



Climate Change and Sustainable Development of Scarce Resources in Egypt

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Abstract

- A general outline of potential impacts of climate change on various sectors in Egypt is discussed with emphasis on scarce water resources, agricultural and coastal zone resources.
- Vulnerability of various sectors for sustainable development is assessed for the city of Alexandria. Future plans of development and regional implications are discussed.
- Within plans of developments, options for adaptations are evaluated and compared based on their environmental impacts.
- Strategic and immediate needs and lessons learned for ensuring sustainable development of scarce resources in the coastal zone, are explored



Vulnerability of important Sectors

■ Water Resources:

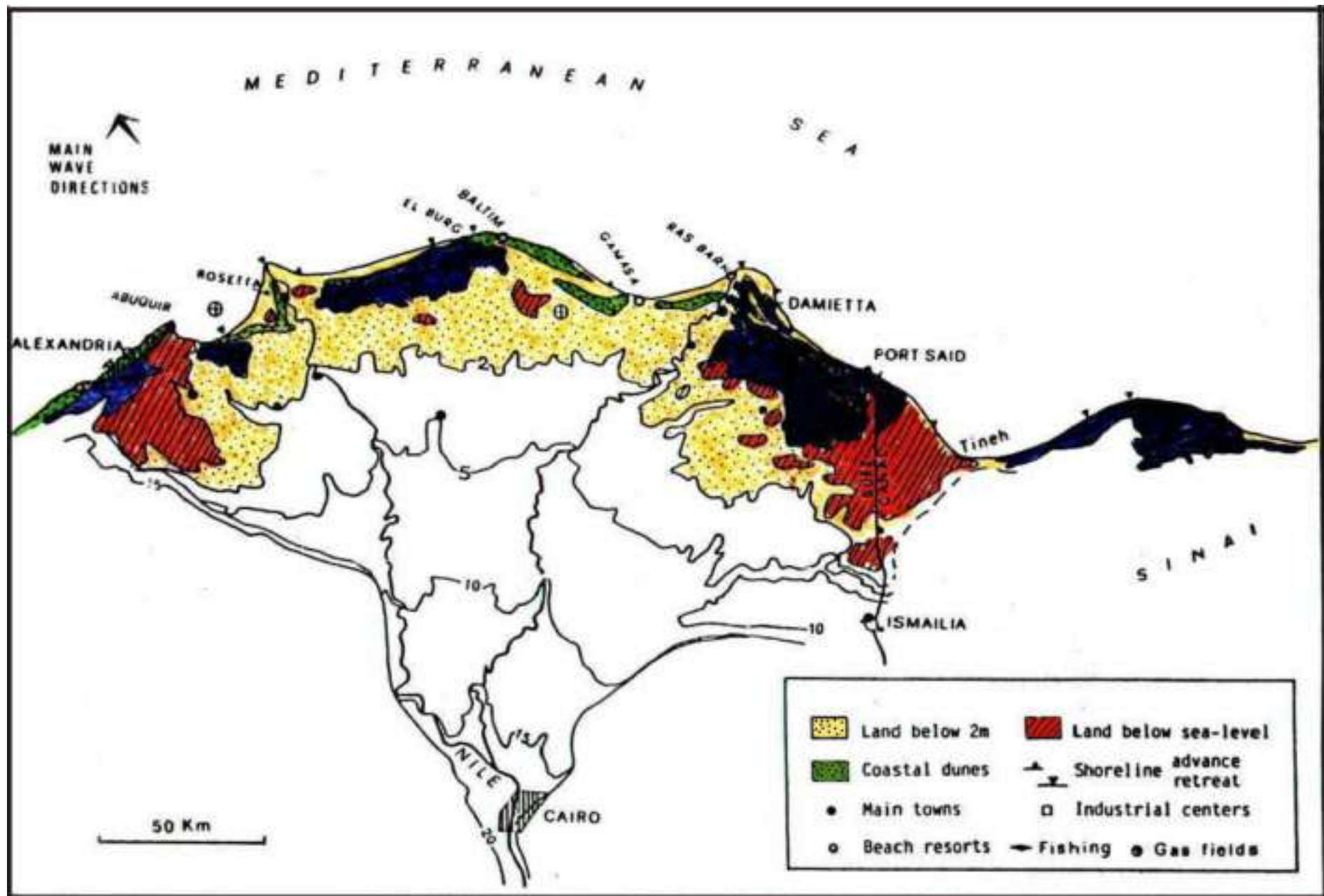
- River Nile is practically the only source, 70% of Egypt water budget is utilized for surface irrigation. The water share/capita has reached below 1000m³/y.
- GCM are still uncertain of future range of Nile budget between a predicted decrease to 25% and a gain to 130% of the original budget.

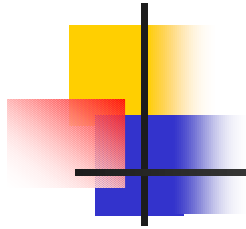
■ Agricultural Resources

- The Nile delta region, the most fertile land of Egypt, is highly vulnerable to the impacts of sea level rise, salt water intrusion and soil salinization.
- Shortage of water resources delays many agricultural developmental plans

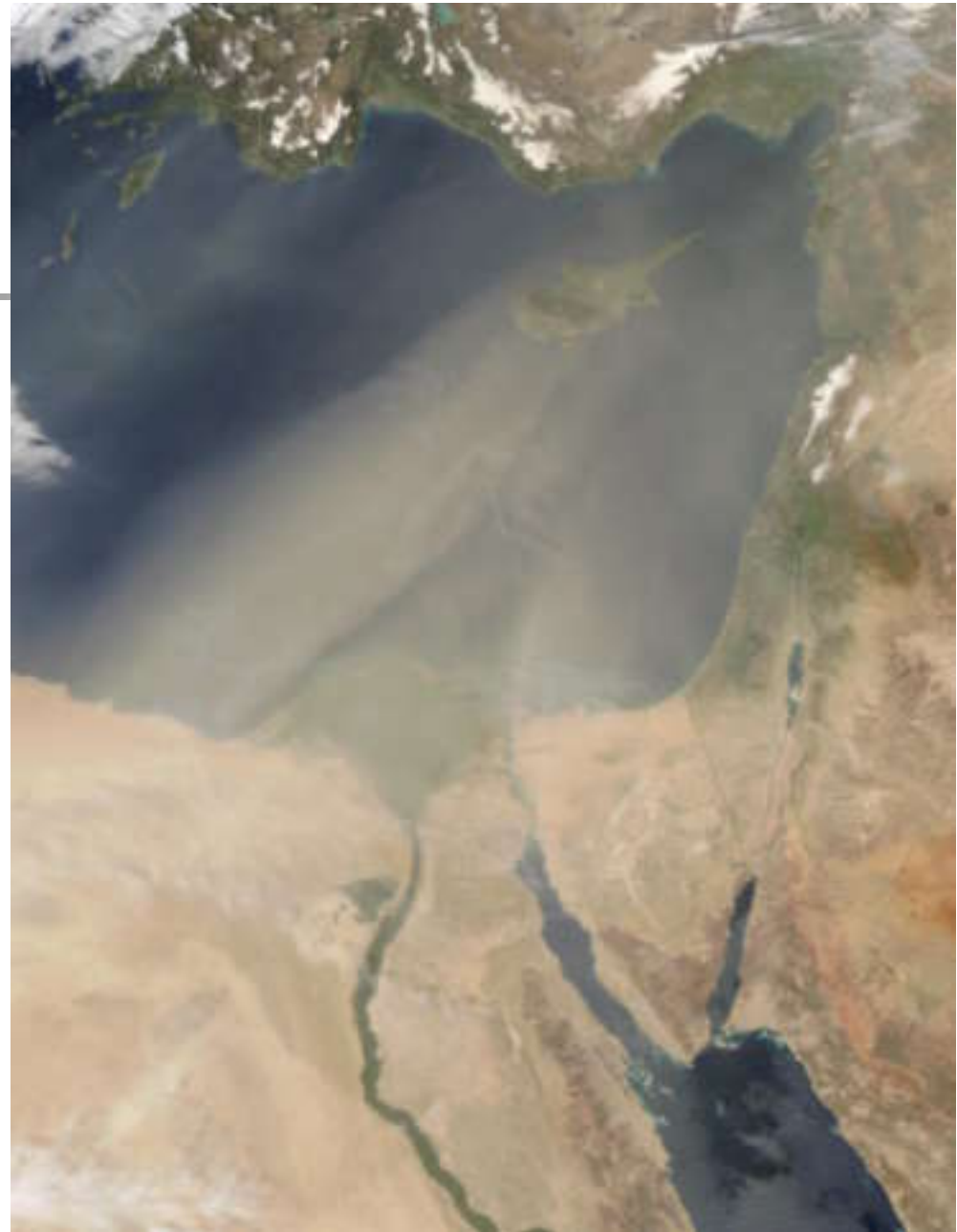
■ Coastal Resources

- Highly vulnerable due to SLR, excessive population densities, erosional problems, marine pollution and shortage of institutional capabilities for monitoring and control.
- Vulnerability assessments of Alexandria City only predicted losses exceeding \$30 Billion and loss of 200,000 jobs over the year 2050, if no action is taken.
- Increased impacts on water and agricultural resources in the coastal zone due to increased frequencies and severity of dust storms, loss of biodiversity and tourism





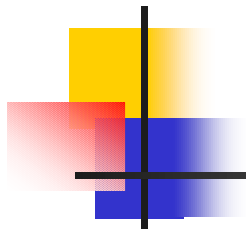
Saharan dust
over Egypt
crossing the
Mediterranean





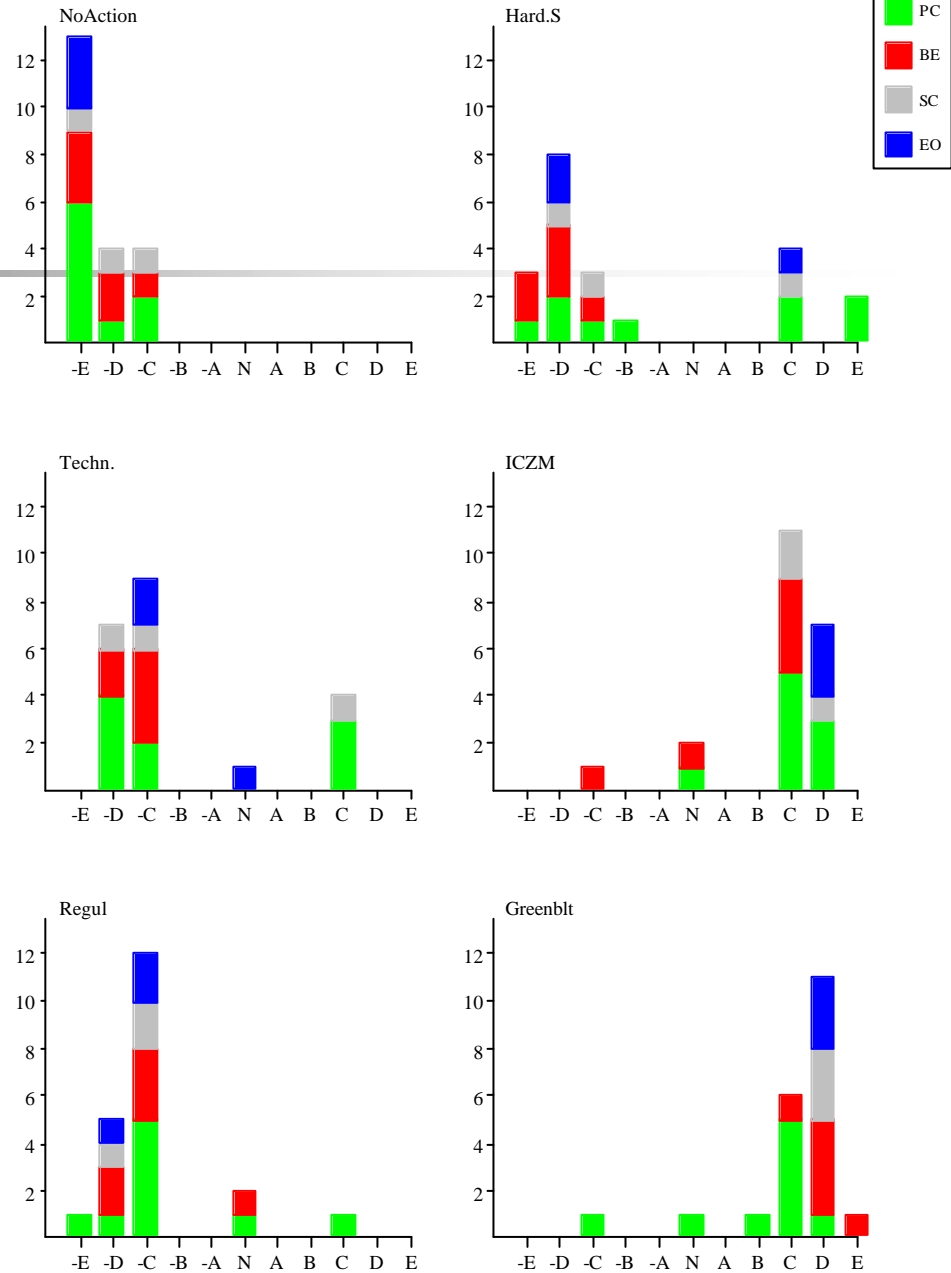
Adaptation Strategy Options

- Adaptation strategy options are dependant on the site, available technology, and.... **Generally, land use change, crop redistribution and drip irrigation programs, are necessary.**
- Options are evaluated for the impact of sea level rise based on **specific criteria: Expenses, net benefit, Environmental impacts, flexibility, chance of success,, feasibility and equity.** Other criteria such as adaptive capacity of the community could also be included.
- **Integrated coastal zone management (ICZM) and establishment of a greenbelt** are considered the best available options on the long term.



Comparison among some options of adaptations based on preset impact criteria

Option summary





Alexandria Plans for the year 2050

- A strategic plan for development of the city is now in progress by the governorate. Extension of sea shore to exceed 180 km along the Mediterranean. Establishing a Greenbelt and/or ICZM implementation, and periodic beach nourishment are needed for adaptation to climate change. A strategic Environmental Assessment is necessary.
- Expected population of Alexandria by then will be 8 million. Development of self sufficient satellite cities. Shifting center of population to the south western (less vulnerable) areas of the governorate, is planned. Water conservation and desalination programs and upgrading of public transportation systems, are required to reduce climate vulnerability.
- Strong law enforcement of integrated coastal zone management, building hard structures in vulnerable areas (e.g. Rosetta) and observing setback distances.



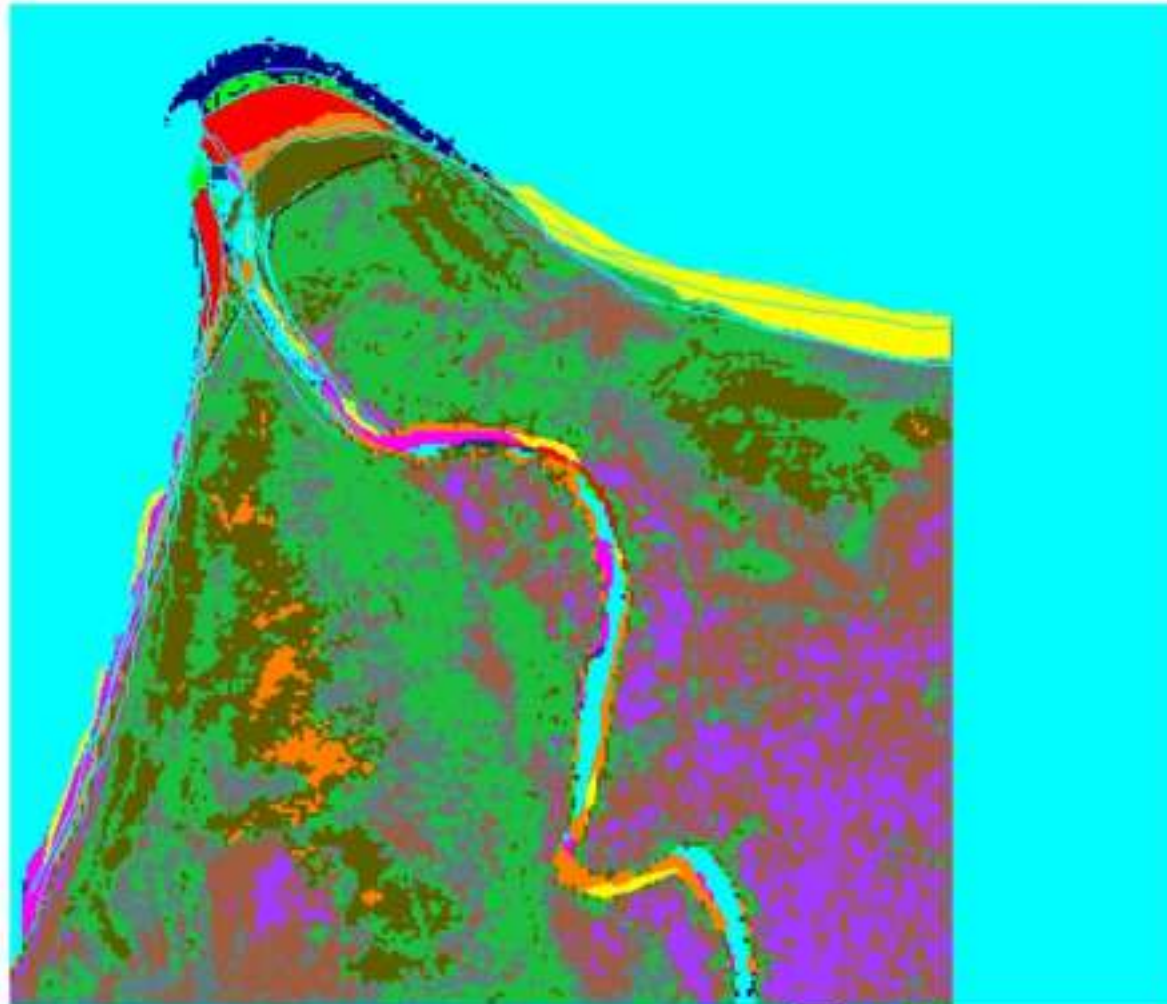
Rosetta ICZM case study

- Rosetta region, east of Alexandria represent an important site for potential development. The region is rich of tourist resources inland and in sea, ecotourism, agricultural and industrial resources.
- It is highly vulnerable to erosion, salt water intrusion, soil salinization and mismanagement due to lack of institutional capabilities and awareness. A sea wall has been implemented.
- Water quality in the region is far below average because of drainage canals, sea water intrusion and industrial pollution.
- Work is in progress under SMART Project (supported by EU) for development as a pilot program of ICZM for similar regions.

Multi-temporal Images of Rosetta Promontory

Sea wall is almost sinking

Erosion and Accretion Patterns of Rosetta Promontory



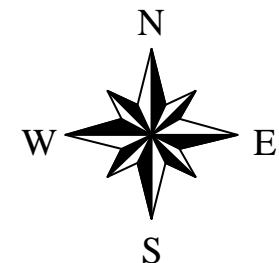
I.G.S.R., Alexandria University

- Sea Water
- Erosion between 72-7
- Erosion between 76-7
- Erosion between 77-7
- erosion between 78-8
- Erosion between 83-8
- Erosion between 85-9
- Accretion areas
- Sea Walls

Water Supply and Drains



- Water level stations
- Roads
- Monitoring
- Lakes
- Drains
- Canals





Soil removal (sand dune quarrying)





Conclusion

1. Egypt scarce natural resources are highly vulnerable to climate change and anticipatory adaptation measures are necessary. Experience has already been gained on some aspects.
2. Some general adaptation measures have already been incorporated in Alexandria plans for the year 2050. These include: land use changes, drip irrigation, wastewater treatment and re-use, upgrading awareness and law enforcement.
3. Priorities of specific adaptation measures have been carried out based on preset criteria to identify appropriate options for a specific location. Proper modeling, continuous monitoring and predictability, are necessary.
4. Strategic environmental assessments (SEA), with a component on climate change adaptation, must be adopted and enforced by a law, at least for large scale national projects.
5. Capacity building on Regional Circulation Models (RCM) and adaptation techniques are highly needed
6. Socioeconomic considerations is the controlling agent of land cover/ land use adaptation and should be given due consideration. The role of specialized NGO cannot be overlooked.