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PRELIMINARY REPORT ON THE GRID MEDITERRANEAN STUDIES

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F I R S T D R A F T

N O T T O B E C I T E D

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Introduction

Scientists agree that temperatures on earth will increase over the next few decades (World Climate Programme 1986; UNEP Workshop on Climatic Change, Nairobi, Jan 21-22 1988). One impact of this climatic change would be a world wide sea-level rise. In the Mediterranean, this rise is expected to be between 50cm and 2m in the next hundred years according to different models.

For the Mediterranean case study, GRID in conjunction with UNEP's Oceans and Coastal Areas Programme (OCA-PAC) and the Mediterranean Task Team on Climatic Change has selected five particularly vulnerable areas: The Ebro delta in Spain; the Rhone delta, including Marseille in Southern France; Venice with the Po delta in Italy; the Nile delta in Egypt and lagoons in Tunisia, the Garet El Ichkeul and the Lac de Bizerte. Digital terrain models as a base will be combined with socio-economic, agricultural, land cover and other data to evaluate the impacts of climatic change. Maps and statistics of different scenarios will be developed for presentation to decision makers and to serve as a basis for contingency planning.

The Nile Delta

Introduction

The Nile Delta is one of the oldest intensively cultivated areas on earth. It is very heavily populated, with population densities up to 1600 inhabitants per square kilometer. The low lying, fertile floodplains (Fig. 1, heavy shade) are surrounded by deserts (Fig. 1, light shade). Only 2.5 % of Egypt's land area, the Nile delta and the Nile valley, is suitable for intensive agriculture (Diercke 1981). The most important cash crop grown in the delta is cotton, which has been in constant cultivation there since 2000 BC.
Most of a 50 km wide land strip along the coast is less than 2 m above sea level and is protected from flooding by only a 1 to 10 km wide coastal sand belt shaped by discharge of the Rosetta and Damietta branches of the Nile (Sestini 1987). Some valuable agricultural land on the delta has only recently been reclaimed. Erosion of the protective sand belt is a serious problem and has accelerated since the construction of the Aswan Dam. From 1915 to 1964 erosion at Rosetta was in the order of 30m per year; today's recession at Rosetta has increased to between 80m and 150m per year (Sestini 1987).

Rising sea level would destroy weak parts of the sand belt, which is essential for the protection of lagoons and of the low-lying reclaimed lands.

The impacts would be very serious:

- ◊ One third of Egypt's fish catches are made in the lagoons. Sea-level rise would change the water quality and probably kill most fresh water fish.
- ◊ Valuable agricultural lands, which have been reclaimed would be inundated.
- ◊ Alexandria and Port Said are ideal locations for Industry and commercial activities, such as thermal power plants, oil refineries, textile and chemical industries. Vital, low lying installations would be threatened.
- ◊ Recreational tourism along the beach has been growing rapidly during recent years. Beach facilities would be endangered.
- ◊ Essential groundwater would be salinated.

The GRID case study

The study area is an approximately 180 km long and 50 km wide strip between Alexandria and the Damietta mouth of the Nile (Fig. 1, Box). The largest part of this area lies below 2m and is therefore particularly vulnerable to sea level rise.

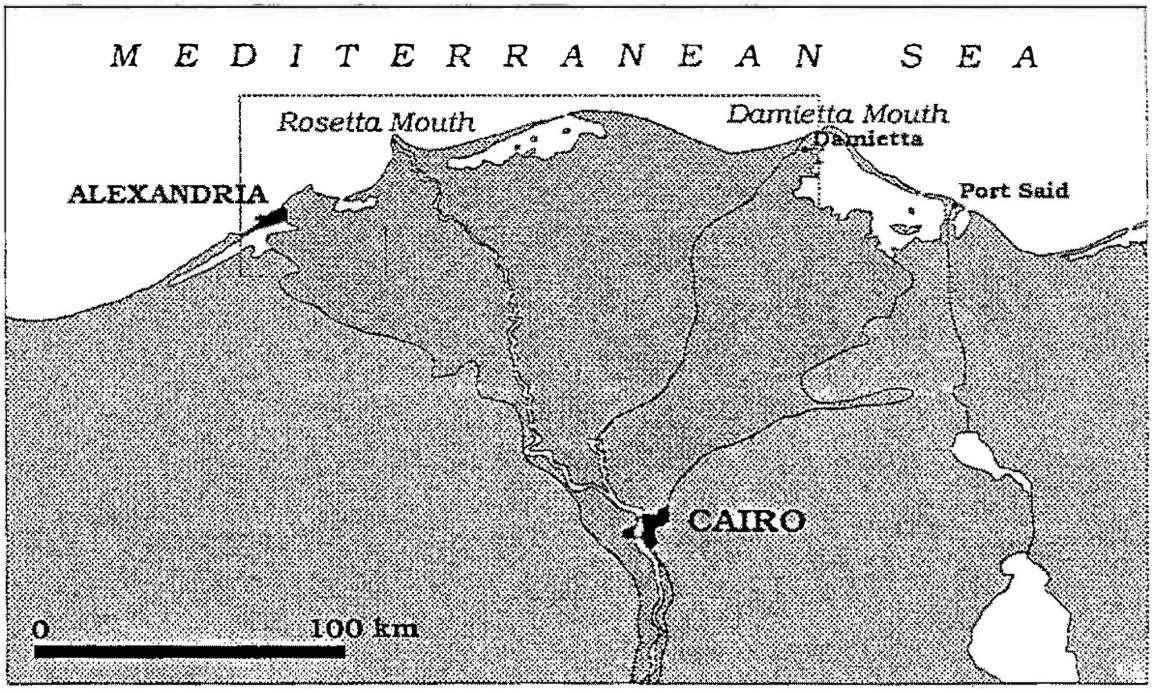


Fig. 1: Nile Delta - Overview. (Heavy shade: land under intensive agriculture. Light shade: desert. GRID case study area: Box)

Methods

Contour maps available for the area, with 1 meter intervals, were well suitable for the analysis. However, because of the flatness of the terrain, the input maps needed a large amount of manual enhancement. Spot heights had to be interpolated to enable the creation of an accurate terrain model. This step turned out to be very time consuming but could not have been avoided.

The enhanced contour maps were digitized with ARC/INFO, a vector based Geographic Information System (GIS).This raw database contains approximately 55,000 points with spot heights. TIN (Triangular Irregular Network), a module of ARC/INFO, then was used to interpolate a Digital Terrain Model (DTM). The DTM then was contoured; contours at 0.5 m intervals were automatically interpolated. Some editing of the contours with ARCEDIT was necessary in order to get good cartographic products. (Details of the methodology may be obtained from the author on request.)

Results

Fig. 2 displays the different stages of sea-level rise; the former coastline is drawn as a dotted line. Areas are calculated automatically in a GIS, loss of land statistics are shown in Table 1.

Sea-Level Rise	Total Dry Land	Cumulative Loss
Datum	540,000 ha	0
+ 0.5 m	382,000 ha	158,000 ha
+ 1.5 m	201,000 ha	339,000 ha
+ 1.5 m	112,000 ha	428,000 ha
+ 2.0 m	56,000 ha	484,000 ha

Table 1: Estimated Land Losses

Next Steps

Future activities will include the overlaying of more specific data, such as population, land use, tourist facilities and others with the sea-level rise datasets. This would enable the calculation of more detailed statistics and provide more information for planning.

GRID is presenting the results of the Nile delta case study at regular demonstrations. A small demonstration of GRID applications on climatic change in general has been created on HYPERCARD, a widely available program running on Apple Macintosh. This demonstration can be obtained from GRID by sending in a blank Macintosh floppy disk.

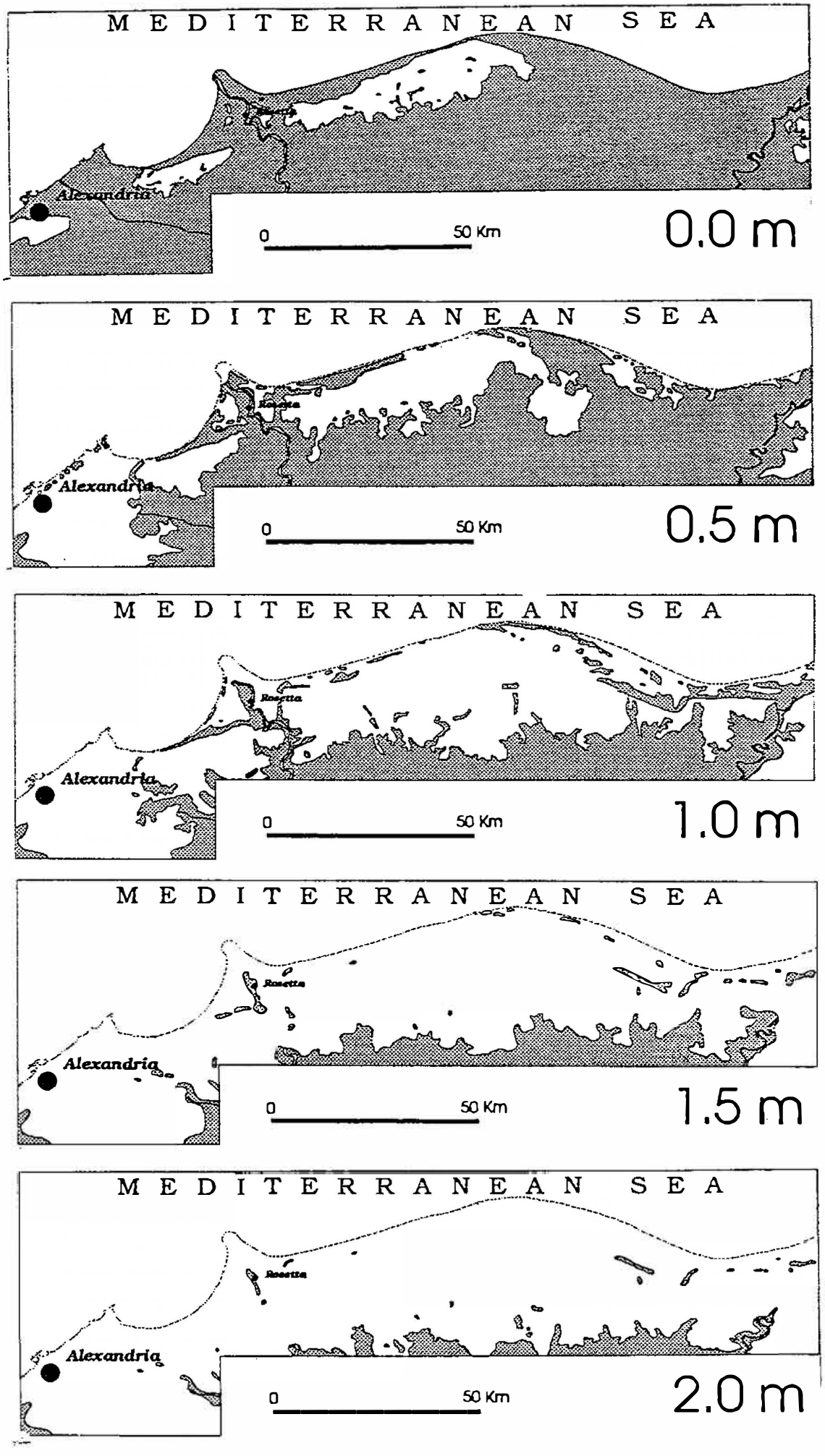


Fig. 2: Nile Delta - Different stages of sea level rise

Garet El Ichkeul and Lac de Bizerte, Tunisia

According to Hollis, sea-level rise is not likely to have a significant impact on either the Lake of Bizerte or Garaet El Ichkeul (Hollis 1988). Much more serious will be temperature increases, which could cause evaporation and salination of the lakes.

Under these circumstances, GRID's contribution to this case study has to concentrate on other aspects than sea-level rise only. GIS technology could be used for water balance and water quality simulations. Data and model evaluations for such analyses are presently being conductet.

Large scale topography maps (1:5,000) of the Lake Ichkeul area have been digitized by GRID. Since the terrain is very flat, the creation of a digital terrain model (DTM) is very difficult, extensive editing work has to be conducted. This work is in progres at the moment.
To cover the whole case study area, additional terrain data of the Lac de Bizerte area has to be obtained. Meaningful analysis can only be conducted with a complete digital terrain model.

Other case study areas

So far, no analysis has been conducted by GRID on the other case studies.

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