Factsheet No 10

WASSERMed

Water Availability and Security in Southern EuRope and the Mediterranean

http://www.wassermed.eu

Climate change impacts and adaptation options in the Rosetta area, Egypt

In brief:

- *Low elevation makes the Rosetta area particularly vulnerable to sea level rise; other climate-related threats concern impacts on agriculture and water balance*
- *Potential impacts of climate change were studied using different models, focusing particularly on changes in crop water requirements and agricultural production, and water deficits*
- *Changes in cropping patterns and agricultural management practices emerge as important priorities to mitigate negative impacts in the agricultural sector*
- *Integrated Water Resources Management, including soft instruments, is important for the mitigation of water-related security threats*

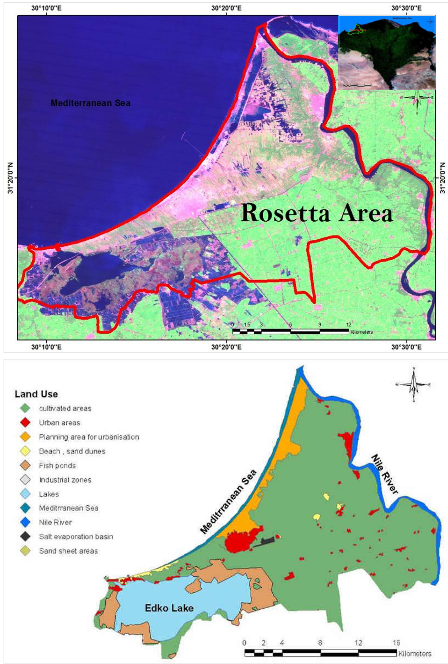
Further Information
Dr. Mahmoud Roushdi
Environment and Climate Changes Research Institute, Egypt. e-mail: mahmoudroushdi@yahoo.com

The Nile Delta and the Rosetta area

The Nile Delta is a triangular area (25,000 km²) in the northern part of Egypt, delineated by the two main branches of the Nile, i.e. the Damietta branch in the east and the Rosetta branch in the west, and by the Mediterranean Sea in the north. This location makes the area very unique, particularly in terms of interactions among sea water, groundwater, and surface freshwater.

The Rosetta area, which was the focus of the WASSERMed Case Study in Egypt, is located near the end of the Rosetta branch, between latitudes of 31°36' and 31°05' and longitudes between 30°33' and 30°43'. The area occupies a 40 km long strip of the Mediterranean coastal zone, with an area about 700 km².

Challenges facing the region include the low elevation, which makes the area and its groundwater resources particularly vulnerable to sea level rise, the water deficit, affecting agricultural activity, and the related socio-economic impacts. In WASSERMed, the main focus of the Rosetta Case Study was to analyse adaptation options in the water and agricultural sectors.



The Rosetta area: Location and land use

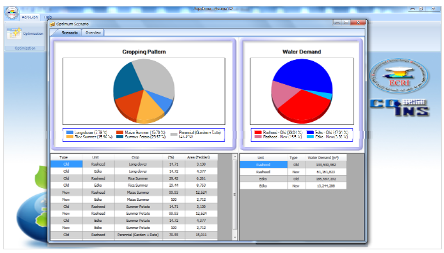
Employed methods

The first step for the development of the Rosetta Case Study was the establishment of a reference database, with all currently available data on climate, water resource management, agriculture and environmental parameters. Then, scenarios were simulated, considering:

- Regional climate projections, as derived through the CLM model;
- Direct impacts of climate change on agriculture (i.e. changes in irrigation water requirements), using results from the SIMETAW model.

The simulation aimed at assessing indicators, quantifying potential threats, costs, and benefits for baseline conditions and future scenarios, through water balance modelling (SDM and WSM DSS tools). In addition, an optimisation model was developed, for identifying the best options to minimise the impacts of climate change in the water and agricultural sectors. This model, developed by ECRI, is distinctive, and includes several parameters and data on climate, crops and yields, fertilisers, costs, manpower, etc. Results were further synthesised into policy recommendations.

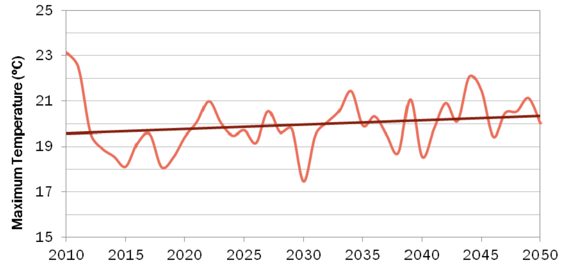
The Case Study built on the active involvement and participation of stakeholders, so as to support the development of outputs suitable to decision-making needs. Several events were held at different levels, involving decision makers and researchers, the local administration, and citizens.



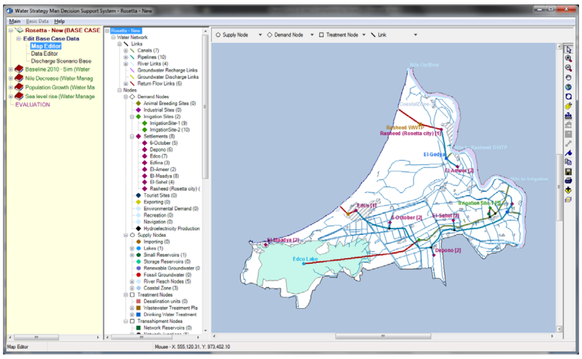
The ECRI optimisation model

Main results

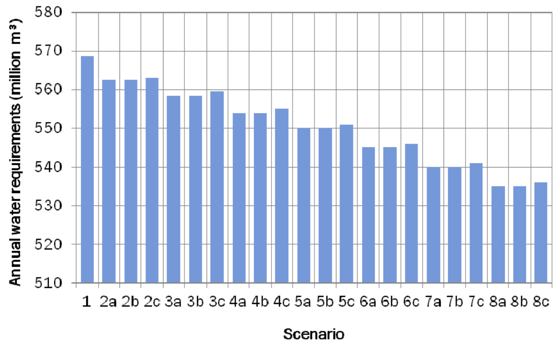
- Climate change could lead to:
  - ✓ An increase in annual average air temperatures, up to +1.4 °C.
  - ✓ Further reduction of the annual rainfall (-12.9 mm/yr), increasing or decreasing at monthly scale.
  - ✓ A slight increase (+68.8 mm/yr) of annual reference evapotranspiration, especially during the spring-summer months (with values up to +9 mm/month in June), and with a “peak” of daily evapotranspiration in July (7 mm/d).
  - ✓ Reduction of wheat yields of about 5.4%, from 5.1 tons/ha (2000) to 4.8 tons/ha (2050), depending on irrigation strategies and planting dates, as a consequence of the expected shortening of the crop growing cycle.
- Results from water balance modelling show that by 2050 there will be a water deficit ranging between 75 and 122 million m³/yr, for a best and a worst case scenario respectively.
- Alternative cropping patterns were identified by the ECRI optimization model; these can compensate for profit losses due to climate change.
- The most important adaptation measures for the agricultural sector include changes in sowing dates and agricultural management practices.
- Shifts to more heat-tolerant crops and changes in cropping patterns are the most promising adaptation measures for the case study.
- Improved and more “professional” practices at the farm level and deficit irrigation can reduce the water deficit in the “old” agricultural lands, and help to overcome negative climate change impacts.
- Both for the Rosetta area, but also at the national level, several measures to enhance water supply can be considered “no-regret” actions. These can include the development of new water supply sources in the upper Nile, rainwater harvesting, desalination, wastewater recycling, and the increased use of deep groundwater reservoirs.
- Soft interventions should also complement the above. Urgent actions include measures to enhance public awareness on the need for rational water use, the enhancement of precipitation monitoring networks in the upstream countries of the Nile Basin, the encouragement of data exchange between the Nile Basin countries, and the development of Circulation Models for predicting the impact of climate change on the local and regional water resources.



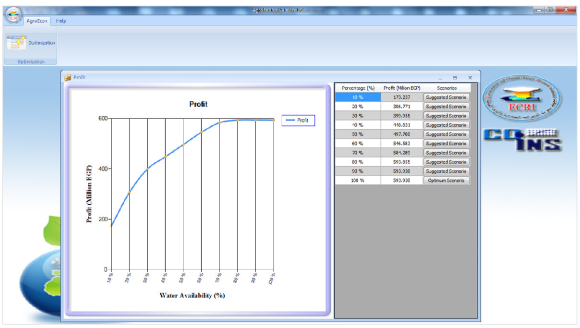
Maximum temperature trend in the coastal part of Rosetta, CLM model results



Water system modelling in Rosetta using the WSM DSS



Results from the simulation of scenarios using System Dynamics Modelling



Analysis of climate change adaptation options using the ECRI optimization model

Recommendations

- The integrated study of sea level rise, water shortage issues and other climate change impacts should be further studied both at local and at national level.
- By combining changes to cropping patterns with more efficient water use, a more water-secure future could be achieved.
- Integrated water resources management and no-regret actions are highly recommended towards water and food security.