

INTRODUCTION

1.1 Description of Study Area

The United Arab Emirates (UAE) is one of the most rapidly developing countries in the Arabian Gulf Region. The UAE is located between Latitude 22° and 26.5° North, and Longitude 51° and 56.5° East, with a total area of 83,600 km² including a number of islands, with a total area of 5,900 km². The UAE is bounded by the Arabian Gulf in the north and northeast, Saudi Arabia in the south and west, and Gulf of Oman and Sultanate of Oman in the east and southeast (Figure 1.1).

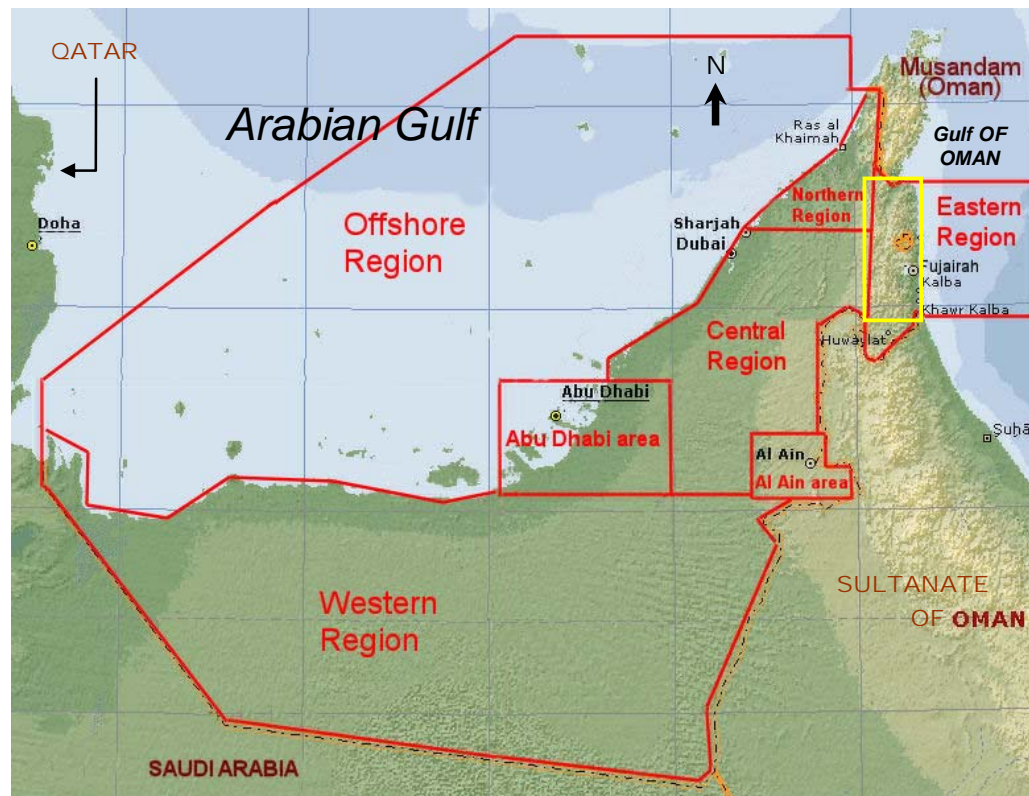


Figure 1.1 Locations of the United Arab Emirates (UAE), and the study area (yellow rectangle) in the Eastern Coast Region (ALHOGARATY).

The eastern coast of the UAE stretches over a shallow marine area, with many islands and coral reefs. The country can be divided into three ecological zones: mountain area in the northeast, sandy desert area in the south and west and marine coastal area in the east and west (Figure 1.1). The coastal area is divided into two coastal strips; the western coast opposite to the Arabian Gulf with a length of 650 km and the eastern coast opposite to the Gulf of Oman with a length of 90 km. The Ministry of Agriculture and Fishers (now the Ministry of Environment and Water) divided the UAE, on the basis of agricultural activities, into five districts including: the Northern Region, Central Region, Eastern Region, Al Ain Area and Western Region (Figure 1.1). The UAE is a federal country composed of seven emirates; Abu Dhabi, Dubai, Sharjah, Ajman, Fujairah, Ras Al Khaimah and Umm Al Quwain. The study area lies entirely within the Fujairah Emirate (Figures 1.1 and 1.2).

The UAE is predominantly an arid country located within a desert belt. About 80% of the country area is desert, covering most of the Western Region. The western and eastern coastal plains occupy only 7%, while the Northern Oman Mountains located in the Eastern Region cover the remaining 13%.

As shown in Figure 1.3, the Eastern Region is located between Latitudes $25^{\circ} 05'$ and $25^{\circ} 40'$ North and Longitudes $56^{\circ} 00'$ and $56^{\circ} 20'$ East, and covers a total area of 5,000 km². The eastern coastal plain is a narrow strip extending for 90 km between Dibba in the north and Kalba in the south, and between the Gulf of Oman in the east and the Northern Oman Mountains in the UAE in the west. The average width of the eastern coastal plain is about 5 km and the average height of the Northern Oman Mountains in the UAE is 1,500 m (Rizk et al., 1997). Administratively, Fujairah Emirate is the only emirate entirely located in the Eastern Region of the UAE, in addition to three cities belonging to the Sharjah Emirate (Dibba, Khor Fakkan and Kalba).

The main natural resources in the Eastern Region of the UAE are water, oil and natural gas. Water scarcity is a main concern as well as how to use the other natural resources like oil and gas on a sustainable basis. The region has 22 large drainage basins with variable catchment areas. Most of the wadis draining these basins

discharge into the Gulf of Oman. Examples of major wadis are: Wahla, Qawar, Zikt, Wurayah, Hadf, Ham, Basseirah, Rumth, Safad, Farfar, Gulfa and Shi (Figure 1.3).

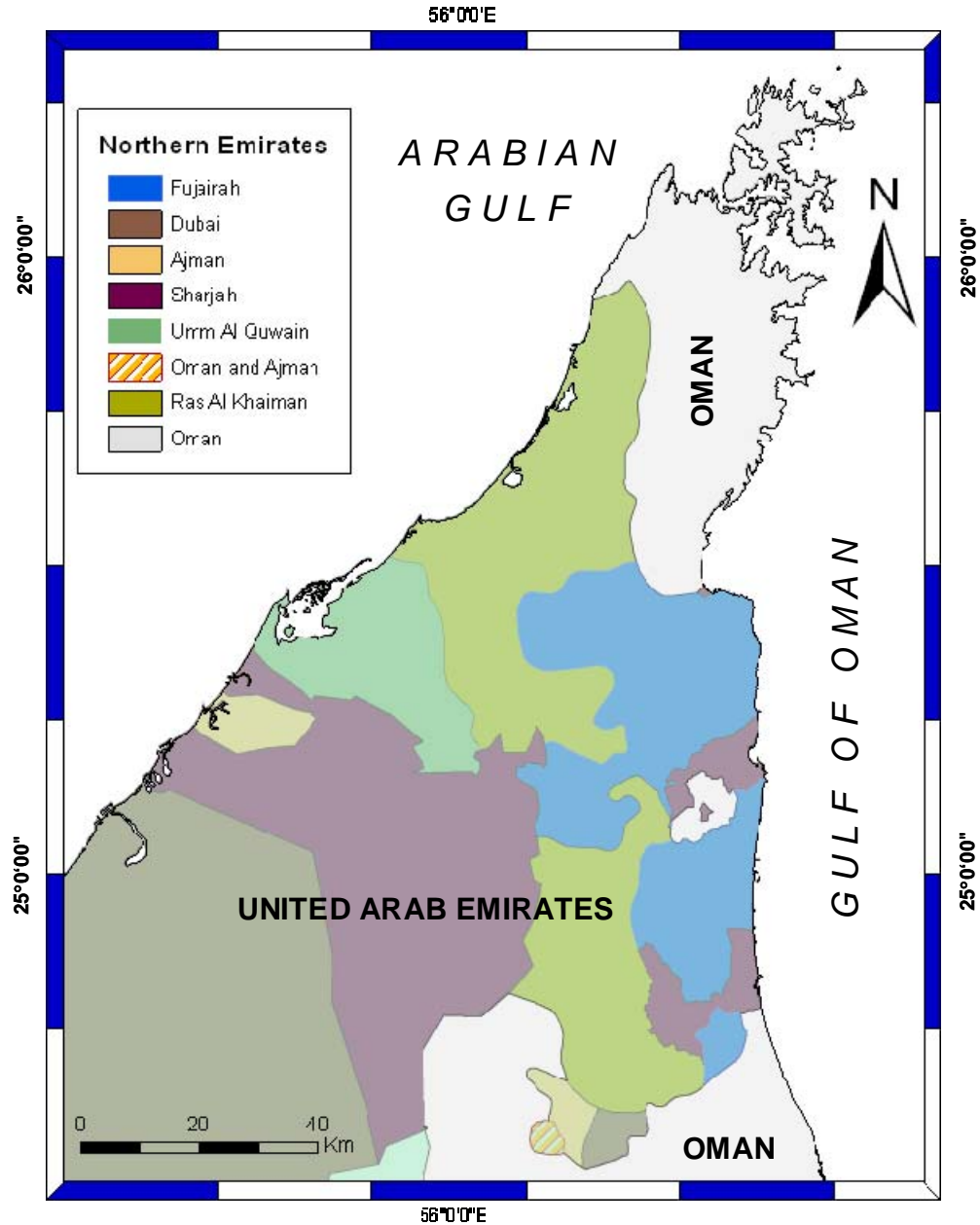


Figure 1.2 Map showing the northern emirates in the UAE and the eastern coastal region (modified from the UAE Atlas, 1993 and the UAE Year Book 2005).

During the last 10 years the Eastern Coast Region has been going through a very rapid change in developing infrastructure, industry and tourism. These activities have affected the environment and may have a long-lasting negative impact if the environmental issues are not considered in future planning. In other words, the Eastern Coast Region has witnessed a continuous economical development on the expense of vulnerable ecosystems, which is requiring a farsighted vision towards biosphere reservation.

The Al Hajar mountain range, where the Wadi Wurayah study area is located, is one of 200 worldwide areas identified by World Wildlife Fund (WWF) for Nature as the most critical regions for conservation. The name Wadi Wurayah comes from the Arabic term “al waraa”, which means water reeds. Historically, names were given to some of the wadi by the Bedouin who used this area as winter grazing grounds for goats. The Wadi is located in the north of Fujairah Emirate between the city of Khor Fakkan and Bidiyah village on the Gulf of Oman coast (Figure 1.3).

Fujairah is the fifth largest emirate in the UAE, which is the exclusively located in Eastern Region. The Fujairah Emirate covers 1150 km², or about 1.5% of the total area of the UAE, and its population is around 130,000 inhabitants. As a home to one of the world's most important oil regions, tankers constitute the majority of the bunker buyers in this market. Fujairah is the only UAE Emirate that is almost totally mountainous. All the other Emirates, like Dubai and Abu Dhabi are located on the west coast, and are largely covered by desert. Fujairah also has a higher than average yearly rainfall, allowing farmers in the region to produce a meaningful crop production every year.

The economy of Fujairah is based on subsidies and Federal Government grants, distributed by the Government of Abu Dhabi. Local industry consists of cement, stone crushing and mining. These industries have witnessed resurgence due to the frenzied construction activity taking place in Dubai and UAE as a whole. Notably, there is a flourishing free trade zone.

The City of Khor Fakkan is geographically situated within the Emirate of Fujairah on the East Coast of the UAE on the Gulf of Oman, but it is actually an isolated enclave

belonging to the Emirate of Sharjah. It is the site of a shallow draught port and oil refining facilities. Khor Fakkan has a long history of human settlement. Excavations by a team from the Sharjah Archaeological Museum have identified 34 graves and a settlement belonging to the early-mid second millennium BC (refer to the website <http://www.sharjah tourism.ae/>). These are clustered on rock outcrops overlooking the harbor. One site of interest is the Rifaisa Dam, in the mountains of Khor Fakkan. It is believed that the dam was built over a village, and when the water is leveled the Dam's reservoir is low, the tops of the old houses become visible. Khor Fakkan is a popular tourist destination, surrounded with high mountains and attractive beaches. Its most famous hotel is the Oceanic. It also features coral outcrops suitable for diving and snorkeling. The fish, fruit and Vegetable Souq (market) is located at the southern end of the corniche.

The middle point for Wadi Wurayah catchment area is located 10 km southwest of the village of Bidiyah. The total catchment area of Wadi Wurayah basin is 129 km² and the maximum elevation is 956 m above mean sea level, which makes the Wadi benefits from orographic rainfall occurring in both winter and summer months and sustains perennial surface water flows in the form of contact springs, pools, flash floods and waterfalls (Tourenq et al., 2006).

In the present, there are no longer any settlements in the area, except in the eastern part of the Bidiyah village and farms. The Wurayah catchment comprises two main wadi branches; Wadi ash Shamah sub-catchment and Al Wurayah catchment proper (Figure 1.5), both of which have large pools and waterfalls. The average lengths of the two catchments are 11.2 km and 10.7 km, respectively. Wadi Wurayah catchment lies on the eastern slopes of the Shimayliyyah (northern) Mountains, which form its headwaters and consist mainly of basic and metamorphic rocks. The high and steep hills delimiting the Wurayah catchment is composed mainly of basic and metamorphic rocks while wadi channels are filled with ancient and re-worked gravels as well as recent boulder and cobble beds.

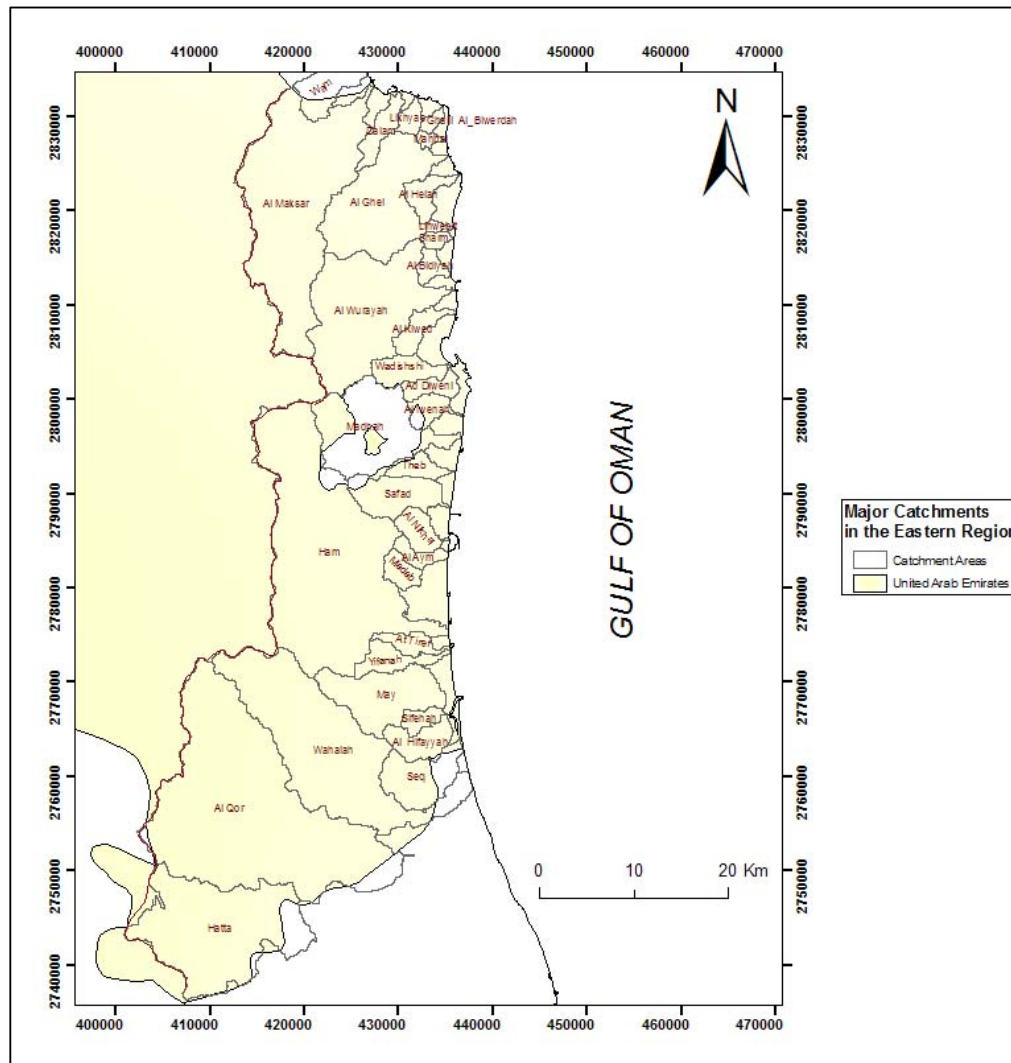


Figure 1.3 Map showing the major drainage catchments in the Eastern Region of the United Arab Emirates traced from topography maps (modified from Rizk and Garamoon, 2006)

1.2 Scope and Objectives of Present Study

Despite the fact that the Eastern Coast Region of the UAE has the largest number of officially declared natural reserves in the country, there are a very limited number of studies addressing environmental issues. Some information about the hydrogeology and water resources of the region is found in Murad & Krishnamurthy (2004), Rizk &

Garamoon (2006) and Ghoneim (2008), while a discussion on the declared four terrestrial and four marine reserves is included in Bani Malik (2002). The terrestrial reserves are: Al Hefya, Ahfourah, Zikt and Al-Ghoub; and the marine reserves are: Dadinah, Al-Iqqa, Al-Bidiya and Al Fageet (Figure 1.4).

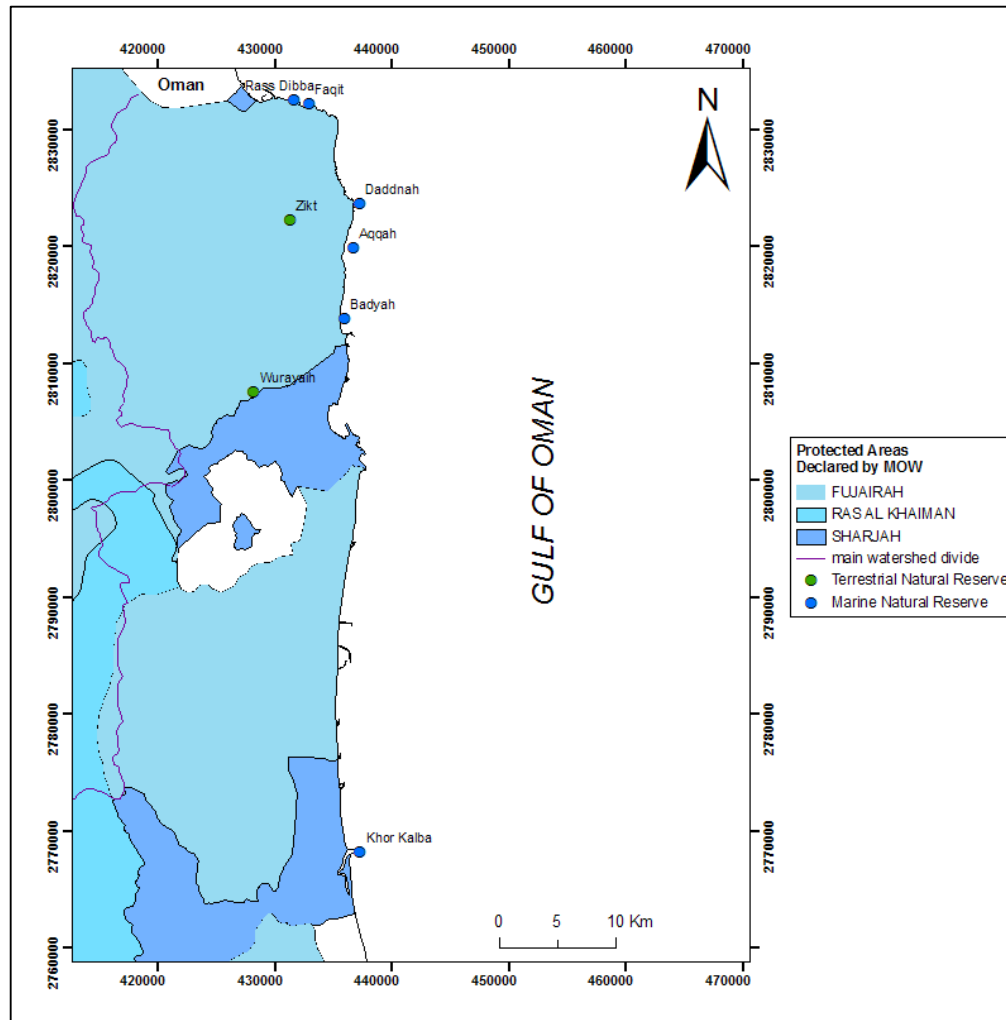


Figure 1.4 Map showing the protected areas in the Eastern Region of the United Arab Emirates (Make different symbols of colors for terrestrial and marine reserves) (ALHOGARATY).

In May 2006, the Emirates Wildlife Society (EWS) and the WWF declared another protected area in Wadi Wurayah, which is between the northern part of Fujairah and Khor Fakkan (Figure 1.5).

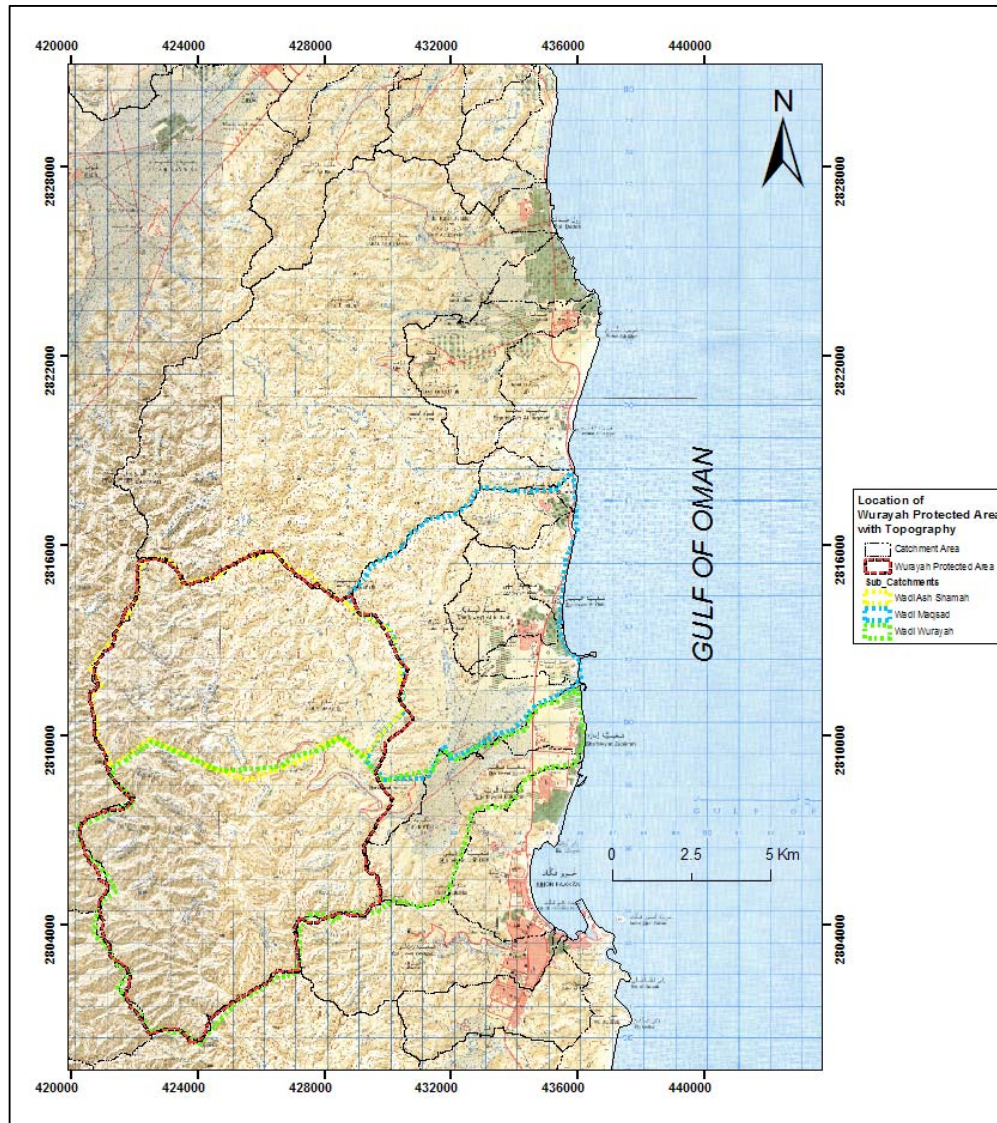


Figure 1.5 Map showing Wadi Wurayah protected area between Fujairah and Khor Fakkan, northeastern coastal region of the UAE (modified from the topographic map of UAE).

The UAE has no biosphere reserves; therefore, the main objectives of the present study are:

- Establish baseline information database for the study area, including geology, geomorphology, climate, water resources and wildlife.
- Explore the potential of including the existing natural reserve (Wurayah Protected Area) into a core major biosphere reserve and explore vulnerability to land degradation in the study area through rehabilitation of degraded lands.
- Assess the ecosystem components within the study area (habitats, biodiversity, pressure and degraded zones), evaluate the existing water resources, water-related problems and integrated water resources management.
- Discuss environmental impacts, management plans, monitoring issues, in view of current and future development initiatives to find alternatives for enhancing people-nature relations, tourism and traditional practices.
- Issue recommendations for necessary action of a biosphere declaration through the legal framework.

1.3 Methodology

To evaluate the effectiveness of existing practices, a key contribution will be the development of an assessment methodology that can be applied to all parts of the study area with a degree of uniformity. An outline of the assessment methodology comprises information gathering and evaluation for the following three elements:

1.3.1 Assessment of Natural Resources; A detailed description of the current state of existing ecosystem services in terms of its natural resources; water, soil, biodiversity, at the local level and their relationships at spatial and temporal scales. A certain level of integration between conservation of natural resources, community development and scientific research is attainable.

1.3.2 Identification of Environmental Stresses and Their Sources; An overall characterization of the typical environmental stresses including scarcity of natural

water resources, land degradation, overgrazing, irrational cultivation and reliance on agriculture, social stresses and social services deficiency, and urbanization dynamics and its effect on local inhabitant's traditions and culture. A number of socio-economic factors like existing livelihood options will be also assessed in the study area and its hinterlands. Characterization of the consumption patterns among the local communities and interdependence of livelihood generating activities will be also assessed, and various stakeholders that are competing for access to resources will be identified.

1.3.3 Description of Indigenous and Adaptive Approaches; The adaptation of the local communities to the conditions in the study area and its hinterlands and whether such adaptations are sustainable in the long-term will be reviewed. Various management approaches and technologies - indigenous and adaptive will be considered, including water resource management practices, grazing patterns, soil degradation identification and land suitable for agriculture. An Environmental Information System (EIS) based on the Geographic Information System (GIS) is suggested for implementation to represent the required master database of the study area.

The proposed environmental information system for the proposed Wurayah Biosphere Reserve (WBR) will be structured to achieve the following goals:

- Building a database for the area under study.
- Delineate major habitats and their spatial distribution and attributes.
- Plan vegetation development and their spatial distribution.
- Understand the dynamics of human activities and the land use to highlight the threats to the environment.
- Plan locations for rainwater harvesting reservoirs and identify areas which can be impacted by flash floods and areas of good groundwater quality.

The EIS is structured to manage all forms of information, spatial (base maps and satellite imagery), and aspatial (texts, tables, graphs and statistics) from existing

literature, previous projects, field observation and data analysis and its interpretation. This will facilitate the data archiving, analysis and query as well as combination of the scientific, administrative and social data obtained for the local inhabitants in one common repository. Implementing this geodatabase will enable comparative evaluation of study sites.

1.4 Expected Outcomes

Based on what has been mentioned before the expected outcomes of this research work could be summarized as follows:

- Establish baseline information database for the climate, geomorphology and geology, water resources and pollution.
- Provide an example for inventory of water resources in the Eastern Coast Region of the UAE and propose restoration, rehabilitation and development of degraded zones.
- Educate people about the basic environmental issues, improve environmental practices, promote tourism and encourage positive traditional practices.
- Provide a framework of an integrated resources management in the Eastern Region of the UAE and lay the foundation for establishment of the first biosphere reserve in the UAE.