

**MISTRALS – Malta – 31.3.2011**

# **Sustainable Management of Water Resources in the Mediterranean Basin**

**Prof. Uri Shamir**

**Stephen and Nancy Grand Water Research Institute**

**Technion – Israel Institute of Technology**

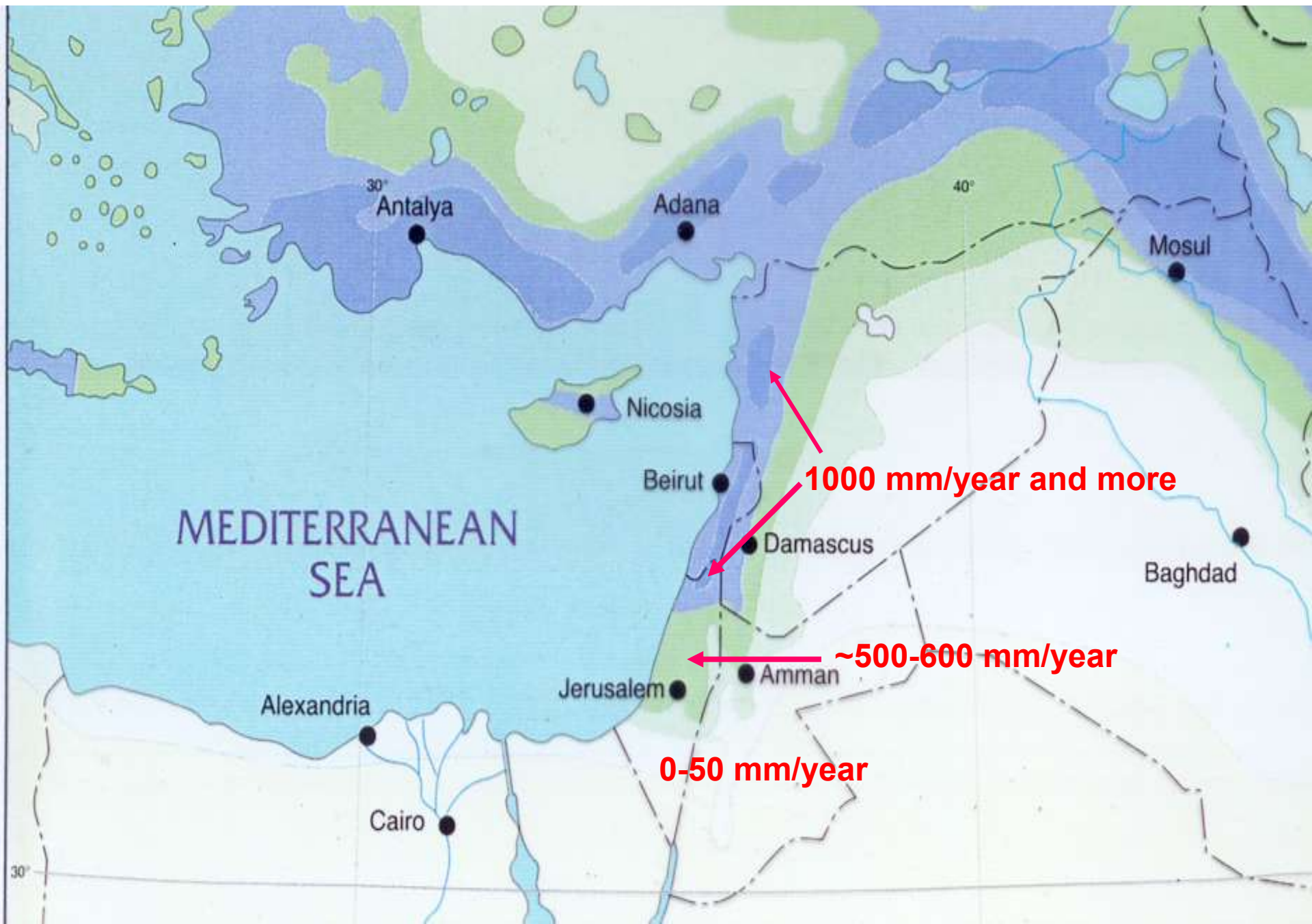


- **Insufficient natural fresh water resources for an increasing population, with a rising standard of living (“fresh” = potable with simple treatment)**
- **High variability and uncertainty of the hydrology causes great difficulty in management and in preparing for the future**
- **Pollution of the sources: still rising, pollution sources must be controlled**
- **Issues with neighbours: cooperation wins over conflict → coordinated management is the best (and proven) response**

# **Israel's Water Situation: Challenges and Responses**

**Similar challenges face the other countries in the region, but responses have to be adjusted to local conditions and capabilities**

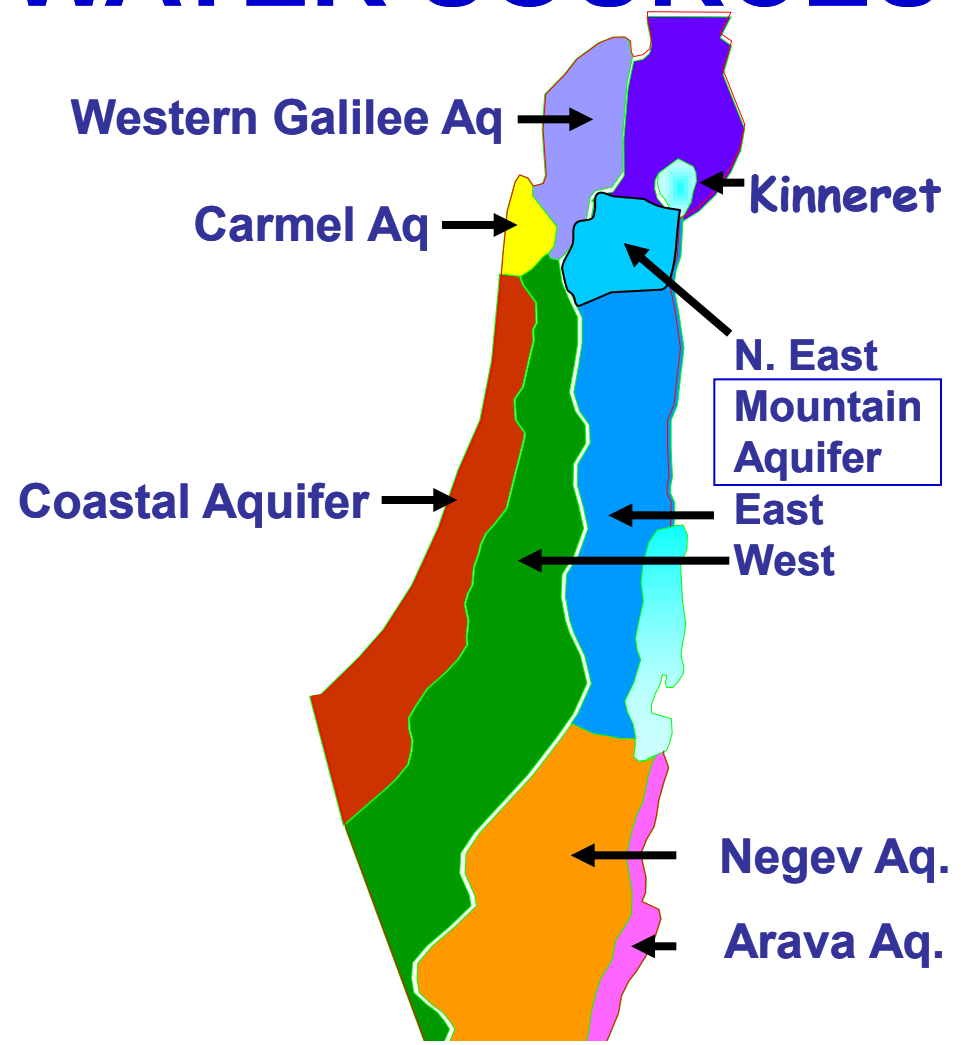
# Rainfall Distribution in the Region





**Highly integrated national and regional water systems**

# WATER SOURCES



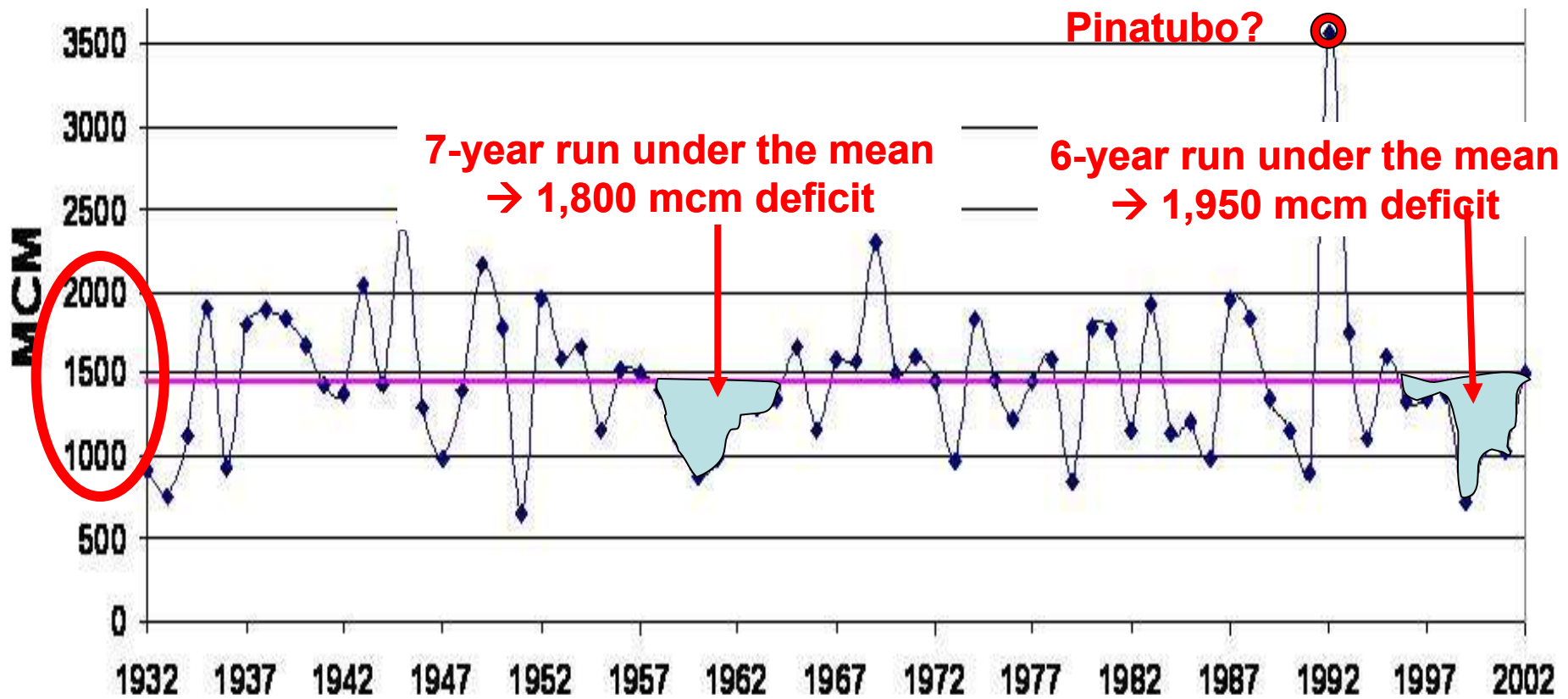
**Average Annual Potential**  
**~1,200 mcm/yr Israeli control**  
**~1,700 mcm/yr whole area**

# Hydrological Variability & Uncertainty

## Replenishment of the Natural Sources (mcm/yr)

1932-2002: Average=1,457, SD=458, Range 657-3,563  
(Recently declining average ~1,200 & increasing variability)

**The variability is forecasted to grow with climate change**



**2003/4-09/10 - 7 years net storage loss = 770 mcm**

- **Total natural fresh water in Israel per capita for all purposes (including fresh water agriculture) is ~150 m<sup>3</sup>/cap/year [1,200 mcm/year for a current population of 7.5 million]**
- **The same figure holds for the entire area between the Mediterranean and the Jordan, for Palestinians and Israelis [1,700 mcm/year for a current population of ~10+ million]**
- **Compared to the 1,000 m<sup>3</sup>/cap/year stated as “the minimum required”**
- **Reclaimed wastewater for agriculture = 50%+ of potable supplies**

# Challenges → Pressures

---

- In the past >70% of fresh water were used by the (politically powerful) agricultural sector
- As long as water for agriculture was subsidized the Ministry of Treasury refused to allow desalination
- Population growth → urban demand for more potable water, now >50%
- **Result: overuse of the sources**



# Challenges → Pressures

---

- **Declining water quality in the sources caused by human activities and lower water levels**
- **Rising quality standards for water (we do have very good quality at the tap) and for treated wastewater**
- **Water agreements with our neighbors → likely reduction of our share of the regional resources**

# Challenges → Pressures

---

- **Large hydrological variability and uncertainty with respect to future hydrology and other factors**
- **Possible impact of climate change**
- **Frequent change in Israeli politics and replacement of Ministers**
- **Uncertainty in the political and management domain can be the most difficult to deal with**

# Israel's main failures

---

- **Overuse of the natural sources**
- **Delayed decisions on large scale desalination**
- **Late attention to stronger urban water conservation measures**
- **Governance of national infrastructures: lack of coordination, slow statutory and budget processes**

# Challenges → Responses

---

- **Reduced by 60%+ fresh water supply for irrigation**
- **Replaced by sewage effluents, while water productivity has multiplied**
- **Water pricing moved to full cost for all sectors (including agriculture)**
- **Conservation in the urban sector by technology, pricing, regulations, education**

# Private homes

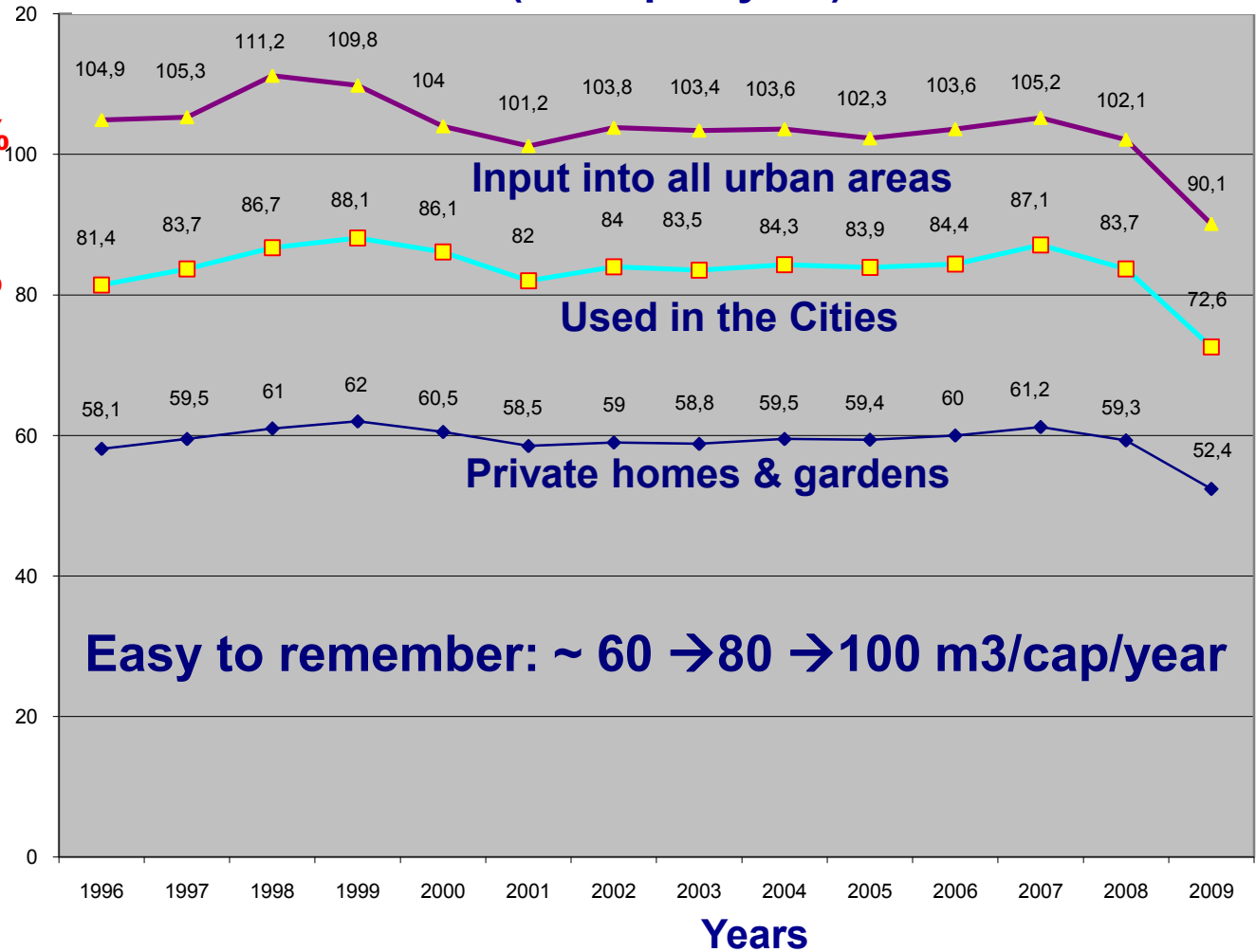
**Reduction  
2008→2009**

$(102.1-90.1)/102.1=12\%$   
**= 90 mcm**

$(83.7-72.6)/83.7=13\%$

$(59.3-52.4)/59.3=12\%$

## Annual Per Capita Consumption, 1996-2009 (m<sup>3</sup>/capita/year)



# Challenges → Responses

---

- **Desalination of seawater: now 287 mcm/yr in three large plants**
- **In 2013: 600 mcm/year → 750 by 2020 → 1,500 by 2050**

**With continuous re-evaluation so as not to over-develop**

- **Desalination of saline groundwater:**
  - **→ 50 mcm/year**
- **Sewage reclamation and reuse:**
  - **300 mcm/year → expanded to 500**

**15+15+27 = 57 mcm have been added to the three existing plants → total = 287 mcm/yr**  
**287/1,200 = 25%**

**Hadera: 100+ mcm/y since end of 2009**

**Palmachim: 30+ mcm/y since 6/2007**

**Ashkelon: 100+ mcm/y since 2006**



**With Sorek and Ashdod => 550 mcm/y**

**We offered the Palestinians to locate a 50-100 mcm plant at Hadera for them - for direct supply to the WB**

**Sorek under construction 150 mcm/y expected in 2013**

**Ashdod: 100 mcm/y**

# Hadera Desalination Plant: 100→127 mcm/year Operating since October 2009







# Israel's main accomplishments

---

- Integrated national water policy and central control → Master Plan (2010 Report)
- Highly integrated water system
- Efficient water use in agriculture
- Reuse of sewage effluents
- Large scale sea-water desalination + local desalination of brackish GW
- Manage the natural sources – they are strategic for supply and for storage



# **Middle East Water Agreements Regional Cooperation**



# The International Arena

Professor Aaron Wolf -- <http://terra.geo.orst.edu/users/tfdd>

- About 3,600 water treaties - mostly about navigation
- About 300 treaties since 1814 on non-navigable uses of water
- Most are bi-lateral
- 145 water-related treaties in the 20th century (see: Transboundary Freshwater Dispute Database)
- They are mostly stable; some have even survived hostilities between the parties (India-Pakistan)
- Shared interests clearly outweigh conflict-inducing considerations, although tensions over water continue



# The International Arena

Professor Aaron Wolf -- <http://terra.geo.orst.edu/users/tfdd>

- ~261 international rivers, covering almost half the land surface, over 40% of the world's population
- Many shared aquifers (S. Puri, UNESCO publication)
- History of acute international water conflicts in the 20th century -- only seven cases -- no wars:
  - Pakistan-India: from 1948, on the Indus, ending in the 1960 Indus Water Agreement
  - Syria-Israel: on the Jordan, 1951-53 and 1964-66
  - Sudan-Egypt: on the Nile, 1958, Egypt sends military expedition into Sudan, tensions reduced, Nile Treaty signed in 1960
  - Somalia-Ethiopia: 1963-64 border skirmishes
  - Syria-Iraq: over the Euphrates, 1975, Arab League intervenes, mediated by Saudi Arabia
  - Senegal-Mauritania: 1989-91 border clashes



# Middle East Water Agreements

- Madrid Process began in 1991 -- 20 years ago
- 1992-1994 Talks in Washington and in the region
- Declaration of Principles (DOP) signed with the Palestinians on the White House lawn in September 1993; Negotiation Agenda with Jordan agreed the next day
- Jordan-Israel Peace Treaty signed in October 1994 (in the Arava Valley) -- water is covered by Article 6 and Annex II
- Oslo II Agreement between Israel and the Palestinian Authority signed in September 1995; water and sewage are covered by Article 40
- Oslo II is a 5-year interim agreement (still “alive”)
- We continue to work with the Palestinian Water Authority
- Meeting with Syria, Shepherdstown, July 2000



# Regional Cooperation

---

## **Jordan: 1994 Treaty is working very well**

- The water situation in Jordan is much more severe
- Jordan has only restricted access to the sea
- Lower economic capability limits high-cost solutions
- The Jordan River and Yarmouk are important sources
- The Red-Dead project is viewed as critically important

## **Palestinian Authority: 1995 Agreement continues to be the basis for cooperation**

- Gaza: almost self-contained, depends on groundwater which has been severely depleted and polluted
- West Bank: depends on groundwater + connections supplying from the Israeli system
- Wastewater is a major issue for Israel and the PA

# Professional Cooperation

---

## Joint Research Projects (examples):

- **PJIP: Wastewater Treatment and Reuse in Agricultural Production – “The King Hussein and Queen Noor Project” – ongoing since 1994 - GWRI, BGU, Volcani, Al- Quds, Palestinian Research Group, NCARTT/Jordan (\$2.7M)**
- **Support Services for Solar Powered Desalination and Pumping Units for Brackish Water**
- **Water Quality along the Lower Jordan River**
- **Reduction of environmental pollution from Olive Oil Production**

## Participation in conferences



# Some Research Priorities

---

- **Climate → Precipitation → Hydrology → Water resources availability → WR Management**
- **Technologies for water treatment, for wastewater treatment and for efficient use**
- **Demand management:**
  - **Efficient use in agriculture**
  - **Efficient use in the domestic sector**



**Desalination Conference – Technion - December 2002**

**Shimon Tal, Rafi Semiat, Chuck Lawson, Nabil Sherif, Ahmad Yakoubi, Uri Shamir**



**Jordanian-Israeli Joint Water Commission – Deir Allah, Jordan - 1995**

**“Water is used to put out fires, not to ignite them”**

**Dr. Munther Haddadin, Past Minister of Water and Irrigation, Jordan, and Chief Negotiator of the 2004 Israel-Jordan Water Agreement, 2001**

**“If you look for reasons to fight – water can provide a reason,**

**But if you seek peace - water can be a bridge”**

**Uri Shamir, 1993**

# Thank You!

