

BRIEFING NOTES ON THE CIRCE URBAN AND COASTAL CASE STUDIES: ALEXANDRIA (URBAN) AND THE WEST NILE DELTA (COASTAL), EGYPT

The city of Alexandria is located to the West of the Nile Delta and shares many of the common issues of the wider coastal region. The justification, research issues and data for both case studies are therefore considered within a single briefing note. Subsequent reports of the impacts of climate change will differentiate between coastal and urban areas of the West Nile Delta.

Summary

- ▶ *The West Nile Delta (Egypt) is an important resource for agriculture, tourism and industry, but suffers from severe environmental pollution and a lack of environmental monitoring and regulation.*
- ▶ *The low-lying coastal areas to the south east of Alexandria city, and in particular the northern part of Behaira governorate, are some of the most vulnerable areas to sea-level rise in Egypt. The aspects of the urban environment that suffers the utmost risks are: residential areas, fresh water resources, energy*

production, settlement and industry, and human health.

- ▶ *The key research issues will include an integrated assessment of the direct and indirect impacts of sea-level rise and salt-water intrusion, an exploration of possible adaptation options, and an evaluation of the socio-economic problems impeding sustainable development in the region.*

1. Physical and socio-economic characteristics

Geography:

The Western Nile Delta

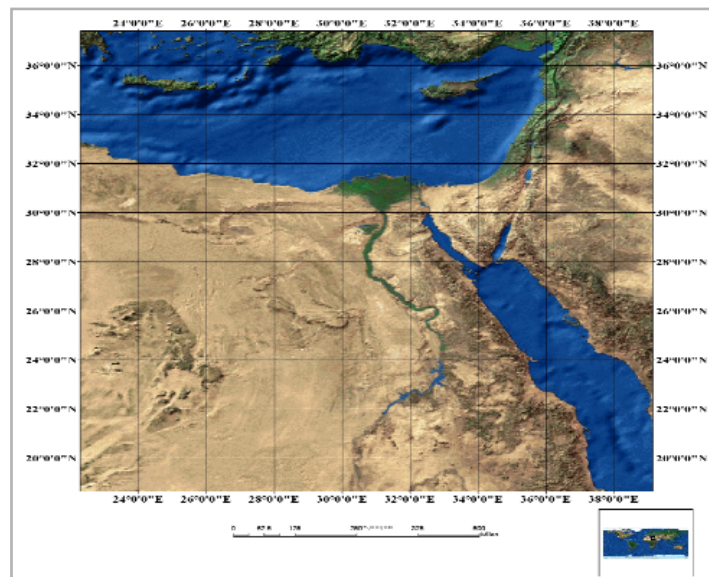
region of the Mediterranean coast of Egypt (Figure 1) includes Alexandria City Abu Qir Bay, and the Rosetta branch of the River Nile, Lake Edku and adjacent regions bounded in the south by the Cairo-Alamien road (Figure 2). A number of historic cities and expansive areas of fertile agricultural land are included and are undergoing vast unplanned development. Extensive industrial, agricultural and domestic pollution in the area is an important factor contributing to the deterioration of environmental conditions. The region is an important underutilized resource for agricul-

ture, tourism and industrial production in Egypt. However, planning deficiencies for monitoring, assessing and controlling pollution, and a general lack of awareness of environmental issues among stakeholders, have rendered this region a highly degraded and deteriorating environment. Inland ancient monuments comprise a collection of nine fort ruins and the restored and famous monument of Qait-Bay Castle, and “Sidi Abdel Razek” shrine. Archeological sites submerged under the western part of Abu Qir bay afford an attrac-

tive salvage operation for marine archeologists and would also stimulate the tourist industry. They include ruins of the ancient cities of Canopus and Herakleion, dated from Greek to Byzantine times which were discovered at depths of 6-7 m in the western part of Abu Qir bay; Bonaparte’s Fleet (the British naval units commanded by Admiral Nelson sank most of Napoleon’s flotilla at Abu Qir Bay) which was discovered on 1st August 1798 and is visible underwater in calm seas. This is a coastal region located between 29° 40’

and 30° 35’ East and 30° 35’ and 31° 30’ North, and extends 50-80 km inland. Several ecological systems can be identified. The coastal ecosystem includes agricultural land, palm trees, sand dune deposits distributed throughout the middle of the area, wide sandy beaches, the Rosetta branch of the Nile, the River Nile basin, Lake Edku, and the urban environment (with a hierarchy of urban clusters varying in size from villages, farms and towns to large urban conglomerations). Even though the region hosts many

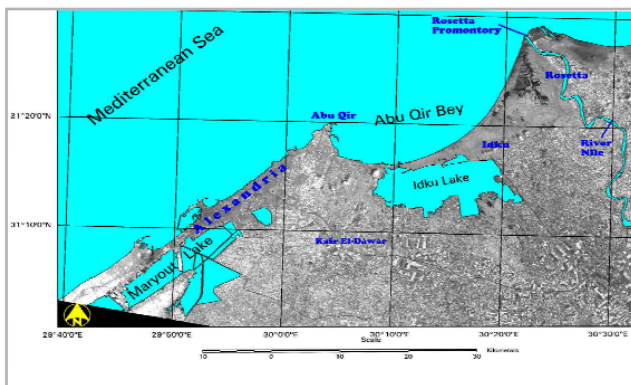
*Figure 1:
Map showing
the case-study
location for the
Nile Delta region
and Alexandria*



natural and economic resources such as scenic landscapes, temperate weather, historic monuments, ecotourism sites, extensive beaches and high ecological and species biodiversity, it has suffered from significant environmental problems. These problems include insufficient institutional capacity, pollution, salt-water intrusion and lack of environmental awareness, which makes sustainable development of the region practically impossible under the prevailing conditions. The main objective of this project is to develop policies and management practices which could facilitate sustainable development of the region under the present conditions of

inadequate high quality water. The case-study area, like most places along the northwestern coast of Egypt, is covered mostly by Quaternary and Tertiary sedimentary rocks which typically have a very low elevation relative to the sea level. The coastal plain occupies the northern part of the area and runs parallel to the coastline. In places, three distinct subunits may be recognized: the foreshore plain, the frontal plain, and the sandy zone. The foreshore plain is characterized by the occurrence of elongated ridges, running sub-parallel to the present shoreline and alternating with lagoons, salt marshes, and alluvial deposits in the depres-

sions between them. The frontal plain is located south of the foreshore plain, and is characterized by the presence of scattered eroded limestone outcrops and alternating gypsum formations and clay deposits. The sandy zone is composed of a variety of different sand formations, such as sheets, dunes and hummocks. Sand particles may be quartzite and / or calcareous in nature. The largest city in the study area is Alexandria, with a population of over 4.1 million. There are four other major cities in the study area; Kafr El-Dawar, Rashid, Edku and Al Maadia. These cities have a combined population of almost 992 thousand (Census, 1996).



*Figure 2:
Detailed Map
of the study area
in and around
Alexandria*

Population growth rates for the study area are not available but the national growth rate increased from 2.75% in 1968, to 2.8% in 1996. Kafr El-Dawwar the largest city of the Beheira governorate is located to the south of the study area, and is resident to about 232 thousand inhabitants. It encompasses important industries, such as textile and dyeing, chemicals, canning and food processing. Rashid City (Rosetta City) is located on the western side of the Rosetta branch of the Nile in the east of the study area. It has a population of around 85 thousand inhabitants. The town is urban in character with many historic Islamic buildings and sites. Edku City houses around 88 thousand inhabitants. Al Maadia Town has a population of about 8.8 thousand inhabitants, and is important to local fisheries due to its new harbour. Areas to the east and west of Lake Edku are densely populated and several villages lie in the vicinity of the major cities. There are no settlements to the northeast of Edku town

because there are no cultivated land or irrigation facilities.

Climate:

The prevalence of northwesterly winds over the Mediterranean Sea for most of the year enhances the constant eastward movement of water. The estimated surface current velocity ranges from 9.26 to 13.5 cm/s during the summer, declines to 4.46 cm/s during the autumn, sharply increases to 23.14 cm/s in winter due to strong winds, and declines again during calm spring weather to 8.4 cm/s. The prevailing northwesterly winds and the availability of long fetches leads to waves coming from the west, northwest and north for 55-60% of the time and from the northeast for 8% of the time. Dominant wave periods are 5-8 seconds; extremes reach 10 seconds or more. The diurnal pattern of cloud cover in winter has a maximum in the early morning because of the presence of low-sheet stratus that normally dissipates after sunrise. There is a second maximum of cloud cover

in the afternoon due to the development of cumulus clouds. In summer, maximum cloud cover occurs in the afternoon, while in the evening the sky is virtually clear. There is no difference in sunshine duration from place-to-place along the coast, or from year-to-year. Cloudiness is greater nearer the coast than inland. Solar radiation is strong from March till the end of September, with a peak in June-July while November, December and January are relatively cloudy. The variation in monthly mean air temperature ranges from a minimum of 14.1°C in January to a maximum of 31.5°C in August. Monthly mean relative humidity has lower values in spring, due to heat waves which are prominent in this season. Rainfall ranges from 180-250 mm/year, with most of the precipitation occurring in January (about 120 mm). The maximum daily rainfall in the area is 10-12 mm. Since the building of the Aswan High Dam in 1964, there has been an imbalance between two of the major forces affecting the

shore, erosion and accretion. Consequently there has been a rapid reduction in the amount of sediment accreted (from 120 million tons per year to only trace amounts). This has caused significant and rapid changes along the shoreline of the North West Nile Delta. Rapid shoreline changes can create catastrophic physical, biological and socio-economic problems. Historical shoreline retreat within the study area has been reported using satellite remote sensing data and field measurements, (e.g., El-Raey et al., 1995). There has been no officially endorsed national policy or national coastal zone management strategy for Egypt, however, consid-

erable efforts by stakeholders have led to an agreement along the general principles of coastal zone management (CZM). A national CZM committee, involving governmental stakeholders, has been established to endorse the definition of the coastal zone. Although it has not convened for some time, the committee has contributed to processes, policies, guidelines and regulatory mechanisms that facilitate the management of coastal resources.

Economy:

There are two main economic activities in the region, agriculture and fishing. These economic sectors not only form the

economic base of the area but have also shaped the social life of the people. The socio-economic activities interact and integrate to form the individual characteristics of the study area. To determine the tourism potential of the region, areas have been surveyed that may attract domestic and international tourism (i.e., the archaeological sites mentioned in the geography section).

2. Justification

The most vulnerable areas of Egypt (Figure 3) are the low-lying coastal areas of Alexandria, Behaira governorates on the West Nile delta, and

Figure 3: Vulnerable coastal areas of the Nile delta region, note in particular those areas below sea level



the area south of Port Said – Damietta governorates. These areas are highly vulnerable to the impacts of sea-level rise, which would affect water, agricultural and energy resources, as well as human settlements.

Further to the high vulnerability linked to direct inundation, the region is also highly vulnerable to the indirect impacts of erosion caused through the tidal action of the Mediterranean Sea which produces high erosion in some regions and accretion in others. Excessive erosion rates of more than 50m/year have been recorded. Figure 4 represents a time series of erosion pattern as revealed by satellite images of the Rosetta promontory.

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3. Key Research Issues

Climate issues:

- ▶ Integrated assessment of the impacts of sea-level rise and possible salt-water intrusion in low-lying areas.
- ▶ Identification and assessment of the available options for adaptation and the likely responses of the local community to these measures.

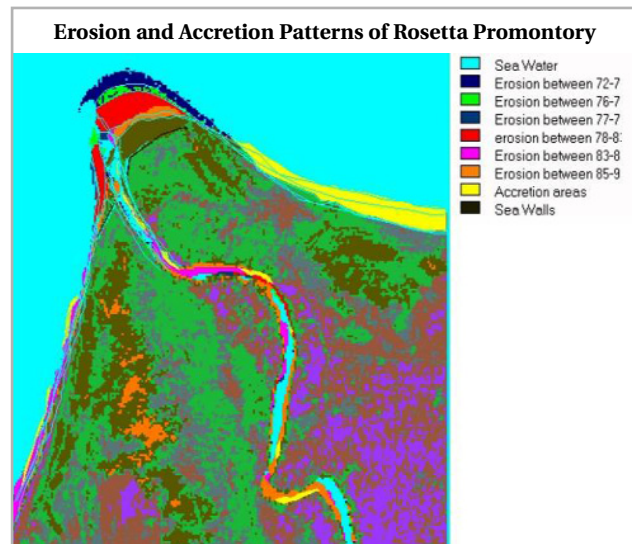
Environmental issues:

- ▶ Identification of coastal areas subject to erosion and accretion using remote sensing technology, including an assessment of the potential change in this pattern for different scenarios.

Social issues:

- ▶ Evaluation of the socio-economic problems impeding the sustainable development of the region.
- ▶ Highlighting the potential socio-economic impacts of climate change

*Figure 4:
A time series
of overlapping satellite
images indicating
successive erosion
of Rosetta promontory
and changes in the
Rosetta branch
of the River Nile over the
period, 1972-1990*



in general and sea level rise in particular across the study area.

4. Regional stakeholders, policy makers, institutions

- ▶ Ministry of Water Resources
- ▶ Ministry of State for Environmental Affairs (MSEA)
- ▶ Ministry of Housing and Urban Development
- ▶ Ministry of Health
- ▶ Ministry of Tourism
- ▶ Egyptian Environmental Affairs Agency (EEAA)
- ▶ Farmers

- ▶ Fishermen
- ▶ Industrial workers
- ▶ Investors
- ▶ Decision makers (Governorates of Alexandria and Behaira)

5. Data availability

Data available for the region include low-resolution satellite imagery, maps and results from a variety of theses and publications for particular sites. It will also be possible to collect data on marine water quality for specific times, monthly time series of sea level near Alexandria, and time series of health data from appropriate authorities. Other data

sets that need to be compiled include: meteorological data (temperature, precipitation, wind); river discharge; sea level; ocean waves and currents; water temperature; salinity and nutrient concentration; and socio-economic data. High resolution satellite imagery needs to be purchased to identify potential impacts of climate change for different time periods.

Field surveys:

The first field survey has been undertaken to gain local knowledge about the study area (Figure 5). Questionnaires will be prepared for the socio-economic impact assessment of sea-level rise and its direct effects on different related activities.



*Figure 5:
Dr. Hattab taking a shot for Prof. Raey and Dr. El-Askary while talking with local fishermen*

Acknowledgements

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Further reading

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