sediment accretion and the provision of habitat for a wide variety of plant and animal species (Begg, 1986).

There is no evidence for artificial surface water body or ponds, but there are two wetlands have been identified in the area of study beyond the two major dams one at Wurayah Dam and the other at Zikt Dam used now for recreational and environmental purposes.

In general the sabkhas plain are dry for the most part of the year, but contain surface water when strong onshore winds drives sea water inland, after period of heavy rainfall and also in winter when groundwater levels rise within the coastal belt. The inland sabkhas indicate groundwater discharge areas whereas coastal sabkhas represent relics of sea water evaporation in coastal depressions (Rizk and Alsharhan, 2003).

One sabkha has been recorded at the proposed transition zone of the biosphere reserve between Aqqa and Sharm in the coastal plain. The inclusion of wetlands and sabkhas into the zonation of the Wurayah Biosphere Reserve will certainly add to the reserve's conservation status.

#### **f. Geology**

As described in chapter 4, the solid geology in general reflects that bedrock comprises assemblages of serpentinite, gabbro and gabbroic rocks which are generally fractured and mineralized with calcite on serpentinite veins (ENTEC, 1996). Little calcite is present in the veins, but mixture of chalcedony and opaline quartz also exist. The whole area is extensively faulted by series of structural episodes. The Ophiolite strata generally form the hills into which the wadis system has been deeply cut (ENTEC, 1996).

The drift geology is composed of recent to Pleistocene Wadi gravels. These deposits infill the wadi floor both as poorly to moderately cemented gravel cliffs and poorly to unconsolidated deposits along wadi channels. The Wadi bed is composed of poorly cemented to unconsolidated Wadi gravels. Sand content within the gravels is very

high and grains size ranges from silt grade up to boulder. The surface of the Wadi gravels is reworked with every major flood event (ENTEC, 1996).



Picture 11.11 Outcrop of volcanic rocks in the study area.

The subsurface geology of the Eastern Coast Region in general and the area of the study in particular are, at present, little understood. However, the current activities may include the launching of intensive exploratory programs of petroleum exploration.

#### **g. Current human activities**

As mentioned in Chapter seven the human interventions are part and parcel of the history of the Wurayah catchment area and its hinterlands. A considerable area of land has been altered by human activities, of which commercial and subsistence crop cultivation is the most important activity in this regards. In the past commercial dryland cultivations was rarely applied to the Eastern Coast Region, and the area of

the study, but because of its rich rainfall in comparison to the other agricultural regions in UAE this practice has increased considerably.

Currently, commercial irrigated cultivation, especially alongside of the wadis course in the study area is the most extensive ongoing land use practice and accounts for positive alternation to the vegetation. To a lesser, but still considerable extent, is the effect of subsistence crop farming, as well as overgrazing by few numbers of domestic and feral livestock with resulting vegetation changes. The growing tourism and hunting industry also influences current human activities. In addition, the infrastructure is constantly changing that the influx of tourists to the region could cause concern if not probably managed (UNEP/CPD, 2002). The current influence of infrastructure in the proposed biosphere reserve, for instance the development of towns, villages and roads with their associated impact, is not as extensive as the other land uses e.g. mining and irrigation, which impact both drastic and irreversible. There is also a clear indication that the impact of overgrazing is more severe around the small villages located upstream, while erosion occurs mainly around these rural human settlements.

As shown in Figure 7.3 mining activities (quarrying) do not currently occur within the core zone of the proposed biosphere reserve except some old traces for this type of activities recorded at the right-hand side of the tarmac road of the Wadi Wurayah, but mainly existing at the buffer zone near to the south eastern boundaries of Wadi Zikt. Another new quarry activity has been identified during the field survey in the area located between Bidiyah and Sharm villages at the transition zone. They must, however, be considered as important interventions that should be managed and zoned accordingly. These mining activities do have an influence on certain tourism activities as well as water resources utilization within the proposed biosphere reserve. This type of activity also have a direct influence on the rural communities since a resettlement of villages takes place when quarrying needs to expand. This has a direct social and environment impact on the proposed Wurayah biosphere reserve that will need management in future while the long term effect of such settlements could influence the land use zonation plans of the Emirate's Municipality and the biosphere reserve itself.

## **Criterion 2: Be of significance for biological diversity conservation**

Taking the general information provided under Criterion 1 into account, the following features could be identified as being significant features.

### **a. Gabbro, Magnesite and Calcite Features**

The Upper parts of the area of study are mostly ultra basics, comprising peridotite, serpentinitized peridotite and serpentinite, with locally banded Magnesite. Thin chrysotile and calcite veins are common. Under extreme temperature, the calcite has transformed to marble. On the other hand, the lower part of the area of study contains complex of gabbro with intermixed ultrabasic rocks.



Picture 11.12 Cross-section showing a part of the geologic features of the study area.



## **b. Hydrogeology**

Based on interpretation of the available data and constructed hydrogeologic maps, two aquifers were identified within the study area, namely: the Quaternary alluvial aquifer and the fractured Ophiolites aquifer. The Quaternary aquifer, the main aquifer within the study area, is composed of alluvium gravel and coarse sand. The gravel aquifer receives recharge from rains falling on the Northern Oman Mountains. The wells tapping the aquifer receive water from a local groundwater flow system characterized by low salinity.

Due to the particular geology of the area, creates a unique hydrogeological system in UAE of perennial streams, falls and pools with an exceptional quality of water that supports a rich biodiversity of fauna and flora in an area of outstanding natural beauty. The exponential quality of groundwater due to the impact of the faults trend which play a big role in the water recharge and renewal.

## **c. Fauna and flora resources (species)**

Compared to a temperate ecosystem, Wurayah proposed Biosphere Reserve has a relative low diversity of fauna and flora but is of considerable ecological significance because of its permanent water resources that allows some of the rarest species found within the UAE, Arabian Peninsula and the World to survive in this harsh environment and climate.

The unique orchid species of UAE, *Epipactis veratrifolia* was found in the core zone. *Tamarix aphylla*, *Moringa peregrine* and *Typha domingensis* were also recorded and are considered as uncommon/rare in UAE.

The proposed biosphere reserve hosts 4 species that are endemic to mountains of UAE and northern Oman: Blue-tailed Lizard, Bar-tailed Semaphore Gecko, Rock Semaphore Gecko, Arabian Toad as well as Dhofar Toad.

Sixty percent of mammal species and 28% bird species recorded in the proposed biosphere reserve are of international or national concern, with such flagship species as the Arabian Tahr, the Mountain Gazelle, the Caracal Lynx, the Blanford's Fox, the Egyptian Vulture, the Bonelli's Eagle and the Barbary Falcon.

With Jabal Hafeet in UAE and the Wadi Surin in Oman, the core area is one of the last 3 remaining strongholds of the Arabian Tahr in the world (Tourenq, C et. al. 2006).

#### **d. Unique landuse practices**

The fact that land use has changed over the last two decades from crop and irrigation practices to residential, commercial, industrial and nowadays the tourism industry indicate a tendency to utilize the natural resources of the area optimally. Figures 7.1-7.3 and 7.4 showed that the area has an increasing human population especially at the transition zone.

The Majority of villages are found in the east of the transition zone at the vicinity of most of the wadis toward the coastline and few are scattered in the north and the south of the buffer zone at the areas of good water quality near the upstream of the wadis. The only difference today is the expansion of the urbanization activities. It must be noted that the availability of water in the area support the dynamic developments which took a special trends of extensions, that's why there are two land use trends available at the area: The first located at the narrow coastal plain next to the downstream of the wadis and the second at the vicinity of the wadis towards upstream.



Picture 11.13 An upstream village at the study area.



Picture 11.14 A downstream village at the study area.



Picture 11.15 An overview of a mosaic between natural vegetation and agricultural activities at the study area.

#### **e. Rock Art and Scio-culture activities**

As mentioned in chapter seven, there is already a rich archeological heritage at the proposed Wurayah Biosphere Reserve especially adjacent to the core zone (at buffer zone). So far, 13 old settlements, two graveyards and one rock carving site have been identified in the area. Other rock carving sites are suspected to present in the area as well.

Including in a program to discover the cultural heritage of the region, the presence of archeological sites- including the most ancient mosque of the country dating from 1466 AD located in Bidiyah and ancient forts of Fujairah at the transition zone constitutes unique opportunity in UAE to attract local and overseas tourists.

Despite the abandonment of traditional seasonal of livestock (goats) in the Wadi Wurayah catchment area, still strong relation between residents and the area. Most of the human's daily visits to the Wadi Wurayah for example are to enjoy the scenery and water, while the few rest visits are for hunting and/or collecting honey in the area.



Picture 11.16 One of the old settlements recorded in the study area reflecting the ancient cultural heritage.



Numerous painting of handprints and geometric designs form part of the contents of the rock art occur in the Wadis catchment areas. The more geometric art that been found is the schematic art tradition which includes finger painting. This tradition is associated with tourists who painted for different reasons.



Picture 11.17 A common water pool existing at Al-Wurayah Basin.

**Criterion 3: Provide an opportunity to explore and demonstrate approaches to sustainable development on regional scale.**

At an operational level sustainable development has four interlinked dimensions namely economic, environmental, social, and cultural (UNESCO, 2002). However, sustainable development can have a working sense only when these four dimensions of development are of equal importance and strength. In fact, no one country or region has reached an acceptable dynamic balance of the four arms of sustainability.

In the late 1970s and early 1980s, the conservation role had been kept prominent in the designation of the vast majority of biosphere reserves (Batisse, 1986) with the

environmental dimension as referred to above as the main focus, but in November 1995 the UNESCO General Conference approved the Seville Strategy for Biosphere Reserves and adopted the Statutory Framework of the World Network, Which define the principles, the criteria and the designation procedure for biosphere reserves (UNESCO, 1996). With these documents, the philosophy and concepts of the biosphere reserves have continued to spread into the broader international context, so that protected areas are being considered as integral to socio-economic development.

Biosphere reserves are increasingly regarded as practical examples of where the conservation and development roles are integrated. All too often conservation programs focus on areas that are too small to meet the habitat requirements of all species. In addition, conservation and resource management goals are often too narrowly formulated to make either economic or biological sense. In spite of that, biosphere reserves provide frameworks for practicing biodiversity conservation and resources management on large scale (UNESCO, 2001).

The proposed biosphere reserve could be affiliated to the dryland ecosystem type as indicated on the map of the world network of Biosphere reserves (Figure 2.2).

Since tourism is one of the fastest growing industries in the world (World Tourism Organization, 2002), the Wurayah Biosphere Reserve capitalized on this tendency, by identifying tourism as one of the economic pillars that needs to be developed as a priority. The old settlements in Bidiyah, Al-Aqqah and Zikt and the new well established resorts at the coastal plain extended from north to the south of the area, are currently engaged in the tourism potential at the local and regional scale. Therefore the Wurayah Biosphere Reserve could be positioned in a way that provides an opportunity to demonstrate sustainable development on a regional scale.

#### **Criterion 4: Have an appropriate size to serve the three functions of the biosphere reserves**

In combining the three functions of biosphere reserves, these reserves should strive to be sites of excellence for exploring and demonstrating approaches to conservation and sustainable development, as referred to in Article 3 of the Statutory Framework

(UNESCO, 1996 and 2000). To accomplish this goal a biosphere reserve must have an appropriate size to serve the three functions.

Based on the previously mentioned boundaries of the proposed Wurayah Biosphere Reserve, It must be clearly stated that the proposed Wurayah Biosphere Reserve's boundary was identified using the declared protected area boundaries, the distribution of the habitats out of the protected area and the extension of the land use due to the human activities and its impact on water resources.



Picture 11.18 General View for the common water pool existing at Al-Wurayah Basin, which represents one of the attraction sites for tourists.

In fact, the biosphere boundaries must not be as cast in stone but the zonation pattern should be re-investigated in future. Other efforts should be done to incorporate the marine protected areas in the biosphere reserve and this will have a direct influence on the size and zonation pattern of the Wurayah Biosphere Reserve.

**Criterion 5: It should include the three functions of a biosphere reserve through appropriate zonation, recognizing:**

- a) A legally constituted core area or areas devoted to long term protection, according to the conservation objectives of the biosphere reserves, and of sufficient size to meet these objectives;**
- b) A buffer zone or zones clearly identified and surrounding or contiguous to the core area or areas, where only activities compatible with conservation objectives can take place;**
- c) An outer transition area where sustainable resource management practices are promoted and developed;**

In many parts of the world, natural ecosystems have been largely converted or transformed into agricultural systems of various kinds, or have been replaced by cities, towns, industrial complexes and other man made infrastructures. This process has in particular been noticeable in those parts of the world that have long been inhabited by high densities of human populations and in process that has accelerated over last few centuries (UNESCO, 2002). In UAE, and in particular in the Fujairah Emirate the situation is the same. However, the land changes as a result of agricultural practices and densely populated rural areas as a result of mainly previous land policies that were set to develop the homeland system, is still felt. The lack of proper land use zonation legislation further contributes to the current mismanagement of the natural resource base especially water. This has been discussed as an important factor that needs to be considered in biosphere reserve planning.

Appropriate land use zonation principles are currently of the utmost importance as the implications of a poorly defined, implemented and regulated planning framework will result in uncontrolled development (UNESCO, 2002). With the provincial Economic Development Strategy in places as a tool to combat economic development is encouraged in all sectors. This strategy is driven by the need for job opportunities and access to services.



Within the Fujairah Municipality, in which the Wurayah Biosphere Reserve is located, all three economic pillars namely Agriculture, Mining and Tourism are competing for space. Moreover, municipality has to force to develop and implement an Integrated Development Plan. It is thus within this planning framework that the zonation criteria for the development of the biosphere reserve concept will play a major role.

#### **a. Zonation of Core Area**

The core zone is a securely protected site for conserving biological diversity, monitoring minimally disturbed ecosystems and undertaking non-destructive research and other low-impact uses such education (UNESCO, 1996).

The core area within the Wurayah Biosphere Reserve was identified according to its legal status after the Amiri Decree, its long term role as protected area and according to the participatory approach of the stakeholder. The core area is situated at the south western part of the Wurayah catchment area. Selection of this protected area aims at conserving components of dryland natural ecosystems, reintroducing rare and endangered species that previously occurred in the area and making the protected area legally acceptable for eco-tourists.

The Wurayah Dam is situated in the northeastern part of the protected area, approximately 10 km southwest of the Bidiyah town. The dam is characterized by densely mountains which mainly comprise of sandstone and surrounding cliffs. The one of objective for the Wurayah natural protected area was to conserve the biodiversity of the dam area with the surrounding water pools, specially the conservation of aquatic habitat.

Streams of water flow freely down the mountain to form beautiful waterfalls during the rainy season. Due to the topography of the area, there is a rich variety of habitat types that can accommodate a variety of bird species.

The inciseness of the area kept it in a pristine state so that well-conserved rock paintings and other archeological sites still exist at the protected area.

The main outcome of determination this protected area as a core zone is to promote the sustainable utilization of natural resources from which the direct surrounding communities can benefit and including them in its future development.

## **b. A Buffer Zone**

A buffer zone or zones has been clearly identified as areas adjacent to or nearby the core areas. It is, therefore, not necessary for all the land surrounding the core areas to be zoned as a buffer (UNESCO, 1996). The land use activities should rather be taken as criteria that depict activities compatible with the conservation objectives of the core areas.

The buffer zone of the Wurayah Biosphere Reserve has a limited number of land uses mainly private farms concentrated southeast, while a part from tourism practices such as claim and visiting of old settlements are found at the north of the zone. A portion of the communal land with well-established road network in Zikt and Amaq where endangered species recorded have also been zoned as a part of the buffer zone strip to be an area where ecotourism activities (recreation, mineral water therapy (spas), cultural tourism, and rural, agro-tourism) could developed to enhance the economic potential within the adjacent transitional zone that includes 7 rural villages.

These explain why the boundaries of the buffer zones were drawn alongside the narrow coastal plain. The importance of zoning of this area as a buffer zone came from the Criterium 7 of the Statutory Framework (UNESCO, 1996) which refers to mechanisms that need to be in place to manage human use and activities in the buffer zone or zones. In the Wurayah buffer zone and authority should be established to manage this zone. Landowners should be encouraged to participate in this authority to contribute with their zone.

The main activity in the buffer zone is house grazing and farming while a portion of this zone is mountainous and difficult to access. According to what has mentioned in chapter 7 hunting Wildlife Hunting still occur in the Wadi Wurayah especially in the buffer and transition zones with limited practices in the core one.

On the other hand, the impact of urbanization on the habitat fragmentation is another environmental factor existing in this area. There is currently a development project under discussion for chalet –type accommodations on the parking above the main waterfall of Wadi Wurayah, while another one is under construction at the Wadi Outlet before the Bidiyah village next to the boundary of the core area.

The development of permanent settlement and the constriction of infrastructure associated with it (buildings, roads canalizations, sewage treatment, etc.) will have a severe impact on the site and the beauty of the scenery, and certainly the integrity of this environment.



Picture 11.19 A mountainous resort is under construction (left).

A secondary consequence of this development will be the continuous presence of people at the site, resulting in the creation of permanent “base camp” that will allow people to explore the wadis deeper, adding to the risk of more rubbish and pollution deposited and the attraction of feral animals (goats, dogs and cats). If the project is accepted, the decision makers must ensure that the developers respect the environment through, for example, architecture integrated in the landscape with the use of traditional material and techniques, and that mitigation measures are implemented to prevent irremediable damages and pollution.

### **c. An Outer Transition Area**

The Seville Strategy (UNESCO, 2002), gave increased emphasis to the transition area since this is the area where the key issues on environment and development of a given region are to be addressed. The transition area is by definition not delimited in space,

but rather to be changed in size according to the problems that may arise over time. In addition, is a zone where sustainable resource management practices are promoted and developed.

The main activities within the transition zone are:

Various small and low impact tourism activities are found between Bidiyah and Rol Dadinah. According to the field observations a larger tourism operations such as holiday resorts and hotels are found. These operations if not managed in sustainable manner it could be a mass node.

Intensive farming is concentrated in the down – stream of the most of the wadis located at the transition zone; most of them are irrigation farms. At some are located at the wadis outlet in the area and others are located at the coastal plain. Most of these farms dealing with Palm other are dealing with crops. They may contribute in to the local economy in some cases specially the Palms. Reference to what has discussed in chapter 10 the phenomena of the salt-water intrusion has been recorded significantly in this zone due to the remarkable extraction of groundwater by farming activities and urbanization as well, so they needs to be monitored closely since this could have an effect on the future sustainability of the groundwater as well as on the activity itself.

The human settlements form another major part of the transition zone. Seven rural villages are suited on the coastal plain with different human activities (traditional, Industrial, commercial and residential). As previously mentioned a detailed study is in need to identify the safe areas and dangerous areas according to the impact of flash floods (Sharm as a case study).

According to what has mentioned in chapter 7 hunting Wildlife Hunting still occur in the Wadi Wurayah especially in the buffer and transition zones

Issues that need to be taken into account within the transition area are:

- The population density in comparison to the other areas of the biosphere reserve.
- The dynamic of economic activities.
- The Pressure on the groundwater resources and the water supply systems.
- The traditional developed rural energy supply system.
- The development of infrastructure and services.



**Criterium6: Organizational arrangements should be provided for the involvement and participation of a suitable range of inter alia public authorities, local communities, and private interests in the design and carrying out of the functions of a biosphere reserve.**

An area as big as the Wurayah Biosphere Reserve should involve various stakeholders. To ensure that people within the biosphere reserve should take ownership of the project is a challenge in it self. The only aspect that will still change will be the number of people participating in the initiative as the biosphere reserve grows in size. Once the Wurayah Biosphere Reserve declare people will start to understand the concept and its benefits and then become more positive and get involved.

Munro (1995) indicates that people support what they believe to be valuable. People are usually most positive and active in their support if the values that they perceive accurate to themselves. The values may be concrete and easy to quantify, such as the provision of employment or other income; tangible but less easy to put into monetary terms, such as opportunities for recreation; and quite intangible and un-quantifiable, such as wilderness experience.

The involvement of all the relevant stakeholder at all times is therefore of the utmost importance for the long-term survival of the Wurayah Biosphere Reserve. Due to the uniqueness of each biosphere reserve the stakeholder composition will differ from one reserve to the other since the biosphere concept allows flexible approach to a biosphere reserves' structural arrangements.

Within the Wurayah Biosphere Reserve a representative management committee of stakeholder should be formed and register as non-profit legal entity to assist in management and fundraising. Members of the committee has to be elected at stakeholder representative level while each of the following stakeholder groups has to be asked to appoint a representative to the committee (Figure 11.2). A balance between government, community and private representation should be exist on the management committee.

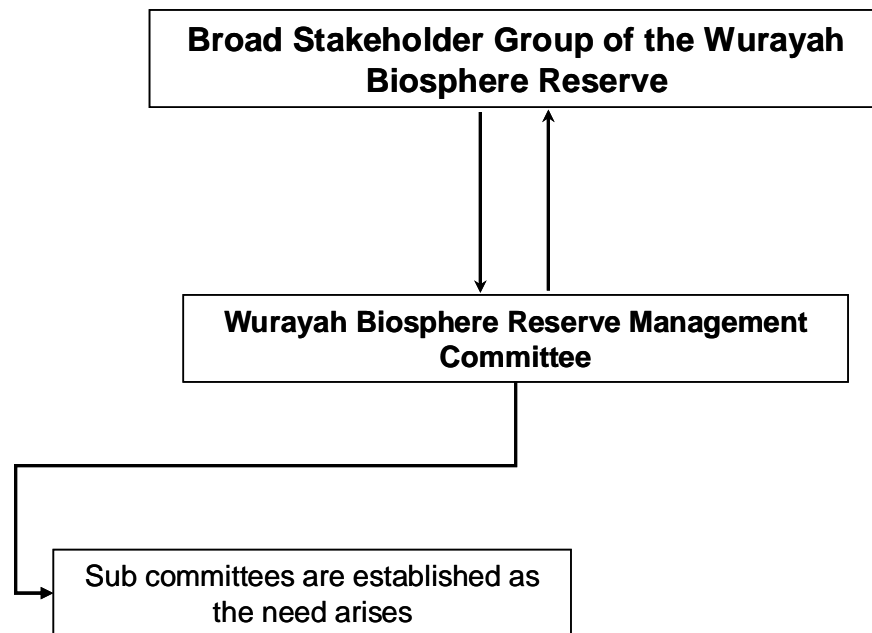


Figure 11.2 Structural arrangement of the Wurayah Biosphere Reserve (ALHOGARATY).

The stakeholders are:

- Ministry of Environment and Water (Eastern Coast Region Office)
- Ministry of Energy
- Ministry of Education
- Environment Authority Abu Dhabi (EAD)
- Fujairah Municipality
- Dibba Municipality
- Fujairah Land Department
- Local Authorities
- Governmental Departments
- Business Sector
- Landowners
- Mining investors (Quarry Owners)
- Other relevant private sector representation.
- Local communities.
- NGO's

**Criterion7: Other provision a biosphere reserve should have in place:**

**a) Mechanisms to manage human use and activities in the buffer zone or zones.**

The only direct form of regulating use and activities in the core zone is through the implementation of existing legislation of the Fujairah's Amiri Decree. Administrative mechanism to manage human use and activities in the buffer and transition zones should mainly be built into the structure and function of the Wurayah Biosphere Reserve Management Committee. All government role-players who are involved in any of legislation implementation should be represented on the committee where issues pertaining to human activities are identified and dealt with. Despite of that, there is no legislation that currently guides any development or activity within a biosphere reserve. The management plan section of this study will investigate the legislative aspects to be considered when dealing with biosphere reserves. The local and district municipalities involved will be the most prominent role-players with appropriate legislative powers to deal with development, activities and land use changes or influences.

The Wurayah Biosphere Reserve, however, Endeavour to let all members and role-players involved endorse the objectives and principals of the biosphere reserve as contained in the constitution. These objectives are founded on the Seville Strategy and Statutory Framework for Biosphere Reserves as approved by UNESCO (UNSECO, 1996).

**b) A management plan or policy for developing the area as a biosphere reserve.**

**- The objective of the Management Plan:**

In agreement with modern conservation principles, the management plan integrates the conservation of biodiversity with the development goals of local communities, taking into account traditional, cultural and spiritual characteristics of the region.

This management plan could represent the reference document for the Biosphere Reserve's management committee and districts municipalities and forms the basis to which all planning and activities undertaken in the Wurayah Biosphere Reserve must refer.

- Themes of the Management Plan (Figure 11.3):

- 1. Management of biodiversity and landscapes** by conserving natural habitats, increasing or at least maintaining plant and animal populations at their current level and Maintaining and conserving geological and geo-morphological characteristics, landscape specificity, dynamics and beauty.
- 2. Sustainable management of natural resources** by regulating and monitoring activities undertaken inside the biosphere reserve to ensure the sustainable use of natural resources
- 3. Promoting public awareness and education** by improving public awareness of and education on the biosphere reserve values
- 4. Promoting traditions and local customs** by conserving local cultural inheritance, and representative traditions and customs
- 5. Tourism management** by promoting a type of tourism that will lead to visitors' increased appreciation of biosphere reserve values that will include local cultural and traditional characteristics and will bring income without negatively impacting the biosphere reserve.
- 6. Administrative management and sustainability**

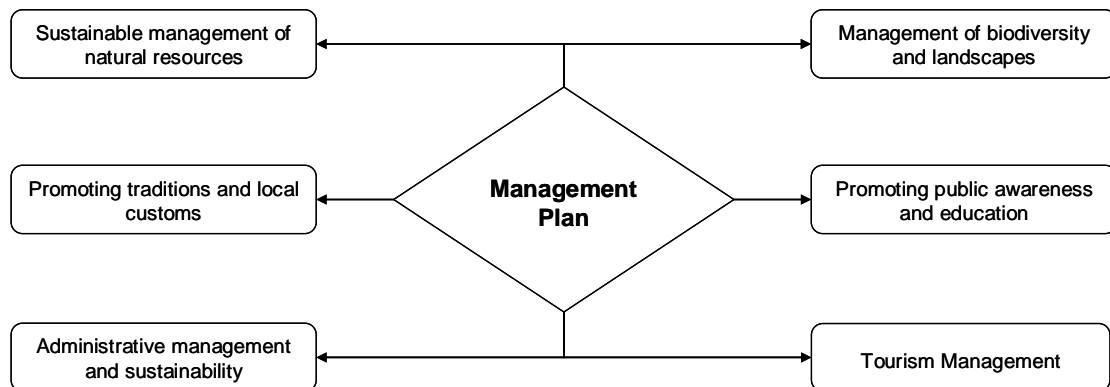


Figure 11.3 The Management Plan for the Wurayah Biosphere Reserve (ALHOGARATY).



The integration of the Wurayah Biosphere Reserve's management plan into a Master Plan of the Fujairah Emirate is crucial for the future existence of this biosphere reserve.

**c) A designated authority or mechanism to implement this policy or plan.**

The Wurayah Biosphere Reserve's Management Committee will be the authority to implement this plan as discussed in Criterion 6.

**d) Programmers for research, monitoring, education, and training.**

An environmental education and training program should be organized to assist in communicating the biosphere reserve concept to the indigenous communities.

Various monitoring programs have to be conducted especially in the core zone throughout the year. These include vegetation monitoring, scarce species monitoring and aquatic habitat monitoring. Conservation and resources management programs should also initiated with regard to erosion control, water resources, energy resources, proper ecological management especially within the core and buffer zones.

Within the framework of monitoring and research it important to establish an entity to coordinate all researchers conducting research in the Wurayah Biosphere Reserve and encourage the private sectors and landowners to in developing research programs for the sustainable development of their reserve.

### **11.3. Management Plan Approach for the Wurayah Biosphere Reserve**

#### **11.3.1 Management of Biodiversity and Landscapes**

Generally, the conservation of biological diversity emphasizes on preservation of what we already have. Preservation has a critical role to play in the conservation of biological diversity. However, it is clear that, by itself preservation is not an adequate strategy for conserving biological diversity. Restoring and rehabilitating damaged ecosystems is the best means of increasing and conserving their biodiversity (UNESCO, 1996, 2001 and 2002).

The restoration and rehabilitation programs strongly emphasize re-vegetation, far less attention being paid to the reintroduction of animal species. This is frequently the case in

restoration and land rehabilitation projects, since the assumption is often made that the appropriate animals will find their way into the community once it has developed to a certain point (UNESCO, 1996).

Introduction of fast growing exotic species of trees and grasses have proved highly successful towards the control of ecological regeneration, and restoration of the degraded arid land ecosystems (UNESCO, 2002). Therefore, beside protection and rational management of natural resources, it is of great importance that extensive programs be formulated and executed for the propagation of the multipurpose native species.

The following are important management and conservation measures:

- Complete the checklist of the flora of the region, particularly the annual species which may appear in some rainy season and disappear in the dry one. This should include assessing the genetic diversity (i.e. within species diversity) such as identifying subspecies, varieties and ecotypes.
- Drawing exact location maps for the endemic, rare and threatened species. This will be helpful in designing any plan for restoring the threatened species in their habitats.
- Assessing the plant communities in the whole area of the reserve regardless the habitat types
- Estimation of the standing crop and primary production in the major habitats in order to estimate the carrying capacity of this region.
- Recording the phenological sequence of the recorded species, particularly endemic, rare and threatened species.
- Applying the grazing rotations for preventing overgrazing practices.
- Preventing the quarrying activities inside the reserve.
- Establishing irrigated rangelands saline water-based particularly in and around the villages located at the coastal plain.
- Strengthening the cooperation between the proposed management committee of the reserve on one hand, and the local inhabitants and related administrations in Fujairah Governorate on the other hand.
- Construction of a nursery for some of the endangered species of wide economic uses to be used for rehabilitation purposes

## **11.3.2 Sustainable Management of Natural Resources**

### **11.3.2.1 Water Conservation**

Water is the main factor, which determines the type, size and location of any economic activity. Local inhabitants in the biosphere reserve are using different methods for groundwater abstraction and rain water harvesting. Most of these methods are traditional methods.

Water harvesting has the potential to increase the productivity of the lands by increasing the yields and by reducing the risk of crop failure. They also facilitate re- or afforestation, fruit tree planting or agro-forestry. With regard to tree establishment, rainwater and floodwater harvesting can contribute to the fight against desertification. Most of these techniques are relatively cheap and can therefore be a viable alternative where irrigation water from other sources is not readily available or too costly. Unlike pumping water, water harvesting saves energy and maintenance costs. Using harvested rainwater helps in decreasing the use of other valuable water sources like groundwater. Remote sensing and Geographical Information Systems can help in the determination of areas suitable for water harvesting.

In general, the water harvesting system depends on the following:

- a) Average rainfall
- b) Number of rain storms
- c) Topography
- d) Evapotranspiration
- e) Surface roughness
- f) Land features

The following is a brief description of the three groups of water harvesting techniques along with sub-types:

#### **11.3.2.1.1 Rainwater Harvesting**

Rainwater harvesting is defined as a method for inducing, collecting, storing and conserving local surface runoff for agriculture in arid and semi-arid regions. Three types of water harvesting are covered by rainwater harvesting (Salem, 2003a).

- Water collected from roof tops, courtyards and similar compacted or treated surfaces is used for domestic purpose or garden crops.
- Micro-catchment water harvesting is a method of collecting surface runoff from a small catchment area and storing it in the root zone of an adjacent infiltration basin. The basin is planted with a tree, a bush or with annual crops.
- Macro-catchment water harvesting, also called harvesting from external catchments is the case where runoff from hill-slope catchments is conveyed to the cropping area located at hill foot on flat terrain.

#### **11.3.2.1.2 Flood Water Harvesting**

Flood Water Harvesting can be defined as the collection and storage of creek flow for irrigation use. Flood water harvesting, also known as ‘large catchment water harvesting’ or ‘Spate Irrigation’, may be classified into following two forms:

- In case of ‘floodwater harvesting within the stream bed’, the water flow is dammed and as a result inundates the valley bottom of the flood plain. The water is forced to infiltrate and the wetted area can be used for agriculture or pasture improvement.
- In case of ‘floodwater diversion’, the wadi water is forced to leave its natural course and conveyed to nearby cropping fields. It is difficult to give exact Figure on the present area under various forms of floodwater harvesting systems.

#### **11.3.2.1.3 Groundwater Harvesting**

Is a rather new term and is employed to cover traditional as well as unconventional ways of ground water extraction. Falaj systems, underground dams and special types of wells are few examples of the groundwater harvesting techniques. For example, The Falaj consists of a horizontal tunnel that taps underground water in an alluvial fan, brings it to the surface due to gravitational effect. Falaj tunnels have an inclination of 1-2% and a length of up to 30 km. Many are still maintained and deliver steadily water to fields for agriculture production and villages for drinking water supply. Groundwater dams like ‘Subsurface Dams’ and ‘Sand Storage Dams’ are other fine examples of groundwater harvesting. They obstruct the flow of ephemeral streams in a wadi bed; the water is stored



in the sediment below ground surface and can be used for aquifer recharge. Sand filled reservoirs have the following advantages:

- Evaporation losses are reduced,
- no reduction in storage volume due to siltation,
- stored water is less susceptible to pollution, and
- health hazards due to mosquito breeding are avoided.

#### **11.3.2.1.4 Solar Water Desalination**

Solar water desalination is a new approach in UAE and still under development. It has been tested in successful and productive way in Abu Dhabi Emirate, easy to use and sustainable.

Solar desalination techniques could be implemented in the Wurayah Biosphere Reserve as a pilot project especially in buffer and transition zones. Before implementation of this pilot project, the solar system has to be tested and its costs benefit analysis has to be conducted to assess its feasibility. Several meetings with the local community have to be conveyed to show and explain the benefits of the system, and make them familiar with this new technology entering their lives. As the system requires no maintenance from the users and depends only on the availability of the saline well water (raw water) and sun, it is considered an ‘appropriate’ technology for healthy drinking water provision to the community.

The government of Fujairah has to offer lands and wells for solar water desalination installations. It could be planned to install these units on roofs of houses of the local community to ensure the provision of fresh health drinking water directly to the houses in a decentralized manner.

The following are also important management practices for water resources which are developed through mixing of modern technologies and indigenous knowledge of the local inhabitants.

##### **a) Groundwater:**

- Hydrogeological investigation of the different aquifers in coastal area
- Monitoring of groundwater levels and preparing water-level maps that shows flow directions.

- Modeling salt-water intrusion.
- Monitoring of groundwater quality
- Suitability assessment for drinking and irrigation purposes.
- Proposing alternative uses for saline groundwater such as small scale fisheries.

#### **b) Runoff Water**

- Accurate determination of drainage basin system using topographic maps, aerial photographs and satellite images
- Carrying out infiltration tests in the different catchments of the studied wadis as well as in different zones of the protected area in order to evaluate the infiltration rates.
- A rainfall-runoff model will be identified and selected to calculate runoff hydrographs corresponding to rainfall events and the total amounts of water.
- Calculation of potential evapotranspiration.
- Calculating the depth and amount of surface runoff on the drainage basins.
- Calculating the average groundwater recharge rate.
- Monitoring of runoff water quality
- Determining the number and location of private wells.
- Locating the best sites for the construction of necessary subsurface reservoirs for rain water harvesting and replenishment of groundwater aquifers.

#### **11.3.2.2 Energy Conservation**

The Eastern Coast Region and off course the area of the study has suffered from the shortage of the electricity due to shortage of power stations in that area which can not cover the rapid development. The climate records show that the Eastern Coast Region in general and the area of study in particular have the potentiality to use the renewable energy instead of the non renewable one. Solar energy and wind energy are the two examples of resources that could be used in this area.

To localize areas best suitable for wind power stations digital map layers of the investigation area could be used. The available and necessary: mean wind speed resulted from meteorological/climatological modeling will helps also to identify sub-regions,

where in the long run the area could have enough wind. The wind station should be constructed away from the core area may be in the buffer zone near the boundaries of the transition or in the transition area itself. In this case the natural heritage sites could be assumed as a core protected area, because it is used by eco-tourism

Settlement areas either the existing or the planned have to be measured to avoid also housing areas, water wells, farms, while roads have to have a buffer zone around but also to use roads for access to future wind power station sites specially for erection and maintenance.

The use of the renewable energy resources will support the objectives of the biosphere reserve, by pushing the area land use to be in sustainable manner.

### **11.3.3 Promoting Public Awareness and Education**

In order to support the capacity building of the biosphere reserve there is a need for training and handling of data collection and inventory techniques and proven management technologies implementation; this may need between 1 to 3 years of scheduled actions.

This task requires an assessment of user needs and requirements to plan for the training, seminars and workshops are targeted to address all levels, such as local community and scientists in addition to the development of field guidelines, data collection, handling and inventory techniques.

Required training workshops could train the local community on:

- Protection of endangered species
- Sustainable water resources practices.
- New irrigation systems.
- Biosaline agriculture.
- Green buildings and green cities.
- Use of renewable energy for power generation.
- Solar water distillation units.

#### **11.3.4 Promoting Traditions and Local Customs**

This could be implemented by:

- Carry out feasibility studies on the income generating activities and the potential commercial values in order to identify production lines, and analyze the market needs.
- Provide technical and financial training for the development and management of the income generating activities incorporating environmental awareness which explain the conservation objectives behind these activities.

#### **11.3.5 Tourism Management**

Promoting a type of tourism that will lead to visitors' increased appreciation of biosphere reserve values that will include local cultural and traditional characteristics and will bring income without negatively impacting the biosphere reserve.

As evolution of ecotourism has provided new potential for conservation initiatives, careful attention should be paid to a number of important details. Valentine (1997) mentioned that the term "ecotourism" refers to tourism based on the natural environment and conducted in an ecologically sustainable manner. The idea of ecotourism is to develop a form of tourism, which is based on enjoying nature but while simultaneously, helping to protect the environment.

As the World's largest industry with an average annual growth rate of 70% (World Tourism Organization, 2002) ecotourism naturally forms a major part of this growing tendency. Wood (2002) in turn defines ecotourism as a form of nature-based tourism, which is rapidly growing industry working within a niche market.

It is known that various debates have been published in defining ecotourism. However, for describing tourism in the proposed Wurayah Biosphere Reserve and the evaluation of tourism activities in the biosphere reserve, the following definition as by the IUCN will suffice:

Ecotourism is environmentally responsible travel and visitation to relatively undisturbed natural areas, in order to enjoy and appreciate nature (and any accompanying cultural features- both past and present) that promotes conservation, has low negative visitor

impact and provides for beneficially active socio-economic involvement of local populations.

This definition has been published by the United Nations Environment Program (UNEP) in collaboration with the International Ecotourism Society (TIES) in the 2002.

Market research shows that eco-tourists are particularly interested in wilderness settings and pristine areas (Wood, 2002). According to the fifth meeting of the Conference of Parties to the Convention on Biological Diversity, ecotourism furthermore has a unique role to play in educating travelers about the value of a healthy environment and biological diversity. Eco-tourists, therefore, expect that eco-destinations will represent areas where natural resources are protected and utilized in a sustainable way.

The planning of an eco-destination depends on baseline data of social and environmental factors, zoning strategies, regulations that can prevent the deliberate abuse of fragile ecosystems, local participation in developing a set of standards for limits of acceptable change, and long term monitoring (Wood, 2002).

Wood (2002) further indicated that any destination that seeks to attract tourists must protect its resources while facilitating a sense of integration with local community.

Tourism activities are restricted in the core area as one can expect. The main activities could be overnight accommodation, self-drive safaris, bird watching and day visitors.

The main types of activities in the buffer zone could be overnight facilities, game drives, swimming in the water pools, bird watching, photo safaris, and night drives. Cultural tours should be offered as main attraction in the buffer zone.

#### **11.3.6. Administrative Management and Sustainability**

It is not the intention of this study to discuss all legislation that might have an effect on biosphere reserve or the protection of the environment and biodiversity. The study rather aims to assess legislation and authorities that will have direct influence on the protection of the current land uses and spatial zonation patterns of a biosphere reserve.

Wood (2002) argues that if no effective enforcement of environmental laws exists, and if natural areas are developed without foresight, facilities will certainly in some instances be improperly constructed.



In November 1995, the UNESCO General Conference approved the Seville Strategy for Biosphere Reserves (UNESCO, 2002). The General Conference also formally adopted the Statutory Framework of the World Network which defines the principals, criteria and designation procedure for biosphere reserves. Although it is not a binding text for states/countries, the Statuary Framework applies to all biosphere reserves designated within the framework of the MAB Program.

The relevant resolution of the UNESCO General Conference invited all members of states/countries to take account of this text when establishing new biosphere reserves. Theses documents, therefore, provide the basic texts shaping and guiding the further development of the World Network of Biosphere Reserves and its component parts.

The country has made sincere efforts to protect its biological diversity. Internationally its intent is shown by signing several international conventions and complemented by domestic legislation. UAE is signatory to nearly 16 international and two regional conventions besides 6 protocols related to environment and wildlife including the Convention on Biological Diversity (CBD), the Convention on International Trades in Endangered Species (CITES) and the Regional convention on Protection of the Marine Environment (ROPME).

However as international conventions are not binding laws and need complementary national laws, to implement these conventions and fulfill the obligations as a signatory, the country has several important environmental legislations which very effectively protect country natural resources (Appendix 1).

The two most important laws, Federal Law No. 24 and Federal Law No 23 deal with the environment and wildlife conservation. The Federal Law 24 of 1999 for the “Protection and development of environment” covers most aspects of the country’s natural environment with Federal Environmental Agency (FEA) as the implementing agency. Local authorities in each emirate are the competent authorities. The first six chapters state the law, while chapter VII (Articles 69-72) has provision for liabilities and compensation for environmental damages. Provisions for penalties are dealt in Chapter VIII (Articles 73-90). Articles 63-68 under chapter VI deal with the ‘Natural Reserve’ and prohibit hunting, transportation or killing of animals and birds, besides encouraging studies and

monitoring, leading to establishment of reserves, protection and monitoring of the biodiversity.

A Federal decree (Law No. 9) of 1983 'Regulating the Hunting of Birds and Animals' is another piece of legislation to protect migratory and resident birds. Provisions for the protection of the country's marine environment are made in Federal Law No. 23 of 1999, regulating the exploitation, protection and development of marine biological resources, which indirectly also protect birds and in particular shorebirds and breeding seabirds. The Federal Law No. 11 of 2002 deals with the regulation and control of international trade in endangered species.

**a) National government institutions to be involved in the research/management of the proposed biosphere reserve**

At the national level the Federal Environmental Agency (FEA) is the main national level agency dealing with environmental legislation and management of CITES in the country. At the emirate level the FEA works closely with various local government agencies which are designated scientific authorities on the subject matter, such as Environment Agency- Abu Dhabi (EAD) in the Emirate of Abu Dhabi. EAD is the only such agency in the entire country; however in other emirates either municipality or relevant environmental bodies undertake some of the responsibilities of environmental protection and implementation of environmental legislation, which is a federal law.

EAD is an Abu Dhabi Government environmental agency responsible for conducting research on various aspects of natural resources of the Emirate. Its main research centers include Terrestrial Environment Research Centre (TERC) responsible for undertaking research and conservation of the terrestrial environment, including those on the islands also; the Marine Environment Research Centre (MERC) responsible for all aspects of marine biodiversity research and management and the National Avian Research Centre (NARC) responsible for the research, conservation and captive breeding of Houbara. EAD is also responsible for permitting, regulation for industrial establishments, fishing licenses etc. The Environmental Education and Awareness Department of EAD look after all the

environmental issues in the emirate, besides partnering with other local government and NGO's in other emirates to spread awareness.

As Fujairah Emirate conservation effort and role of Fujairah Municipality is highly significant at the overall Emirate level and in a way compensates for other equivalent bodies in other emirates.

**b) Main non-government organizations and academic institutions to be involved in research/management of the proposed biosphere reserve**

There are four main non-governmental organizations related to the environment and wildlife conservation in the country. The Emirates Natural History Group (ENHG) is the oldest with Abu Dhabi, Dubai and Al Ain chapters and the primary focus is on birds. WWF-Emirates Wildlife Society (EWS) indirectly contribute to conservation of biodiversity, through education and awareness programs. Other contributions could come from Environment Friend Society and Emirate Environmental Group (EEG).

**c) International Instruments**

By being a signatory to the Convention on Biological Diversity (CBD), an overarching biodiversity conservation convention, the country is obligated to protect its biodiversity.

The Convention of Conservation of Wildlife and its Natural Habitat in the Gulf Cooperation Council (GCC) countries is another significant regional convention signed in 2003 which also protects wildlife in the country. Besides these, there are other conventions and protocols to which UAE is signatory or party of, which directly or indirectly help protect wildlife in the country. The UAE is also signatory to the Convention on International Trade in Endangered Species (CITES) and EAD is the scientific authority for CITES in the UAE.

**d) International Programs and Activities**

In the past several studies have been undertaken in the country, however, most of them were not part of a cooperative international and regional programs or

activities. Several short-term and independent studies by students have been undertaken on wildlife.

One of the international bodies that should be approached is the Arab Man and Biosphere (ArabMAB) Network which was officially launched in Amman (Jordan) in 1997. The overall objective of ArabMAB is to promote co-operation between Arab National MAB Committees in order to strengthen the MAB program in the Arab Region, through the establishment of biosphere reserves and the implementation of common research and public awareness projects.

Members of ArabMAB constitute the ArabMAB Coordinating Council that meets every two years to elect a Bureau and to adopt a work program for the biennium. The Council meetings are also the venue for expert meetings and technical workshops.