

WATER ISSUES IN THE UNITED ARAB EMIRATES

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Wealth generated by oil revenues:

- Drastic changes in population size:
 - x 16 in the last 30 years
 - in 2000: 3% population growth (World average= 1.3%)

- Drastic changes in the environment: roads, housing, forestry, agriculture...

Ex: The total cultivated area has increased by 26 % per year since 1989 in Abu Dhabi.

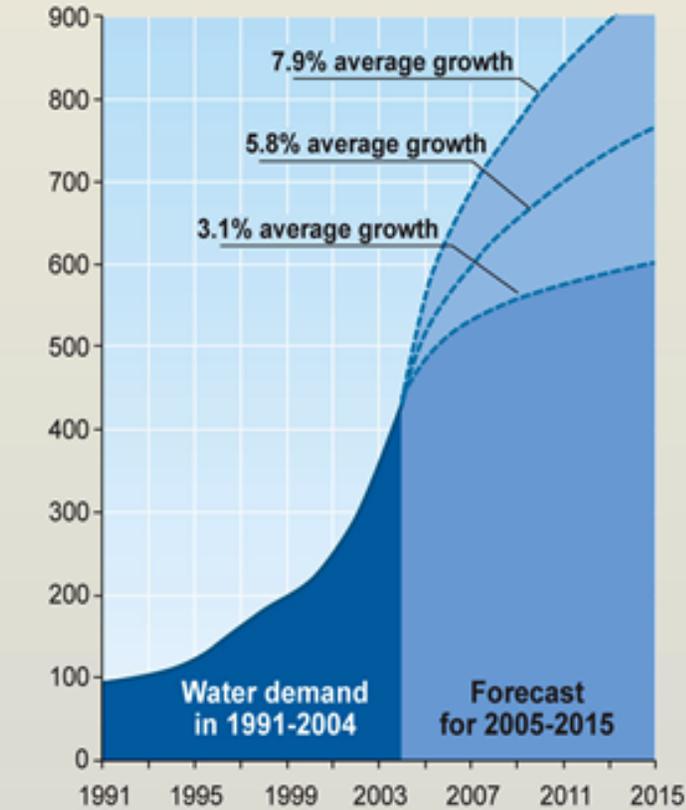


*Brook et al. (2006),
Dawoud (2007),
EAD*



Water demand forecast for Abu Dhabi Emirate

Demand, millions gallons per day



Source: Abu Dhabi Water and Electricity Company 2005

- UAE arid climate with:
 - < 100 mm/year average rainfall,
 - high evaporation rate (2-3m/year),
 - low groundwater recharge rate (<4% of total annual water used)

- Traditional systems: falaj in mountains & hand-dug well in desert

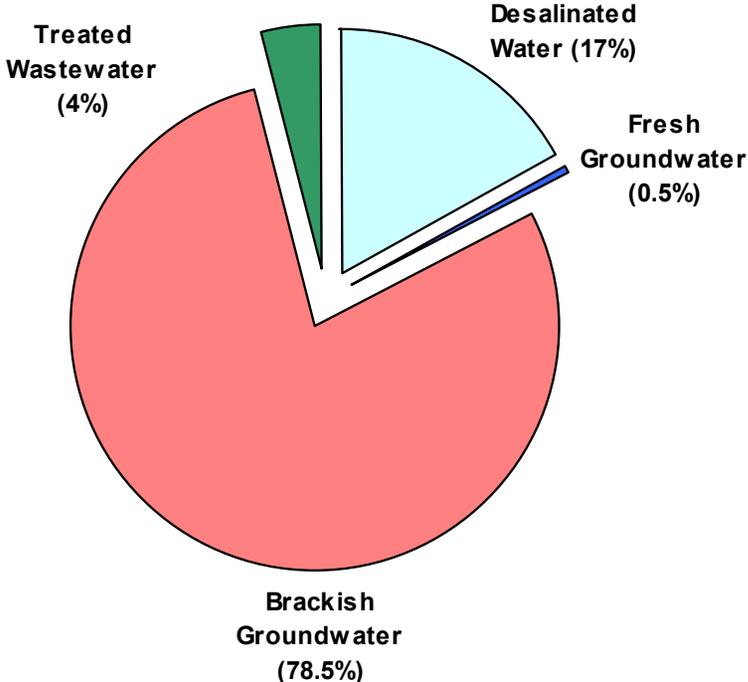
➤ Increase of demand: dams in mountains, drillings in desert, desalination plants on the coast

Country	Litres per person	Comment
Abu Dhabi Emirate	525 – 600	overall
	160 – 220	flats only
Australia	288	urban residential only
USA	305	figure for 1980
UK	141	metered
	153	unmetered
Czech Republic	113	
Hungary	102	

Source: Bureau calculations for Abu Dhabi, and OECD (1999), *the price of water: trends in OECD countries*



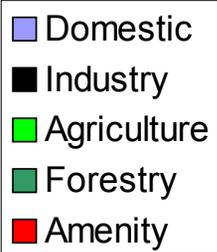
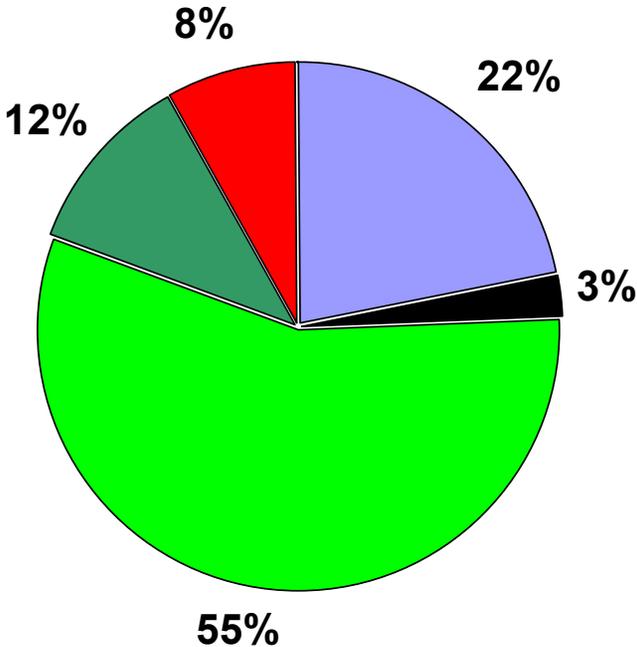
Groundwater



In GCC, groundwater abstractions to total demand: 68% (Kuwait) to > 90% (Bahrain)

In Abu Dhabi Emirate, in 2005:

- ca 79% of all water sources (ca 2.5 billion cubic meters/year abstracted)
- 75% of the water taken by agriculture, forestry and amenity plantations



Brook et al. (2006), Dawoud (2007), EAD

A tremendous pressure on arid ecosystems...

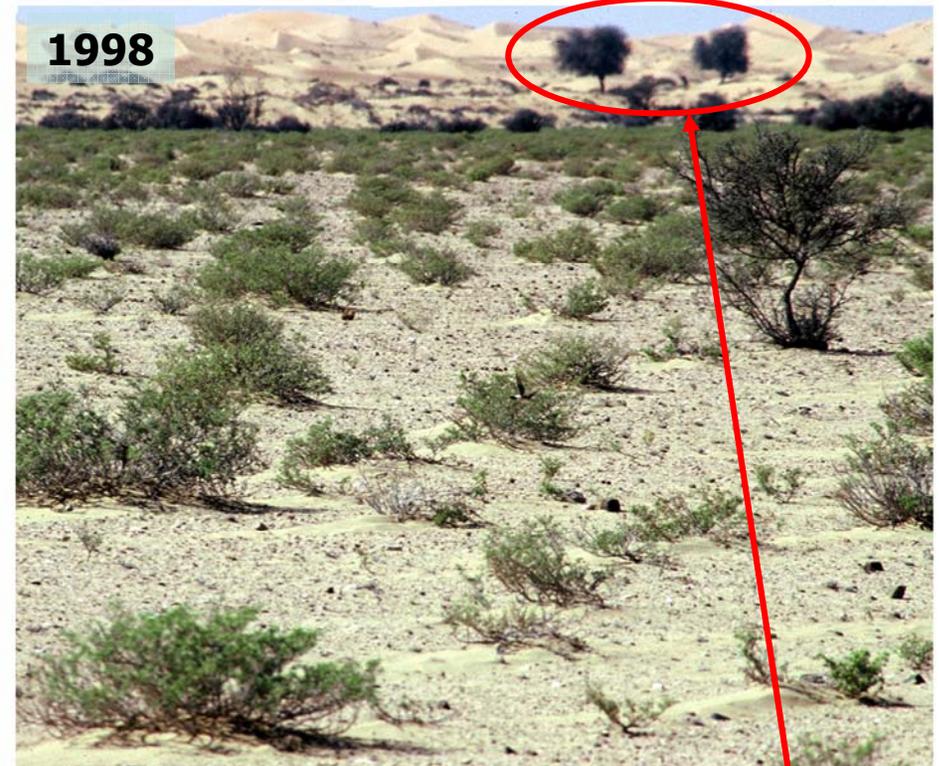
Water level fluctuation in monitored wells in Abu Dhabi Emirate



Source: Environment Agency - Abu Dhabi

- **level loss of 93 m in 10 years** in Al Ain region
- **pollution by fertilizers**

Brooke et al. (2006), EAD, SOE





Dams and mountain water resources

140 dams in UAE mountains, of which, 9 mains:

- **Capacity: 300,000 to 18.5 million m³**
- **Aim: Groundwater Recharge and Flood Protection**

➤ ***“ UAE to build 68 dams in five years”***
Kippreport (13 August 2008)



Damming...

+ natural causes (drought)

+ overhunting/poaching

+ overgrazing by livestock (goats)

+ quarrying and crushers

➤ **irreversible loss of habitat**

➤ **a supplementary stress on remnant wildlife populations**



Arabian Tahr



Arabian Leopard



Solution: desalination plants?

- 99% of Kuwait needs
- 50% of KSA needs in water and 20% of energy needs
- > 20% of water used in UAE (ca 100% of drinking water)

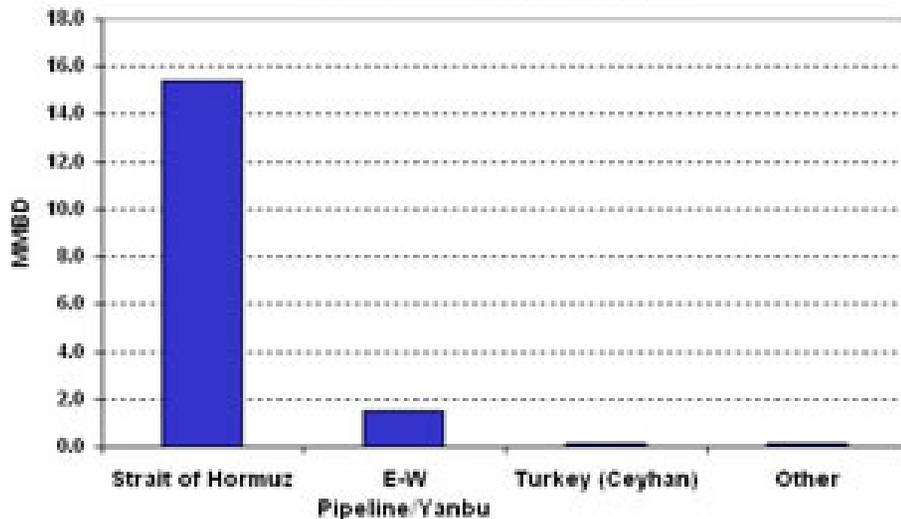
GCC countries hold about 45% of the total global desalination capacity!



But desalination = energy consuming
+
concentration of desalination plants on the Arabian Gulf (= **closed sea**):

- Environment impacts (dredging, hot water and brine effluents, heavy metals, cleaning agents) on sensitive marine habitats (coral reefs, seagrass beds)
- High oil industry activity (refineries, transport) = high risk of oil pollution for intake
- Diplomatic tensions with Iran...

Persian Gulf Oil Exports by Route – 2003
(Million Barrels per Day)





New threats for water resources:

Climate change / global warming

Introduced invasive species

Sea level rise due to global warming

Sea level rise:

[Europe](#) [N. America](#) [S. America](#) [Africa](#) [SE. Asia](#) [China & Japan](#) [AU](#)

1m only = Abu Dhabi, Dubai cities underwater
Expected: 7m (Greenland's icecap melting)

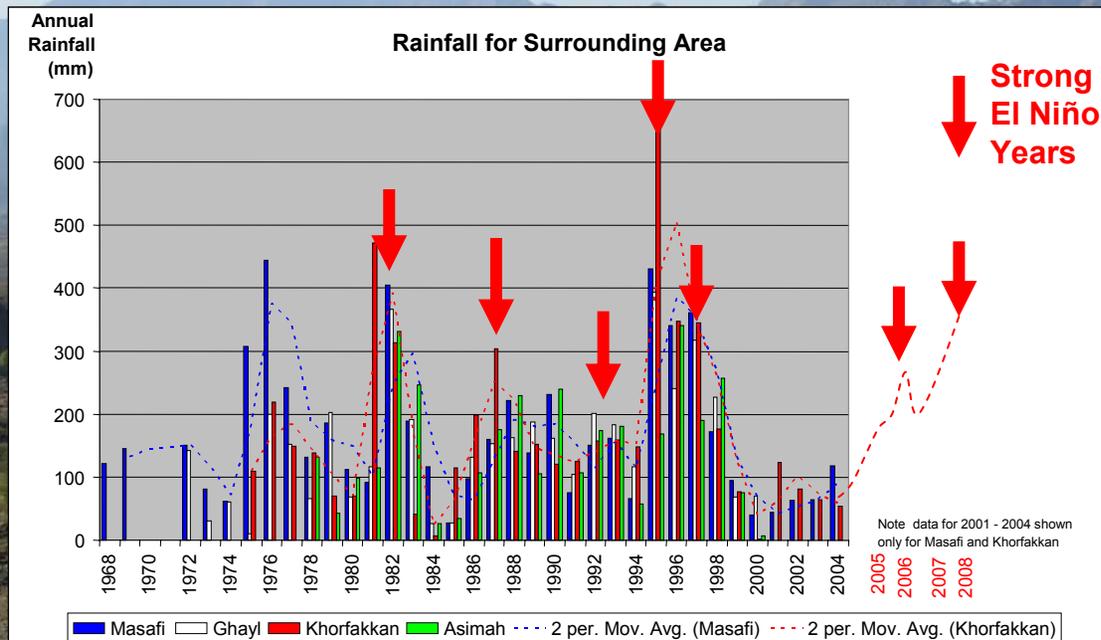


➤ **Impact on desalination plants + coastal infrastructure**

➤ **Saline intrusions in groundwater table**

Changes in precipitations patterns due to global warming

- Rainfall in Eastern emirates and Oman influenced by El Niño-Southern Oscillation / La Niña (ENSO)



Strong
El Niño
Years

La Niña / El Niño cycle depends on Pacific Decadal Oscillation (PDO).

➤ Climate change disturbs PDO cycle...

- Impact on unique fauna and flora
- Impact on groundwater recharge
- Impact on infrastructure and population



Fujairah, 2008

A growing threat : introduced invasive species

Ex: *Prosopis juliflora* (**beautification**)

- Competition with local species for water
- Supplementary stress on groundwater resources



Cochlodinium

Ex: *Cochlodinium* sp. (**ballast waters**)

- red tide for 7 months now in UAE
- cloth of intake filters of desalination plants

Measures

- **Local (Emirate) level:**

- **2005: Establishment of the Ground Water Resources Monitoring Network in Abu Dhabi**
- **2005: Administrative order 4 regulating drinking water in Abu Dhabi**
- **2006: Law no 6/2006 for control of drilling in Abu Dhabi**
- **2007: MASDAR initiative in Abu Dhabi**
- **2007: Master of Science “Groundwater Engineering and Management”, Ajman University**
- **2008: Arab Water Academy in Abu Dhabi**
- **2008: Water saving campaigns in Dubai, Sharjah**
- **2008: Rise of water tariffs in Dubai**
- **2008: Green building codes in Abu Dhabi, Dubai**
- **2009: Protected Area for conservation of freshwater resources in Fujairah**

- **Federal level:**

- **1992: Federal Laws 39 and 41 concerning importation and handling of agricultural pesticides and fertilizers**
- **1999: Federal Law 24 for protection of environment**
- **1999: Creation of Water Resources Master Program of UAE University**
- **2005: Creation of Ministry of Environment and Water of UAE**
- **2007: Ecological Footprint Initiative (MoEW, EAD, EWS-WWF, GFN)**
- **2009: National water and energy saving campaign (MoE, MoEW, MASDAR, ADWEA, EAD, EWS-WWF)**

Soon to come: Federal Legislation on water conservation and protection...



• International level

Convention/Protocol	Date Ratification	Website
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LDC),1972	1974	www.imo.org
International Convention for the Safety of Life at Sea (SOLAS), 1974.	1983	www.imo.org
International Convention for the Prevention of Pollution of the Sea by Oil, 1954 and its amendments.	1983	www.imo.org
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION), 1969.	1983	www.imo.org
International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969.	1983	www.imo.org
Vienna Convention for the Protection of the Ozone Layer of 1985 and Montreal Protocol on Substances that Deplete the Ozone Layer of 1987.	1989	www.unep.org/ozone
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973.	1990	www.cites.org
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal, 1989.	1990	www.basel.int
United Nations Framework Convention on Climate Change for the year 1992.	1995	www.unfccc.int
1992 Protocol Concerning Amendments on International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969 and International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971.	1997	www.imo.org
Convention on Limitation of Liability for Maritime Claims (LLMC), 1976.	1997	www.imo.org
United Nations Convention to Combat Desertification for the year 1994.	1998	www.unccd.org
Convention on Biological Diversity (CBD) for the year 1992.	1999	www.biodiv.org
Convention on Persistent Organic Pollutants (POPS), 2001.	2002	www.pops.int
Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC Convention),1998.	2002	www.pic.int
Montreal Amendments (London 1990, Copenhagen 1992, Montreal 1997, Bijing 1999).	2005	www.unep.org/ozone
Kyoto Protocol, 1997	2005	www.unfccc.int
RAMSAR Convention on Wetlands, 1998	2007	www.ramsar.org

Challenges

- Set-up of sound data monitoring (**standardisation**)
- Implementation (**+ standardisation**) of laws, decrees and international agreements / conventions
- Integrate the environment, its resources and their preservation in the development planning
- Invest in technology and research & alternatives (ex: artificial recharge stations in AD, Middle East Desalination Research Centre in Oman...)
- Trans-boundaries collaborations **within UAE**, and GCC

Change habits!!!





➤ Need to connect the dots!

*“ ...1.4 billion square feet of empty desert and sea into an international community for an estimated population of **1.5 million people that is twice the size of Hong Kong Island...**”*

Nakheel

*“Our five-year strategy indicates the increase of expected tourists arrivals to **2.7 million visitors by the year 2012,...**”*

ADTA

With already > 4 millions people, water and electricity shortages, and one of the highest footprint in the world:

can the UAE really afford it?