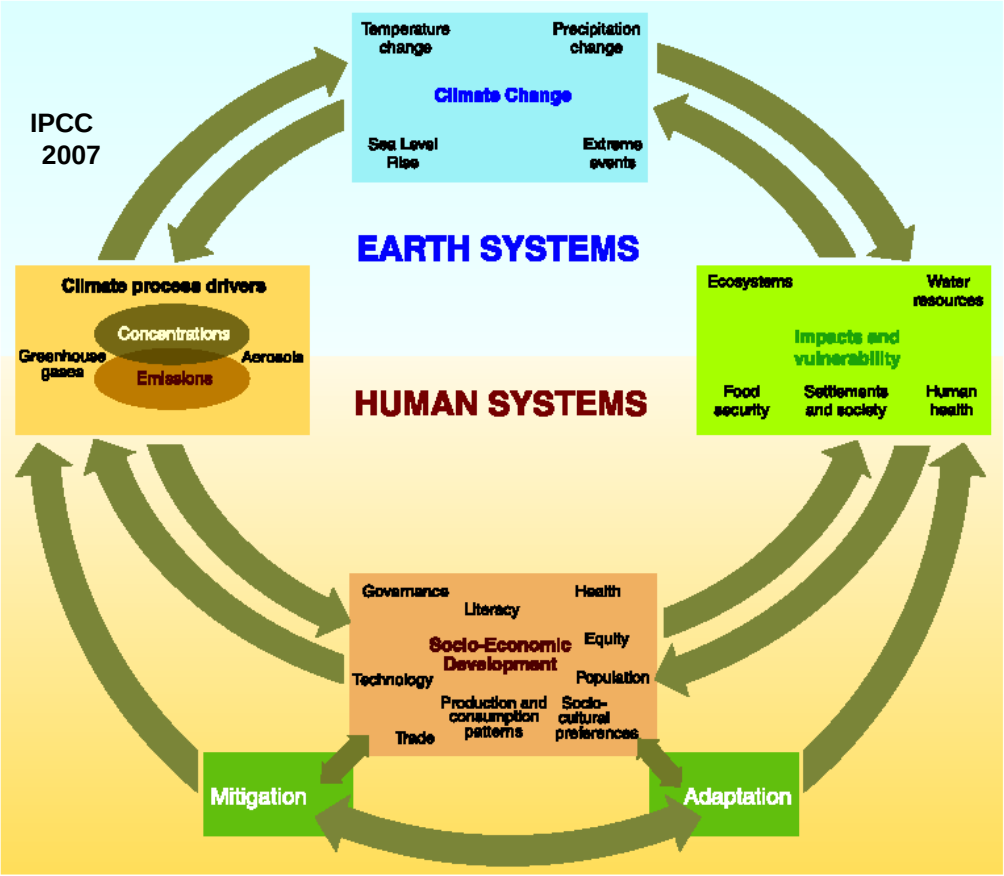
**Regional Workshop on Disaster Risk Reduction and Climate Change "Challenges and Future Actions“, Cairo 21 -23 November 2009**

United Nations
International Strategy for Disaster Reduction
*Regional Office for Arab States*

THE WORLD BANK

Schematic framework of anthropogenic climate change drivers, impacts and responses




# Climate change impacts on the Arab region coastal zones

*By*

*Mahmoud Khamis El-Sayed, Alexandria University*

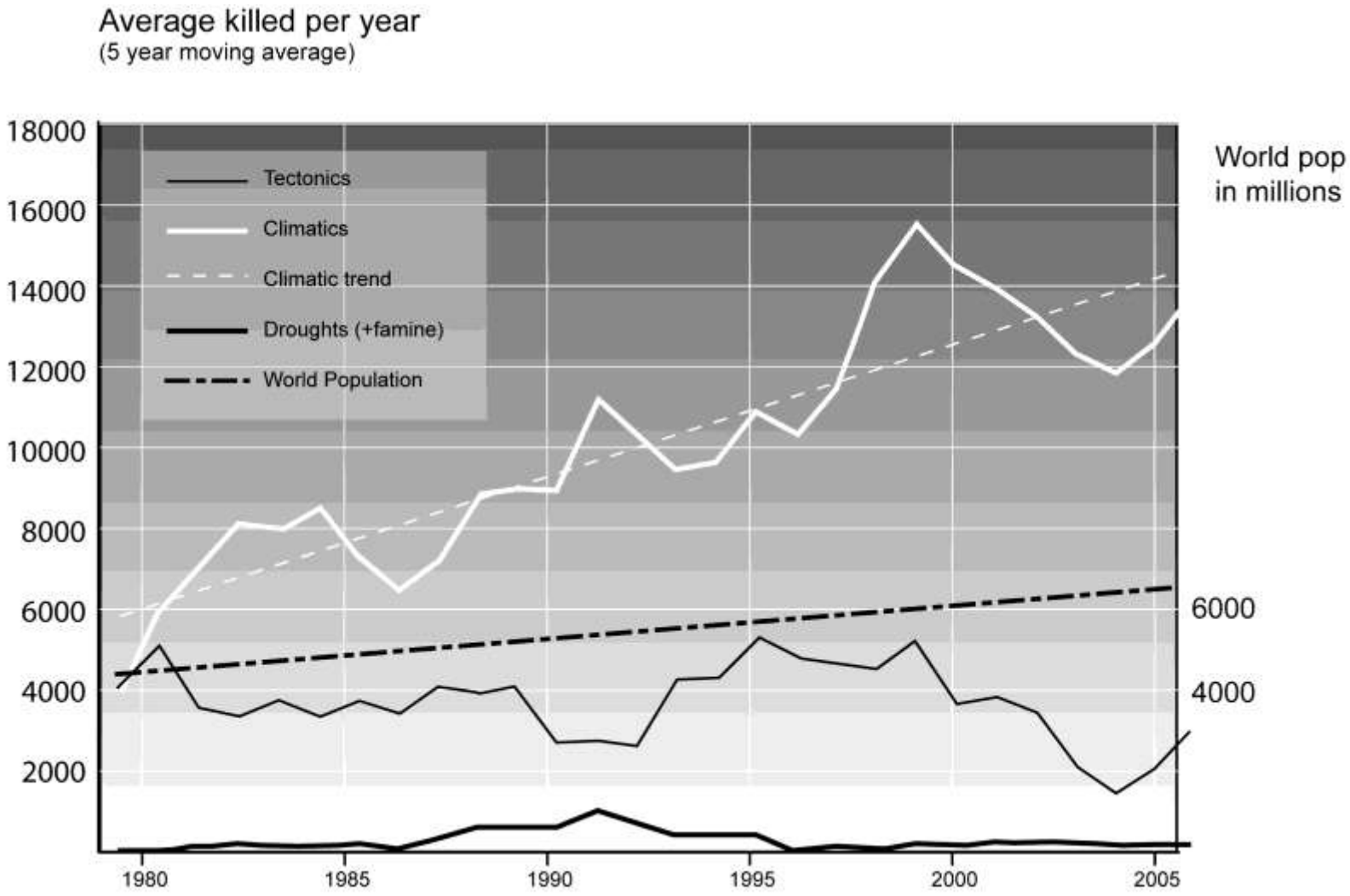
# Global Climate Change

**CC is perhaps the greatest global outcome of environmental inequity, since it is driven by the emissions that have brought benefits to affluent societies yet most of the burdens fall on poorer individuals and societies, with developing countries and their poorest citizens being the most vulnerable (GAR 2009).**

**CC will have many negative effects, including:**

- **greater frequency of heat waves;**
- **increased intensity of storms, floods and droughts;**
- **a more rapid spread of disease; and loss of biodiversity.**
- **Sea level rise (SLR) poses a particular threat to countries with heavy concentrations of population and economic activity in coastal regions.**

# Average killed per hazard per year without "mega events"




**Data source: EM-Dat, graphic: ISDR, 2007**

# Projections of Future Changes in Climate

**For the next two decades a warming of about 0.2°C / decade is projected for a range of emissions scenarios.**

**Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would *very likely* be larger than those observed during the 20th century (IPCC 2007).**

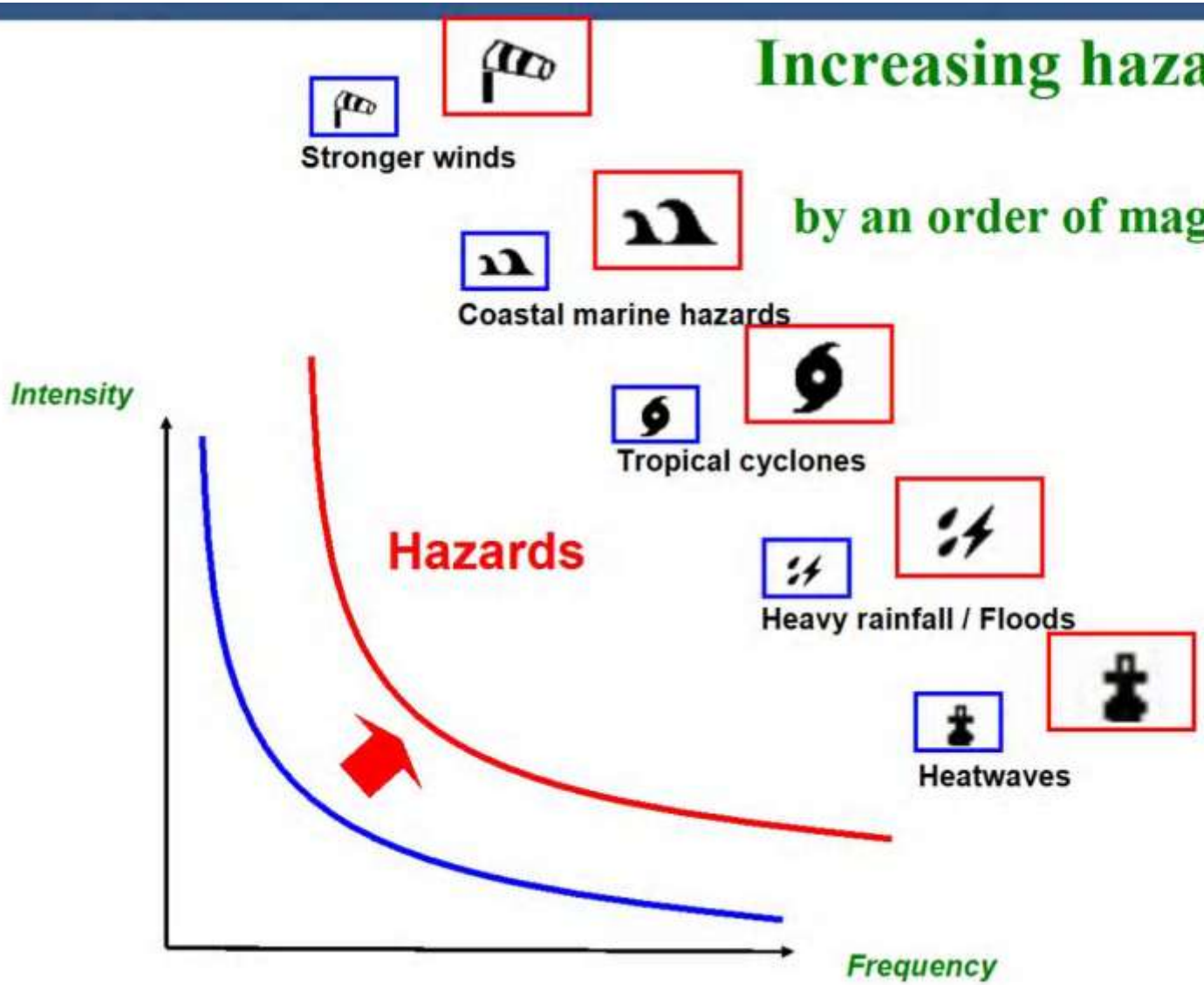
*Table 3.1. Projected global average surface warming and sea level rise at the end of the 21st century. (WGI 10.5, 10.6, Table 10.7, Table SPM.3)*

| Case | Temperature change (°C at 2090-2099 relative to 1980-1999)[a, d] | | Sea level rise (m at 2090-2099 relative to 1980-1999) |
|---|---|---|---|
| | Best estimate | *Likely* range | Model-based range excluding future rapid dynamical changes in ice flow |
| Constant year 2000 concentrations[b] | 0.6 | 0.3 – 0.9 | Not available |
| B1 scenario | 1.8 | 1.1 – 2.9 | 0.18 – 0.38 |
| A1T scenario | 2.4 | 1.4 – 3.8 | 0.20 – 0.45 |
| B2 scenario | 2.4 | 1.4 – 3.8 | 0.20 – 0.43 |
| A1B scenario | 2.8 | 1.7 – 4.4 | 0.21 – 0.48 |
| A2 scenario | 3.4 | 2.0 – 5.4 | 0.23 – 0.51 |
| A1FI scenario | 4.0 | 2.4 – 6.4 | 0.26 – 0.59 |

**IPCC 2007**

# Increasing hazard risk

## by an order of magnitude?




ISDR-WB

# Impacts of Future Climate Changes

**Impacts on systems and sectors (IPCC 2007)**

**Ecosystems Food Water Urbanization socio-economic…**

**Co**asts

**Coasts are projected to be exposed to increasing risks, including coastal erosion, due to CC & SLR. The effect will be exacerbated by increasing human-induced pressures on coastal areas (*very high confidence*).**

**By the 2080s, many millions more people than today are projected to experience floods every year due to SLR. The numbers affected will be largest in the densely populated and low-lying mega deltas of Asia and Africa (*very high confidence*).**

# Impacts on Regions (IPCC 2007)

**Africa**

By 2020, between 75 and 250 million of people are projected to be exposed to increased water stress due to CC.

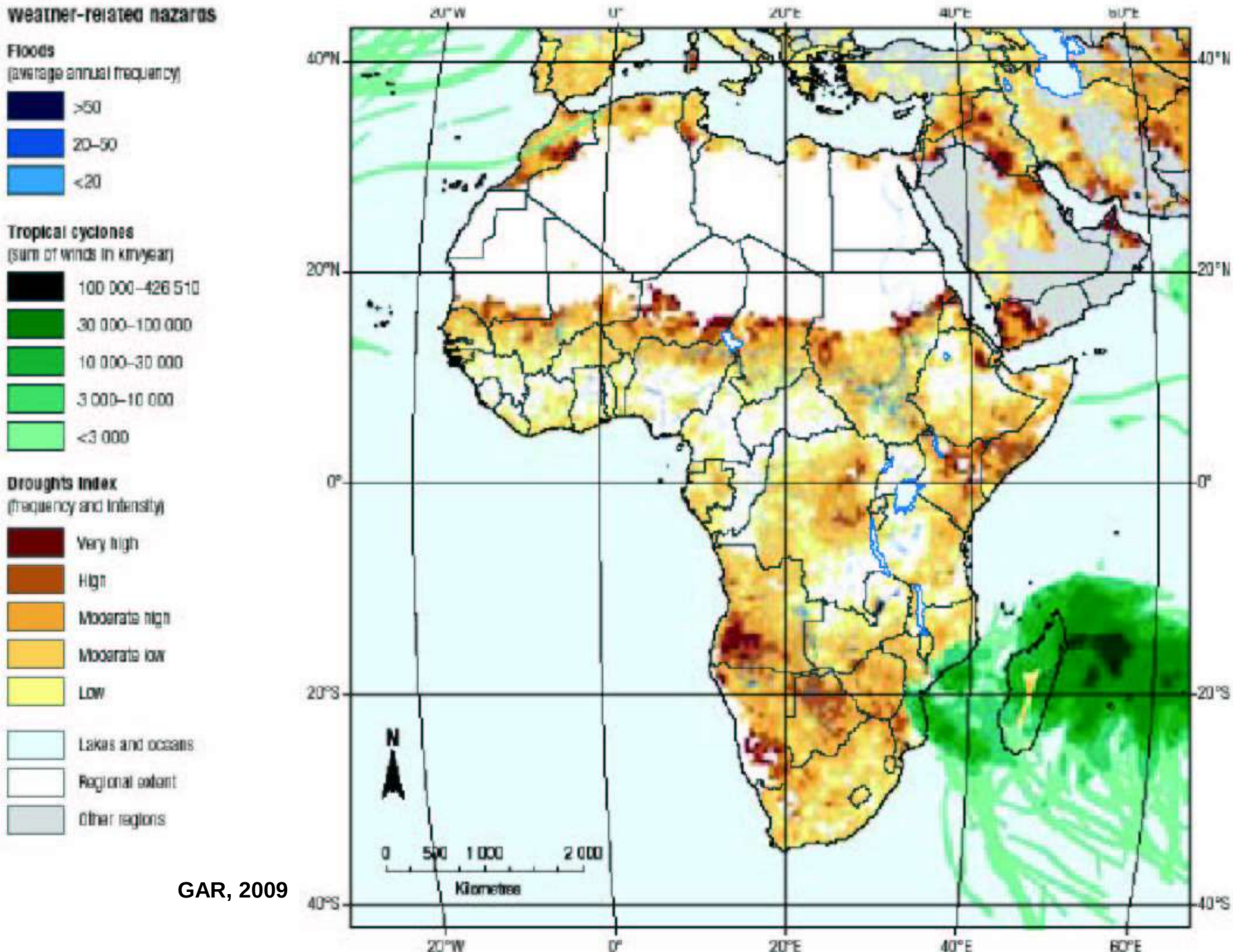
By 2020, in some countries, yields from rain-fed agriculture could be reduced by up to 50%.

By 2080, an increase of 5 to 8% of arid and semi-arid land is projected under a range of climate scenarios

Towards the end of the 21st century, projected SLR will affect low-lying coastal areas with large populations. The cost of adaptation could amount to at least 5 to 10% of GDP

**Asia**

CC is projected to compound the pressures on natural resources and the environment associated with rapid urbanisation, industrialisation and economic development.


Weather-related hazards
Floods
(average annual frequency)
>50
20–50
<20
Tropical cyclones
(sum of winds in km/year)
100 000–426 510
30 000–100 000
10 000–30 000
3 000–10 000
<3 000
Droughts index
(frequency and intensity)
Very high
High
Moderate high
Moderate low
Low
Lakes and oceans
Regional extent
Other regions
20°W
0°
20°E
40°E
60°E
40°N
20°N
0°
20°S
40°S
N
0 500 1 000 2 000
Kilometres

GAR, 2009

# Regional Context

**The area of the 22 members of the League of Arab States covers around 14 million km2 and straddles two continents.**
**About 320 million people live in the Arab states (5% of the total world population)**

**Coastline of the Arab countries (km)**

| | |
|---|---|
| Med+ Atlan | 11 841 |
| RSGA | 13 404 |
| Gulf+Ind | 7 184 |
| | 32 429 km |

AFED 2008

TABLE 1 **BASIC INFORMATION ON THE COASTAL AND MARINE ARAB ENVIRONMENT**

**COASTAL & SHELF EXTENSION & AREA**

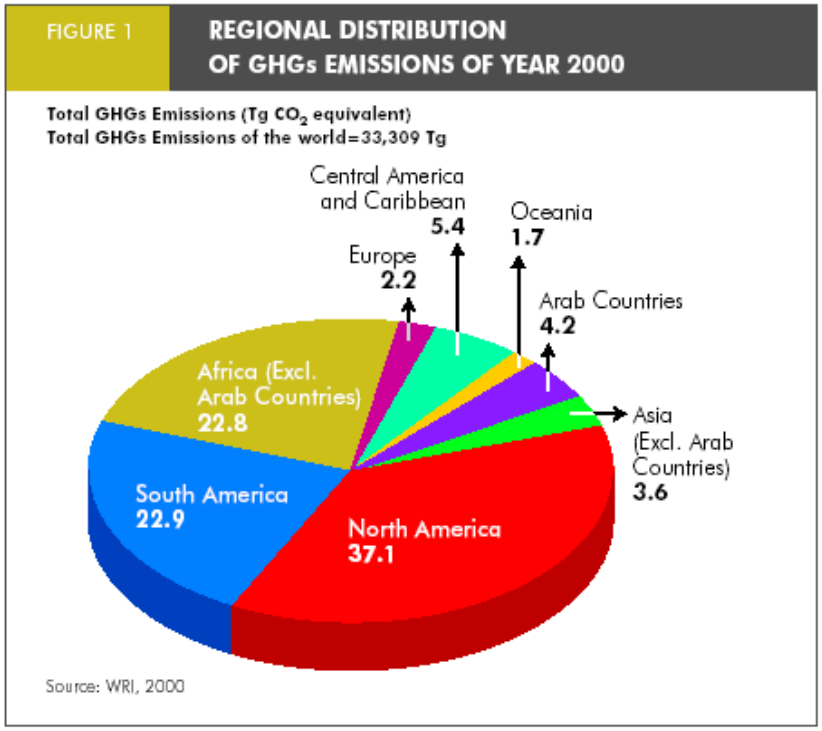
| Region | Arab Countries | Coastline km | Cont. shelf km² | Territorial Sea km² |
|---|---|---|---|---|
| MED Region | **Morocco** | 2,008** | 70,365 | 37,481 |
| | **Algeria** | 1,557** | 9,688 | 27,863 |
| | **Tunisia** | 1,927** | 65,347 | 36,773 |
| | **Lybia** | 2,025** | 63,595 | 38,131 |
| | **Egypt#** | 2,450** | (Med+RS) 50,060 | (Med+RS) 82,048 |
| | **Lebanon** | 294** | 1,169 | 4,702 |
| | **Syria** | 212** | 852 | 3,866 |
| PERSGA Red Sea & Gulf of Aden Region | **Djibouti** | 443*** | 3,406 | 4,853 |
| | **Egypt** | 1,800*** | X | X |
| | **Jordan** | 27*** | 82 | 87 |
| | **Saudi Arabia** | 1,840*** | (RS+RSA) 95,580 | (RS+RSA) 95,580 |
| | **Somalia** | 3,898*** | 40,392 | 68,849 |
| | **Sudan** | 2,245*** | 15,861 | 32,645 |
| | **Yemen** | 3,149*** | 65,341 | 82,359 |
| ROPME Sea Area (GULF Region) | **Bahrain** | 255# | 7,967 | 4,006 |
| | **Iraq** | 105# | 1,034 | 716 |
| | **Kuwait** | 756# | 6,526 | 5,362 |
| | **Oman** | 3,165# | 46,670 | 51,821 |
| | **Qatar** | 909# | 31,156 | 11,373 |
| | **Saudi Arabia** | 790# | (RS+RSA) 95,580 | (RS+RSA) 95,580 |
| | **UAE** | 735# | 51,394 | 30,962 |
| Other Regions | **Mauritania** | 1,268 | 28,370 | 19,455 |
| | **Comoros** | 469 | 1,426 | 12,684 |

Main source: World resource Institution. Earth trends: The Environmental Information Portal (2006)
** EEAA (2006)
*** PERSGA (1998)
# ROPME (2003)
Med: Mediterranean Sea
RS: Red Sea
ROPME Sea Area: RSA

# Arab Region and CC

**Although the Arab region does not contribute > 5% to the causes of global CC, its effects on the region will be very severe.**

**In fact, the region is particularly vulnerable given already scarce water resources, high levels of aridity and the long coastal stretch threatened by SLR**



# Projection of Future CC in the Arab Region

**The Arab region will face an increase of 2 to 5.5°C in the surface temperature by the end of the 21st century. This increase in T will be coupled with a projected decrease in precipitation of between 0 and 20%. The results for the region include shorter winters, dryer and hotter summers, a higher rate of heat waves, increased weather variability, and a more frequent occurrence of extreme weather events (AFED, 2008).**

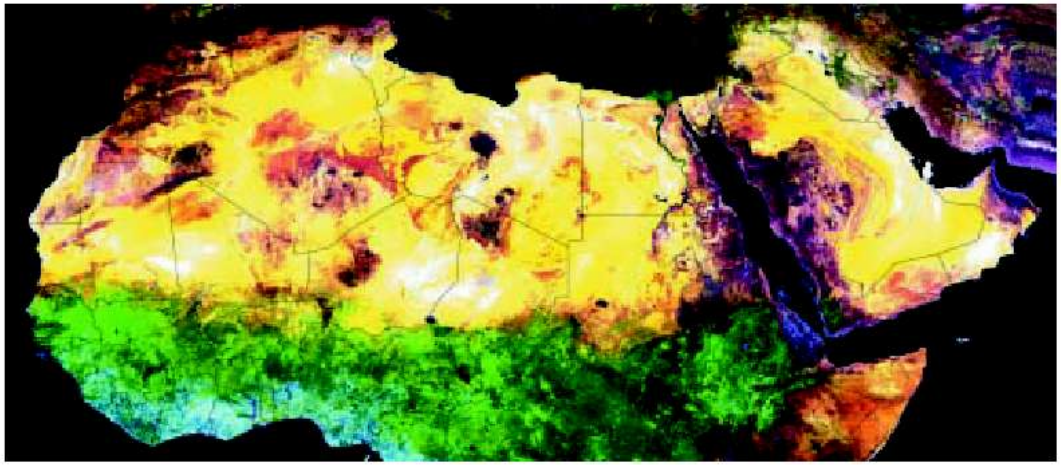
# The Arab Region Disaster Profile: A snap shot

*Source: LAS/ISDR Regional Synthesis Report on The Progress in implementing the HFA in the Arab Region (2009)*

**The Arab Region is affected by natural disasters. Floods may be the most frequent event across the region but the most damaging in human and economic terms are earthquakes.**

**Between 1980 and 2008, droughts, earthquakes, floods and storms had seriously impacted lives and livelihoods in the region ~ > 37 million people and causing economic damage estimated at > 19.8 billion US$ (EM-DAT).**

## *Drought and Aridity*



**Drought and aridity in the Arab Region Source: AFED (2008)**

**Arab region has an area of about 14.1 million km2 of which 89% is arid and semi arid lands (ACSAD, 2009). About 52% of the area receives an average annual rainfall of less than 100mm, while 15% receives 100–300 mm, and 18% receives more than 300 mm.**

**In the last 30 years, more than 32 million people were affected by drought in the Arab region. Higher T will increase the incidence and impact of drought in the region, threatening water resources and productive land. Drought frequency has already increased in Algeria, Morocco, Syria, and Tunisia.**

## *Flood*

**Despite the low rate of rainfall in the Arab region, expanded areas of watersheds lead to the collection and formation of floods. Flood is expected to increase in the light of forecasted CC.**

**In October 2008, Algeria, Morocco and Yemen have experienced unprecedented flooding. Floods in Yemen displaced approximately 25,000 people. Algeria and Morocco were hit by the worst flooding for decades affecting more than 12,000 families.**

# *Storms/Tropical cyclones*

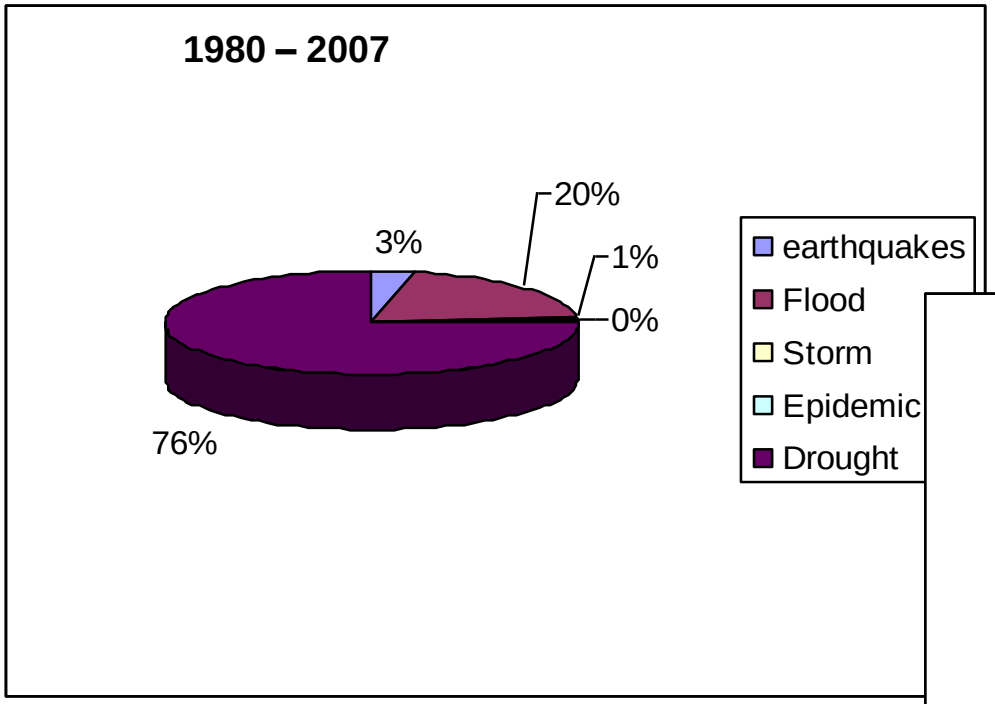
**The strongest cyclone "Gonu" ever recorded (> 190 km/hr) churned up the coast of Oman in 6 June 2007, sending high winds and waves through a region that is used for oil exports and shipping traffic.**

**Thousands of residents were evacuated from Oman's coast and the offshore island of Masirah. Oman, Yemen, and Somalia were also affected by the Indian Ocean Tsunami in December 2004.**

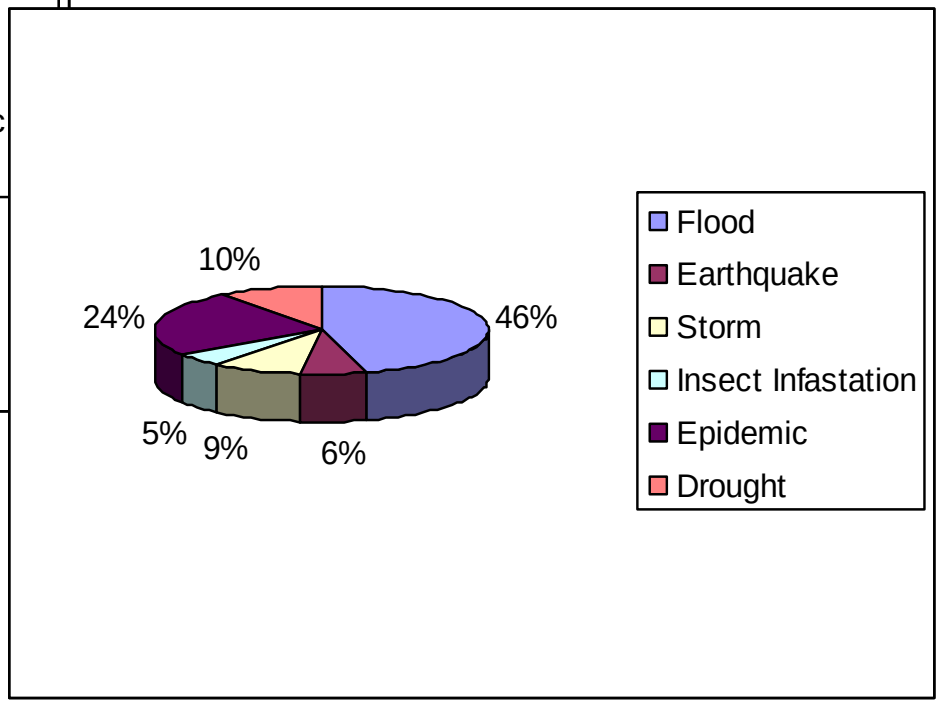
| Countries | affected X1000 Flood | Storm | Drought | killed Flood | Storm | Drought |
|---|---|---|---|---|---|---|
| Algeria | 236 | | | 1176 | | |
| Comoros | | 115 | | | 59 | |
| Djibouti | 472 | | 915 | 245 | | |
| Egypt | 161 | | | 615 | 48 | |
| Iraq | 68 | | | 20 | | |
| Jordan | 18 | 0.2 | 330 | 19 | 16 | |
| Kuwait | 0.2 | | | 2 | | |
| Lebanon | 18 | 105 | | | 25 | |
| Lybia | | | | | | |
| Mauritania | 140 | | 3000 | 53 | 4 | |
| Morocco | 125 | | 275 | 1010 | | |
| Oman | | 20 | | | 140 | |
| Palestine | | | | | | |
| Saudi Arabia | 19 | | | 130 | | |
| Somalia | 2140 | | 5200 | 2300 | | 600 |
| Sudan | 4500 | | 23200 | | | 150000 |
| Syria | 329 | 0.35 | | 6 | 32 | |
| Tunisia | 218 | | | 205 | | |
| Yemen | 321 | | | 600 | | |
| **Total** | 8765.2 | 240.55 | 32920 | 6381 | 324 | 150600 |

**Summary statistics of the affected and killed peoples in the Arab Region (1980 – 2007)**

*Source: http://www.preventionweb.net , http://www.em-dat.net/disasters/list.php*

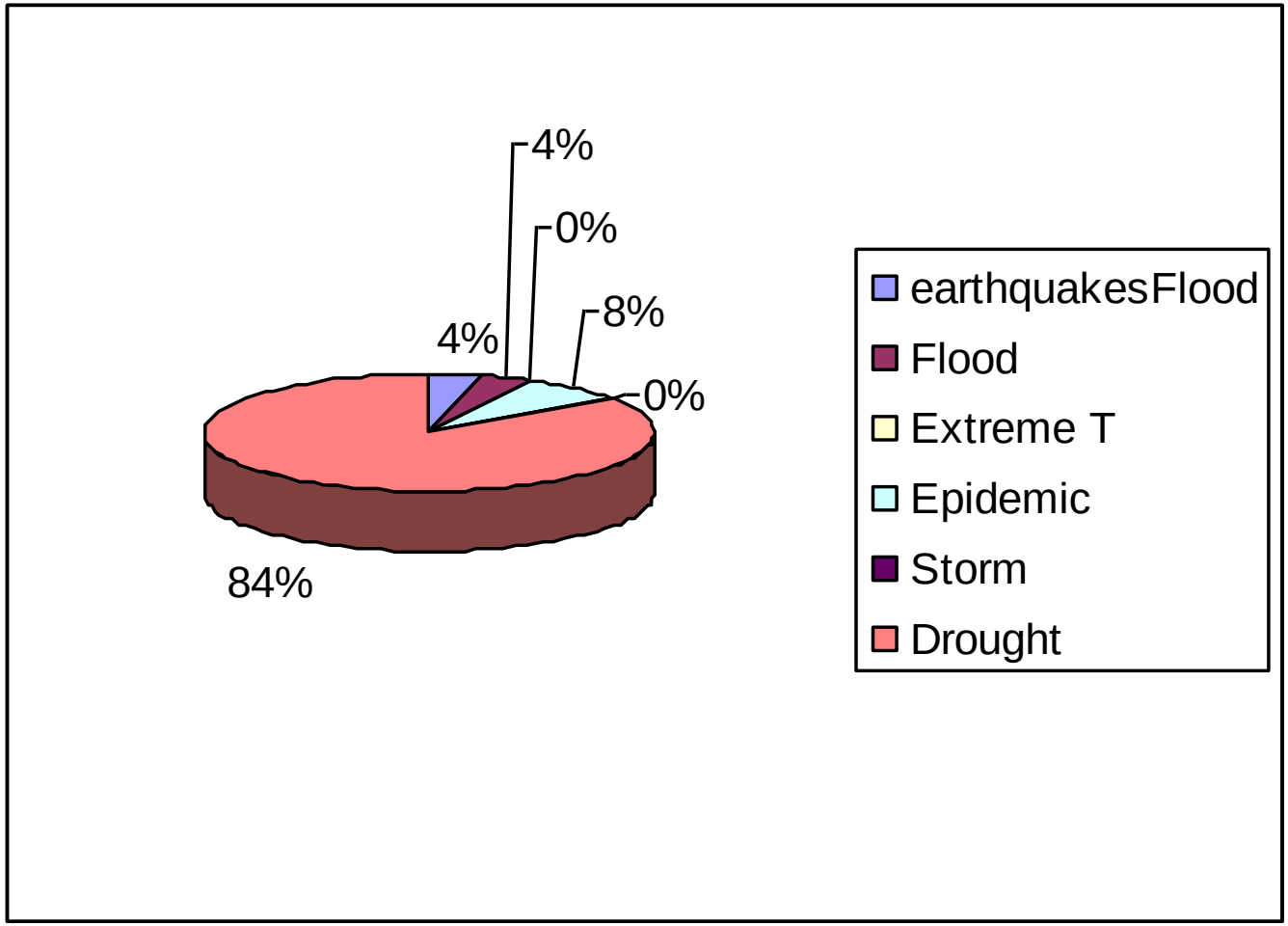



**Relative Distribution of Affected Peoples in the Arab Region**




**Relative Distribution of Disasters in the Arab Region**

***Source: Data compiled from http://www.preventionweb.net, http://www.em-dat.net/disasters/list.php***




**Relative Distribution of Killed Peoples in the Arab Region during 1980 –2007**

# Implications of CC on the Arab Region CZ

**The coastal zones are particularly vulnerable, and according to *WMO more than 80 % of disasters caused by natural hazards in the Arab region were caused by weather, climate and water-related hazards*.**

**Especially the costal zones on the Mediterranean and the Arabian Gulf are facing SLR due to CC, with significant implications on the environment, lives, livelihoods and the economies of those countries.**

# Mediterranean (Specific)

**Variations in world climate will be reflected in the Mediterranean region. Potential impacts include drought, decline of water quality, floods, changes in soil erosion and desertification, storms, coastal erosion, changes in seawater temperature and salinity, SLR and biodiversity reduction. How serious these consequences will be depends partly on the extent to which adaptation measures will be implemented in the coming years and decades.**

- ***State and pressures of the marine and coastal Mediterranean environment. Environmental issues series No 5,European Communities, 1999***

# MED Examples: major potential impacts

- **Nile Delta, Egypt:** increased coastal erosion; overtopping of coastal defences and increased flooding; damage to port and city infrastructure; retreat of barrier dunes; decreased soil moisture; increased soil and lagoon water salinity; decreased fisheries production

- **Ichkeul-Bizerte, Tunisia:** decreased soil moisture, reduced lake fertility; increased salinity of the lakes and shift to marine fish fauna; reduced extent of wetlands and loss of waterfowl habitat

- **Syrian coast, Syria:** increased soil erosion; increased aridity; increased salinization of aquifers; erosion of beaches and damage to coastal structures due to exceptional storm surges

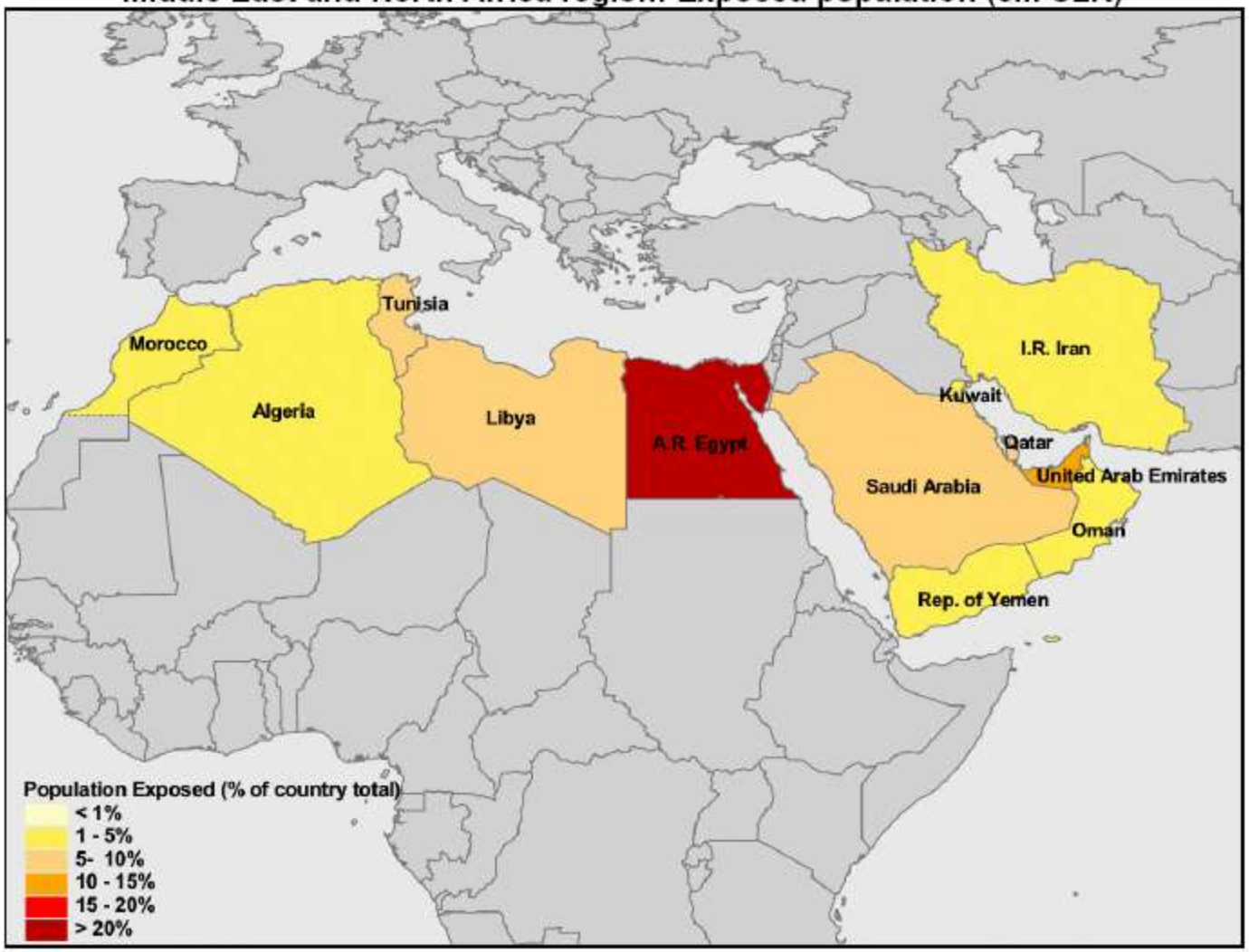
***Source: UNEP/MAP***

# RSGA Examples: major potential impacts

**CC may play a role in the increase in coral bleaching events, and could cause the destruction of major reef tracts and the extinction of many coral species.**

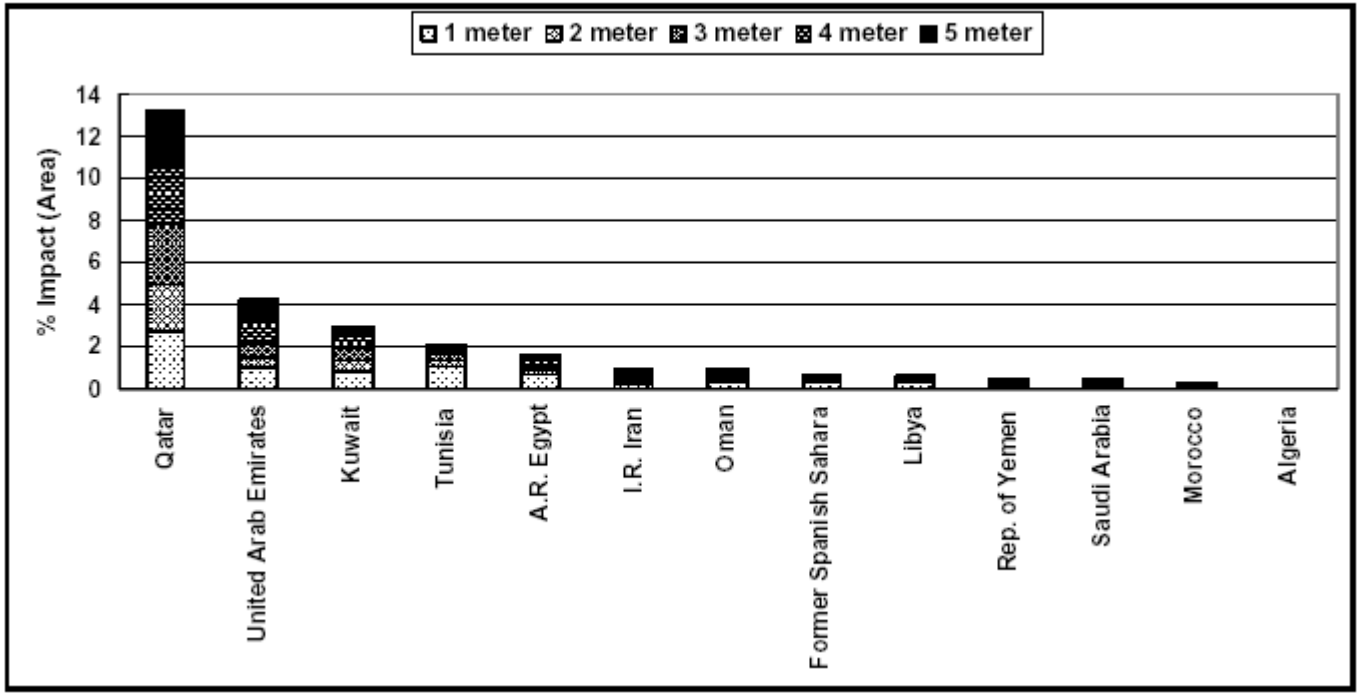
**SLR in the RSGA will affect the coastal zones. The direct effect of inundation would produce a large loss of inhabited areas, wetlands and low islands. SLR will allow waves to cover coral reefs, increasing coastal vulnerability to erosion and storms. threaten wildlife , mineral resources development (including oil industry, human settlements and harbor facilities. Capital values at lost by shoreline retreat and especially from flooding, will be of enormous proportion. Besides other socio-economic and health impacts (GIWA, 2004)**

## Middle East and North Africa region: Exposed population (5m SLR)

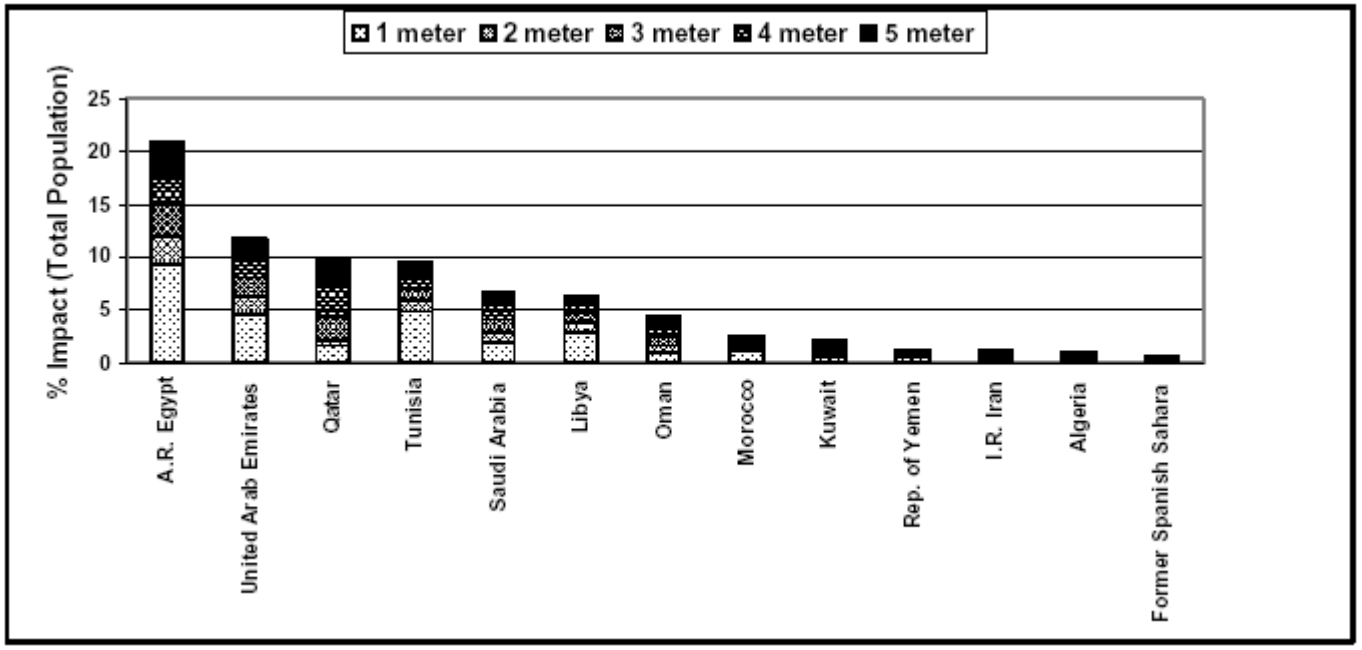



*WB Policy Research Working Paper 4136, February 2007*

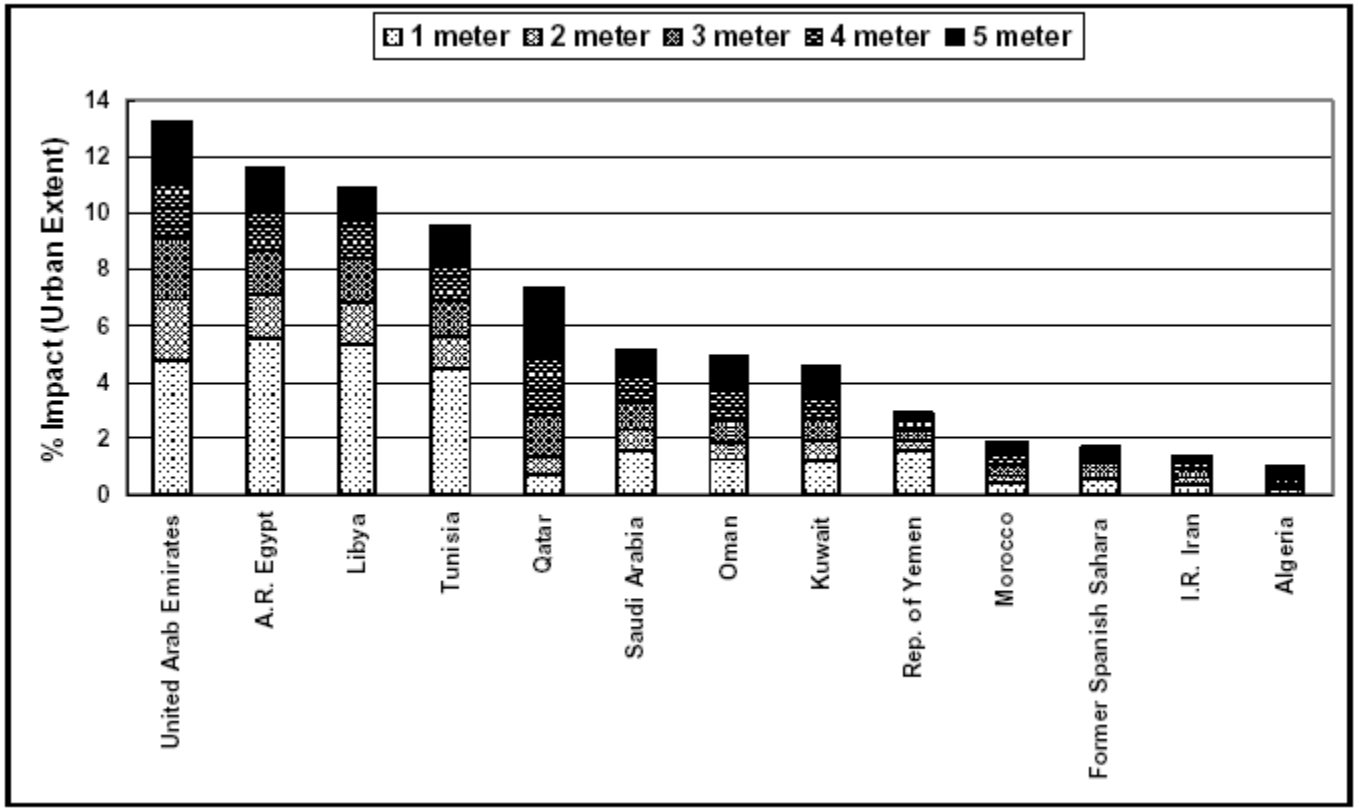
## Middle East and North Africa region: Country area impacted



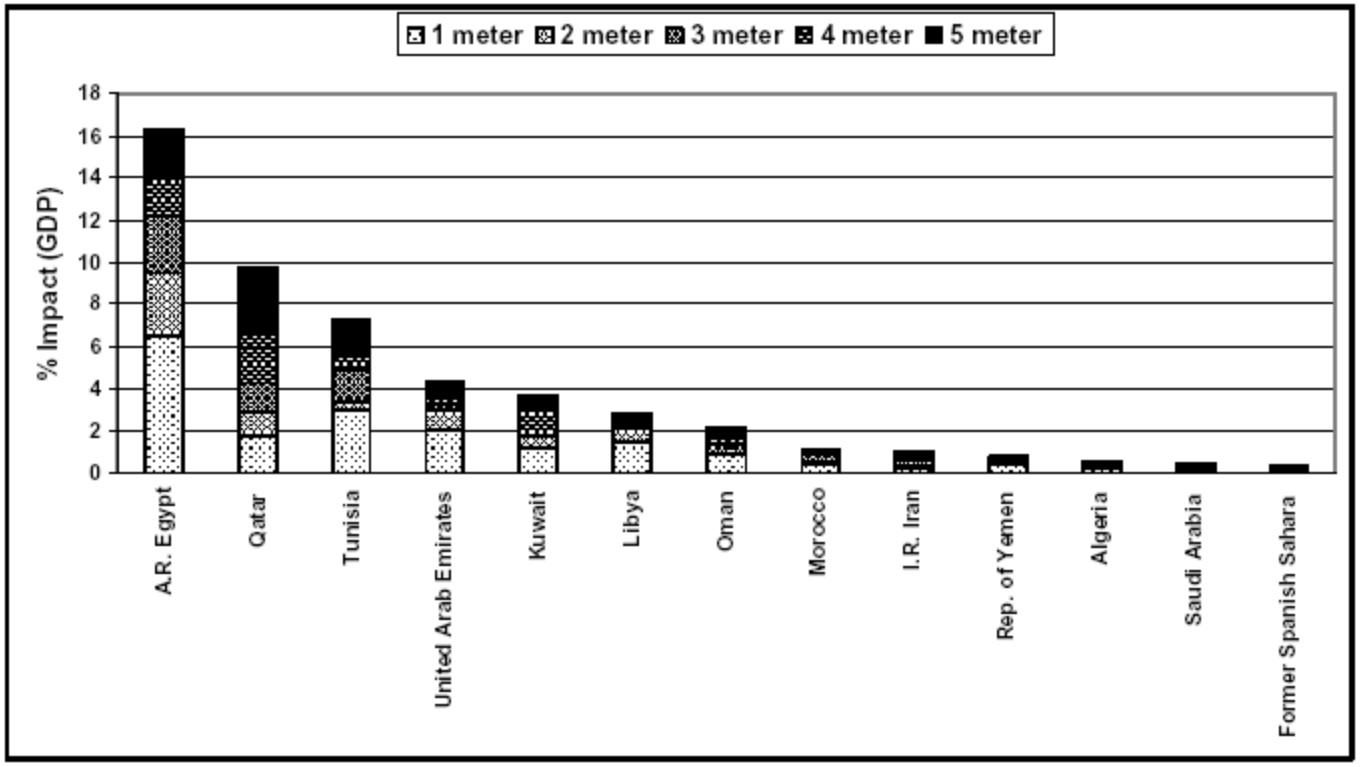
## Middle East and North Africa region: Population impacted

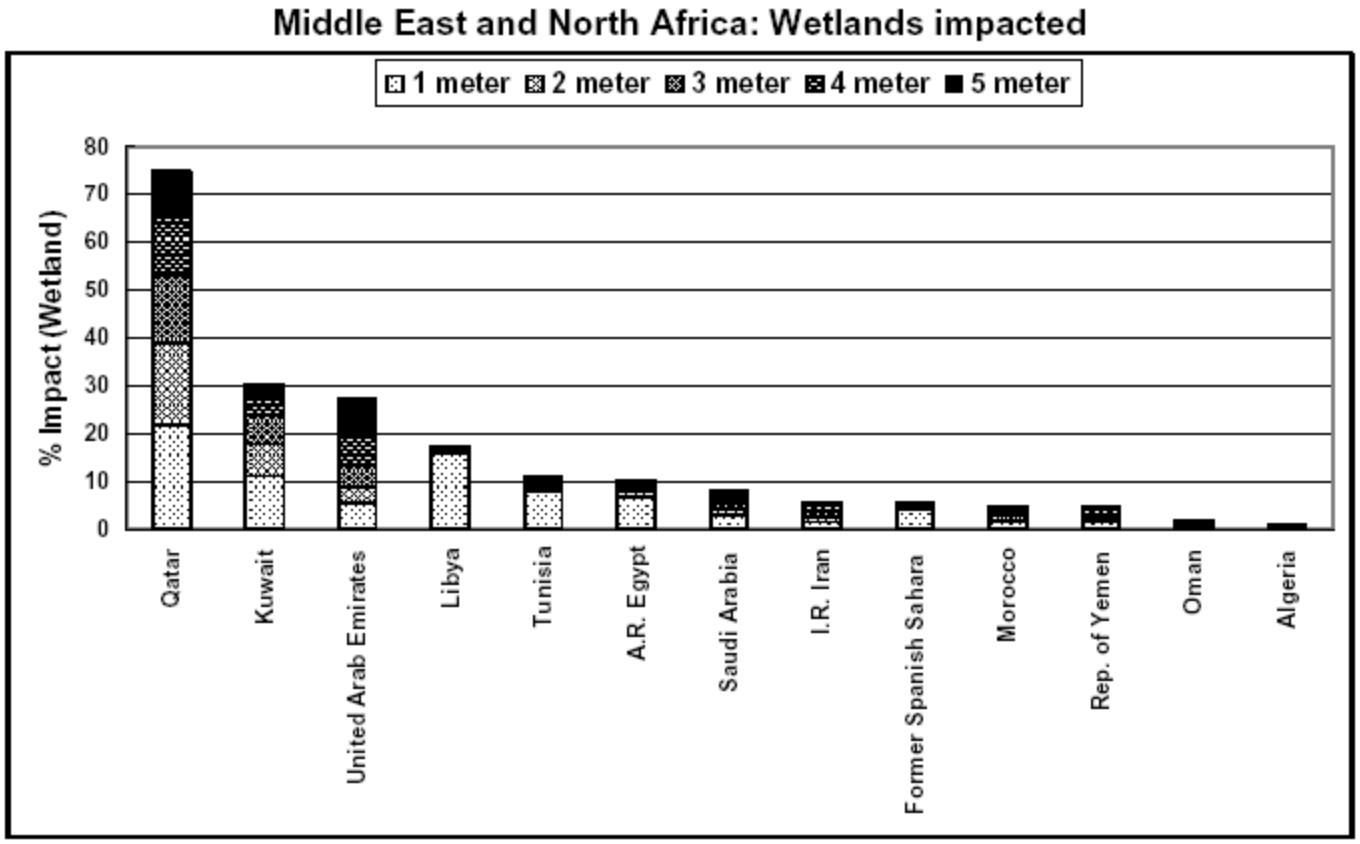


## Middle East and North Africa: Urban extent impacted

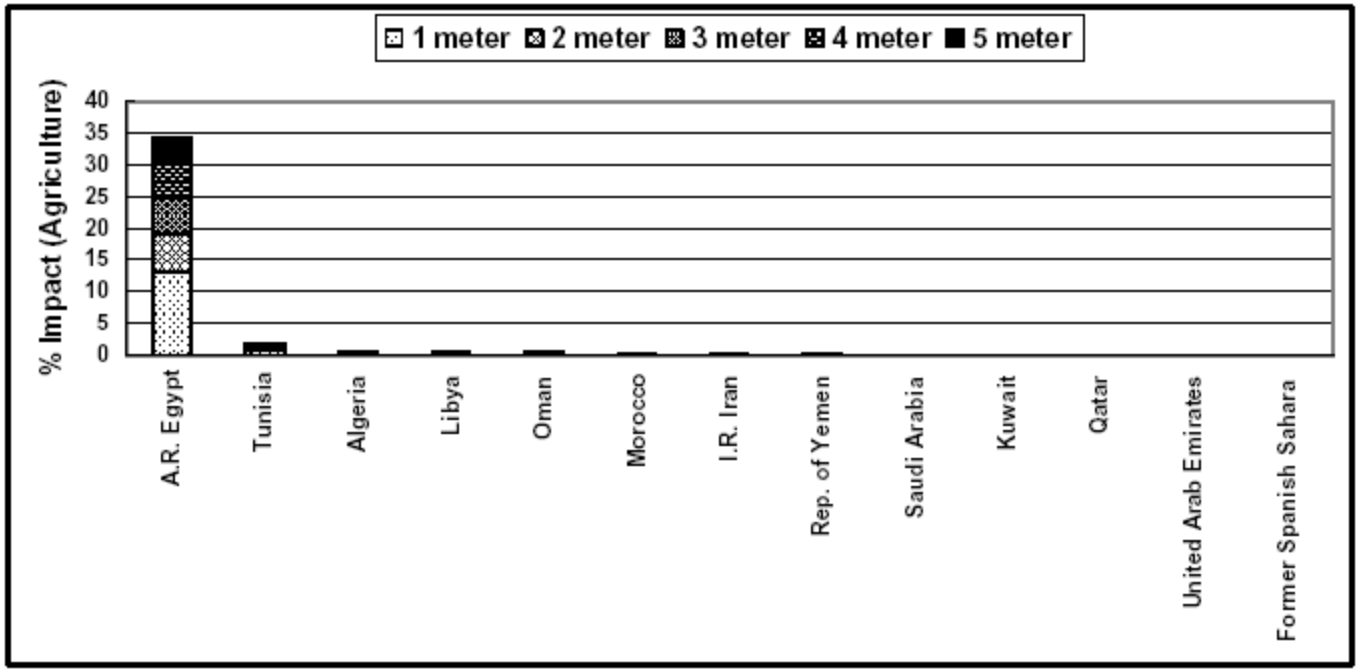


## Middle East and North Africa: GDP impacted




Middle East and North Africa: Wetlands impacted
1 meter
2 meter
3 meter
4 meter
5 meter
% Impact (Wetland)
80
70
60
50
40
30
20
10
0
Qatar
Kuwait
United Arab Emirates
Libya
Tunisia
A.R. Egypt
Saudi Arabia
I.R. Iran
Former Spanish Sahara
Morocco
Rep. of Yemen
Oman
Algeria

## Middle East and North Africa: Agricultural extent impacted

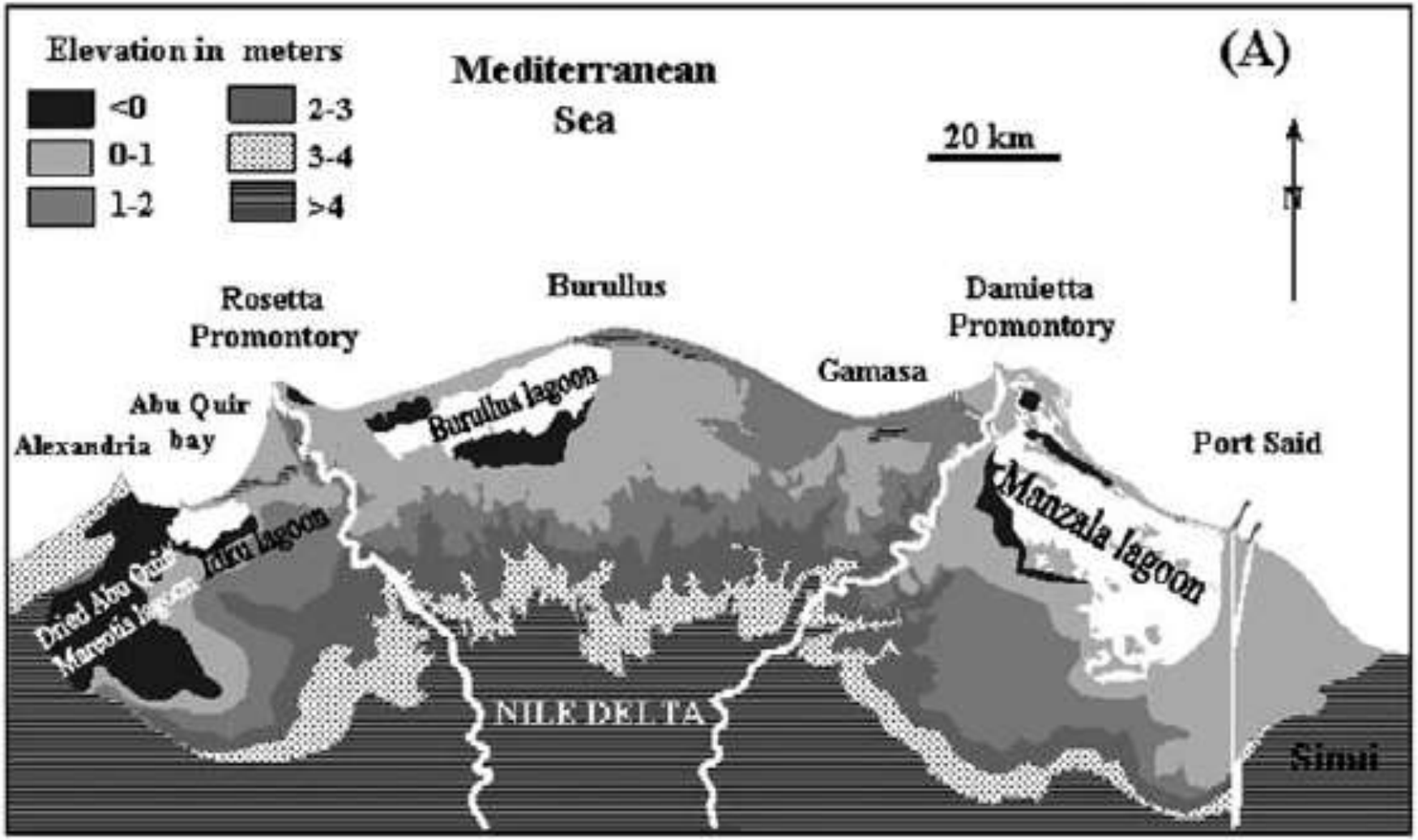


# Impacts of CC: SLR
# Scenarios vs Scenarios

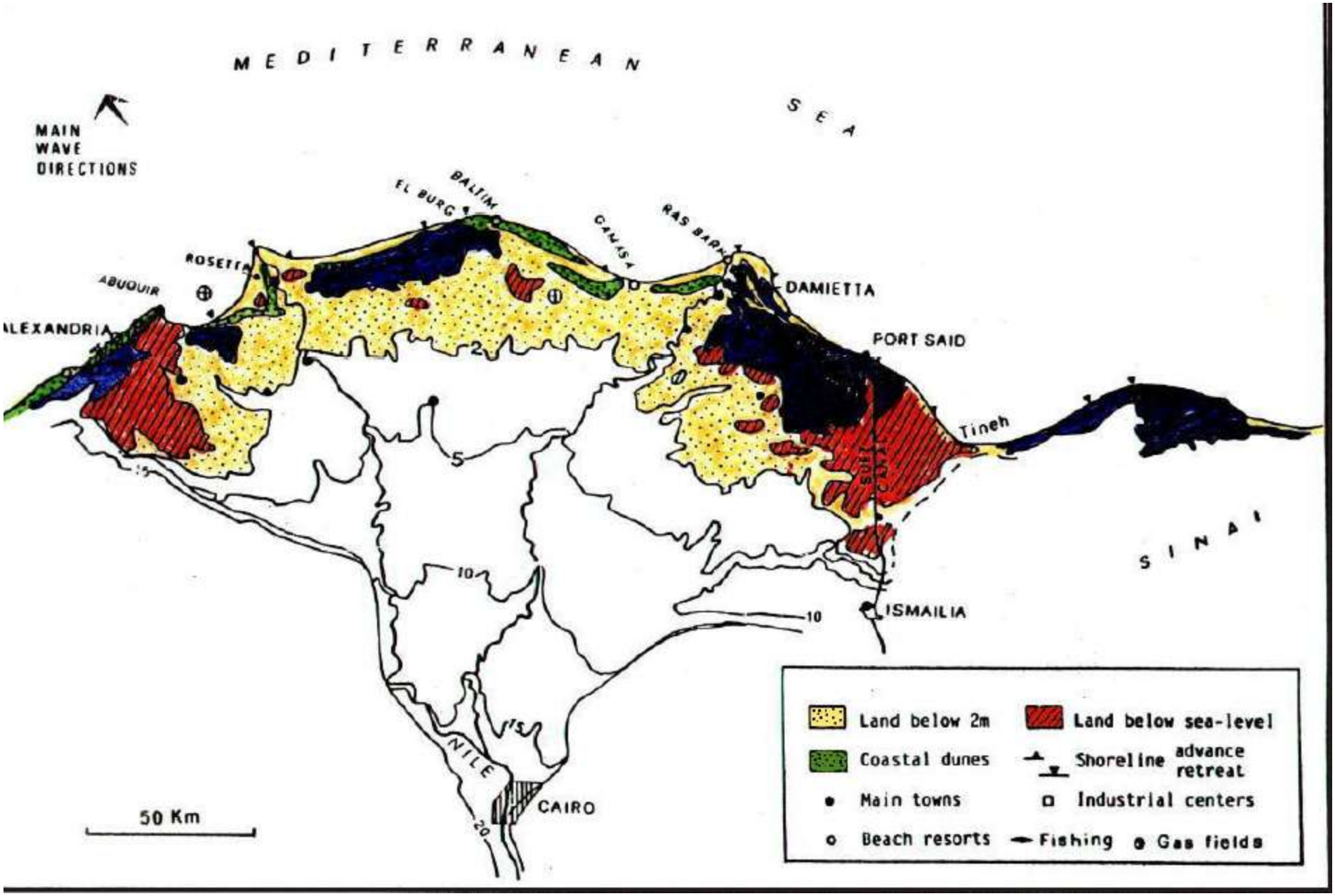
# Nile Delta
## Potential impact of sea level rise

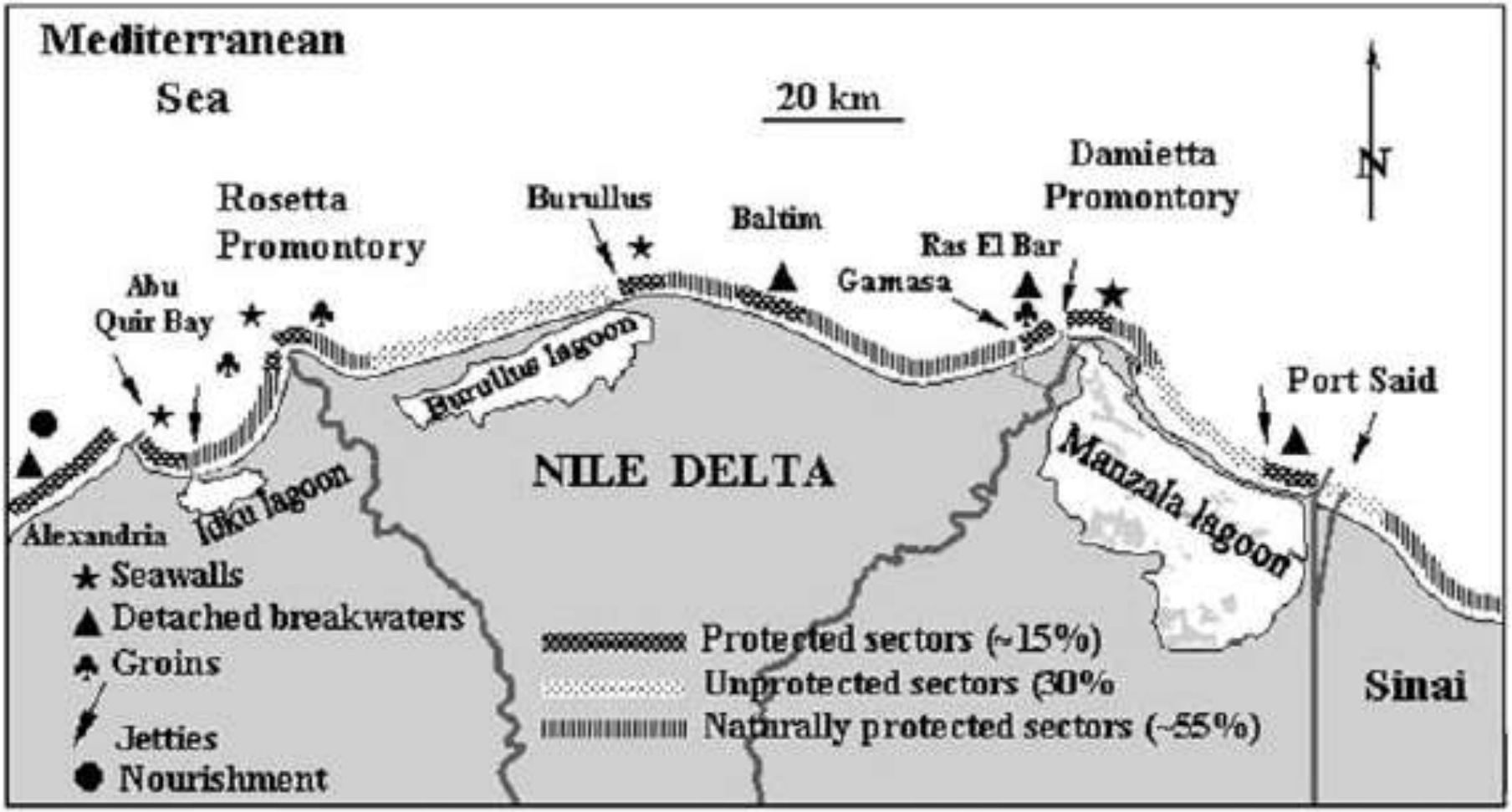
Sources: Otto Simonett, UNEP/GRID Geneva; Prof. G. Sestini, Florence; Remote Sensing Center, Cairo; DIERCKE Weltwirtschaftsatlas.

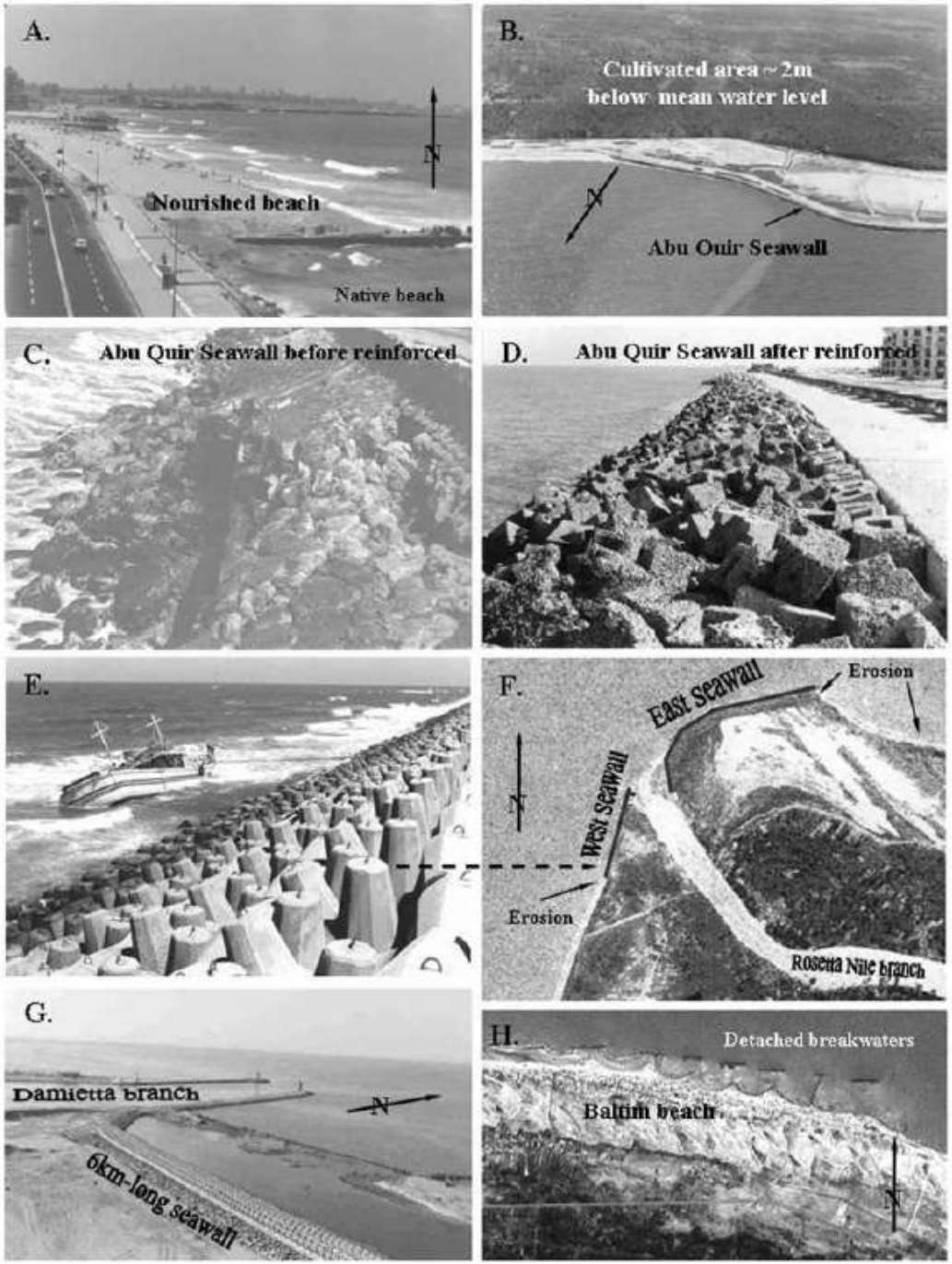
GRID Arendal UNEP


Elevation in meters
<0
0-1
1-2
2-3
3-4
>4
Mediterranean Sea
(A)
20 km
N
Rosetta Promontory
Burullus
Damietta Promontory
Gamasa
Abu Quir bay
Alexandria
Burullus lagoon
Port Said
Manzala lagoon
Idku lagoon
Dried Abu Quir Maryotis lagoon
NILE DELTA
Sinai

Frihy ( 2003)


MEDITERRANEAN SEA
MAIN WAVE DIRECTIONS
EL BURG
BALTIM
CAMASA
RAS BARR
ROSETTA
ABUQUIR
ALEXANDRIA
DAMIETTA
PORT SAID
Tineh
SUEZ
SINAI
ISMAILIA
NILE
CAIRO
50 Km
Land below 2m
Land below sea-level
Coastal dunes
Shoreline advance retreat
Main towns
Industrial centers
Beach resorts
Fishing
Gas fields


Mediterranean
Sea
20 km
N
Rosetta
Promontory
Burullus
Baltim
Damietta
Promontory
Ras El Bar
Gamasa
Abu
Quir Bay
Burullus lagoon
Port Said
NILE DELTA
Manzala lagoon
Idku lagoon
Alexandria
Seawalls
Detached breakwaters
Groins
Jetties
Nourishment
Protected sectors (~15%)
Unprotected sectors (30%
Naturally protected sectors (~55%)
Sinai


A.
N
Nourished beach
Native beach
B.
Cultivated area ~ 2m
below mean water level
N
Abu Quir Seawall
C.
Abu Quir Seawall before reinforced
D.
Abu Quir Seawall after reinforced
E.
F.
East Seawall
Erosion
N
West Seawall
Erosion
Rosetta Nile branch
G.
Damietta branch
N
6km-long seawall
H.
Detached breakwaters
Baltim beach
N

# Regional Current Efforts: DRR and CC

## Milestones

- **Arab Ministerial Declaration on Climate Change, 19th session 5-6 December 2007**
- **Council of Arab Ministers Responsible for Environment (CAMRE) 20th session of the** 2008 adopted decision (No. 295)
- **Draft framework action plan for CC developed by LAS on request by CAMRE included DRR in its component for adaptation measures**
- **UNISDR Regional Office for Arab States**
- **Working Group on CC between the relevant UN agencies working in the Arab Region (CAMRE ...)**

# DRR and CC in the Arab Region : Policy

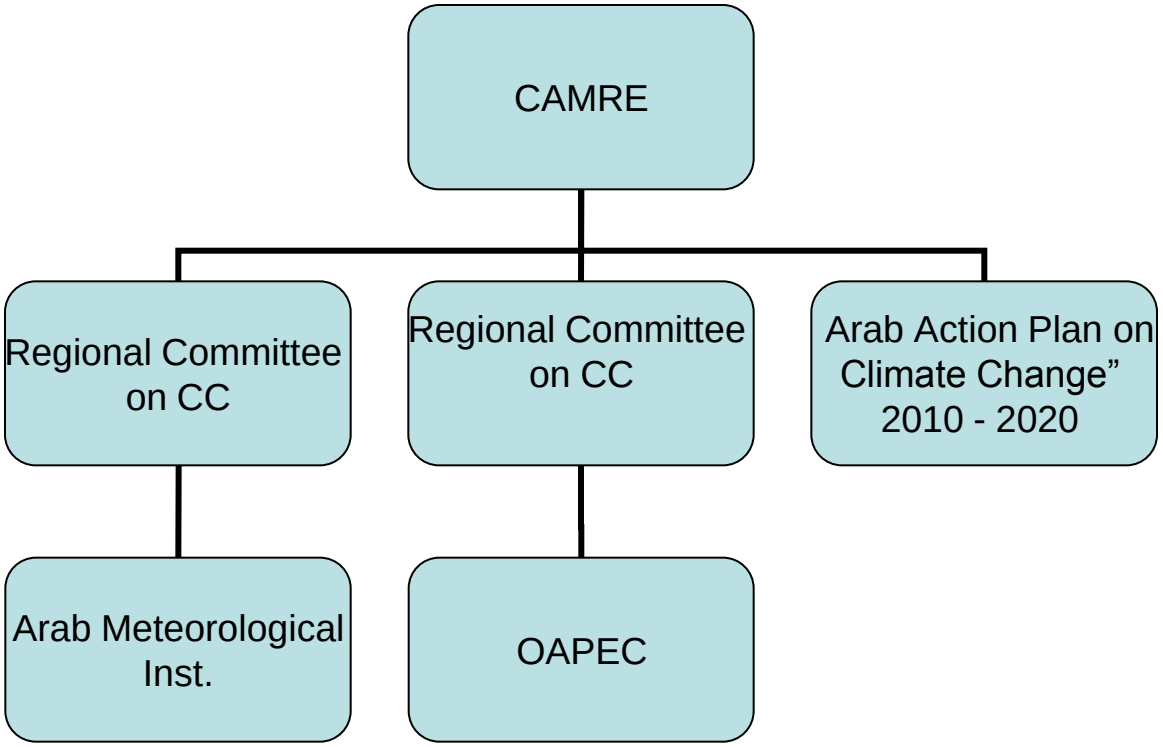
**The risks associated with CC and the need to ensure integration of DRR into CC adaptation has been recognized in the region firstly through the Arab Ministerial Declaration on CC, in its 19th session 5-6 December 2007 *"include appropriate mechanisms for risks insurance, improvement in the management efficiency of natural resources through the use of appropriate techniques and advanced monitoring, control and early warning systems, as well as adequate preparedness to confront disasters caused by climate change".***

**In addition, the Arab Draft Framework Plan to deal with CC Issues for the period (2010 – 2020), being developed, is taking into consideration DRR concerns.**

# The League of Arab States (LAS)

**LAS and its specialized organizations, through the Department of Housing, Environ and SD, are the responsible regional bodies leading the integration of DRR in key regional policies in SD and disaster management coordination mechanisms. Within the SD framework, LAS has facilitated the main-streaming of DRR in regional strategies on environment and SD.**

**During the 20th session of the CAMRE, held on 20-21 Dec. 2008 a decision (No. 29) adopted calling for increased cooperation and coordination with ISDR and follow-up to the implementation of HFA.**


CAMRE
Regional Committee on CC
Regional Committee on CC
Arab Action Plan on Climate Change” 2010 - 2020
Arab Meteorological Inst.
OAPEC

# Global and Regional Instruments

***UN Convention on CC (UNFCCC) and the Kyoto Protocol***

**The UNFCCC adopted in 1992, has at its ultimate objective the *"stabilization of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."***

**The Kyoto Protocol, adopted in 1997, contains, for the first time, GHG reduction targets for most industrialized countries.**

**Nineteen Arab countries have ratified or acceded to the UNFCCC, only one country has ratified the Kyoto protocol, and seventeen other Arab countries have acceded to it.**

TABLE 1 **RATIFICATIONS OF MEAS BY ARAB COUNTRIES**

| States | POPs | Biosafety | UNCCD | CBD | UNFCCC |
|---|---|---|---|---|---|
| **Algeria** | 09/22/2006 | 08/05/2004 | 05/22/1996 | 08/14/1995 | 06/09/1993 |
| **Bahrain** | 01/31/2006 | | 07/14/1997 (a) | | 12/28/1994 |
| **Comoros** | | | 03/03/1998 | 09/29/1994 | 10/31/1994 |
| **Djibouti** | 03/11/2004 | 04/08/2002 (a) | 12/08/1997 (a) | 09/01/1994 | 08/27/1995 |
| **Egypt** | 05/02/2003 | 12/23/2003 | 07/07/1995 | 06/02/1994 | 12/5/1994 |
| **Iraq** | | | | | |
| **Jordan** | 11/8/2004 | 11/11/2003 | 10/21/1996 | 11/12/1993 | 11/12/1993 |
| **Kuwait** | 06/12/2006 | | 06/27/1997 | 08/02/2002 | 12/28/1994 (a) |
| **Lebanon** | 01/3/2003 | | 05/16/1996 | 12/15/1994 | 12/15/1994 |
| **Libya** | 06/14/2005 (a) | 06/14/2005 (a) | 07/22/1996 | 07/12/2001 | 06/14/1999 |
| **Mauritania** | | 07/22/2005 (a) | 08/07/1996 | 08/16/1996 | 01/20/1994 |
| **Morocco** | 06/15/2004 | | 11/07/1996 | 08/21/1995 | 12/28/1995 |
| **Oman** | 01/19/2005 | 04/11/2003 (a) | 07/23/1996 (a) | 02/08/1995 | 02/08/1995 |
| **Palestine** | | | | | |
| **Qatar** | 12/10/2004(a) | 12/06/2007 (a) | 03/15/1999(a) | 08/21/1996 | 04/18/1996(a) |
| **Saudi Arabia** | | 07/11/2007 (a) | 06/25/1997 (a) | 10/03/2001 (a) | 12/28/1994(a) |
| **Somalia** | | | 07/24/2002 (a) | | |
| **Sudan** | 08/29/2006 | 06/13/2005 (a) | 11/24/1995 | 10/30/1995 | 11/19/1993 |
| **Syria** | 08/05/2005 | 04/01/2004 (a) | 06/10/1997 | 01/4/1996 | 01/04/1996(a) |
| **Tunisia** | 06/17/2004 | 01/22/2003 | 10/11/1995 | 07/15/1993 | 07/15/1993 |
| **UAE** | 07/11/2002 | | 10/21/1998(a) | 02/10/2000 | 12/29/1995(a) |
| **Yemen** | 01/09/2004 | 12/01/2005 (a) | 04/14/1997 (a) | 02/21/1996 | 02/21/1996 |

Sources: WTO, ESCWA, UNEP and MEA secretariat homepages
(a) Accession
R: Ratified

# International collaboration and support for Regional efforts on DRR

**Several DRR activities contribute directly to CC adaptation**

- **EWSs,**
- **Risk assessment ;**

**UNISDR has focused on fostering partnerships for DRR with :**

**LAS, Regional organizations (AASTMT and ACSAD), Civil society networks, Expert technical groups and media.**

**UNISDR works with partner organizations like the WB, UNDP, WMO, UNESCO, …. targeting mainstreaming of DRR in SD, delivering technical support and guidance to national counterparts.**

**UNISDR in partnership and collaboration with the WB, implements the global and regional tracks of the Global Facility for Disaster Reduction and Recovery (GFDRR).**

# The GFDRR Climate Resilient Cities Assessment & DRR Regional Data Base

**GFDRR carried out a pilot testing of a risk assessment tool for climate resilient cities of 5 cities in the region: Alexandria (Egypt), Amman (Jordan), Damascus (Syria), Tripoli (Lebanon) and Sana'a (Yemen). The findings of the assessment exercise identify gaps and challenges at local level for risk associated with CC.**

**UNISDR, AASTMT and the WB have initiated the development of a regional database on DRR, hosted by AASTMT in the Regional Centre for DRR – training and Research. The regional database will provide key regional and national data on hazards and risks as well as disaster profiles for the countries in the region.**

# What Needs to be Done ?

## Do nothing

## BAU

## Active intervention

**The term adaptation appeared in the 1st IPCC AR 1990, which calls upon states to *"cooperate in preparing for adaptation to the impacts of CC, develop and elaborate appropriate and integrated plans for CZM, water resources and agriculture, and for the protection and rehabilitation of areas……"* (GAR 2009).**

# *Closing thoughts*

- **Support and enhance the role of LAS as an Arab Regional coordinating body in CC related issues.**
- **Develop regional & National EWS**
- **Adaptation to CC & Management of impacts and risks due to CC**
- **Linking DDR into CC adaptation**
- **Environmental issues need to be integrated into CC adaptation strategies.**
- **Improving the scientific capacity in the various fields related to CC**
- **Increasing PA and education of the impacts of CC on the environment and human health.**
- **Ensuring political and financial support for the implementation of adaptation strategies.**

- **Regional & National Strategies/Priority Action Plan (Impacts & Adaptation) to be developed, including possible impact scenarios for the future, based on solid scientific findings and information**

- **Vulnerability and risk assessment on CC/SLR have to be carried out, taking into account that CZ vulnerability depends not only on morphological features but on the degree of development and economic value of the shore; subsidence or uprising in coastal plains often exceed the increase in SLR.**

**Regional Workshop on Disaster Risk Reduction and Climate Change "Challenges and Future Actions“, Cairo 21 -23 November 2009**

United Nations
International Strategy for Disaster Reduction
*Regional Office for Arab States*

THE WORLD BANK

# Thank You