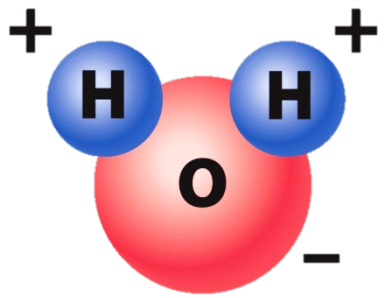
Israel Water- Development, type of sources, characterization of surface and groundwater resources



Prof. Dror Avisar,
Head of the Water Research Center,
Head of the Hydrochemistry research Group
Tel Aviv University

Water Research Center
Tel Aviv University

The Raymond and Beverly Sackler Faculty of Exact Sciences
Tel Aviv University

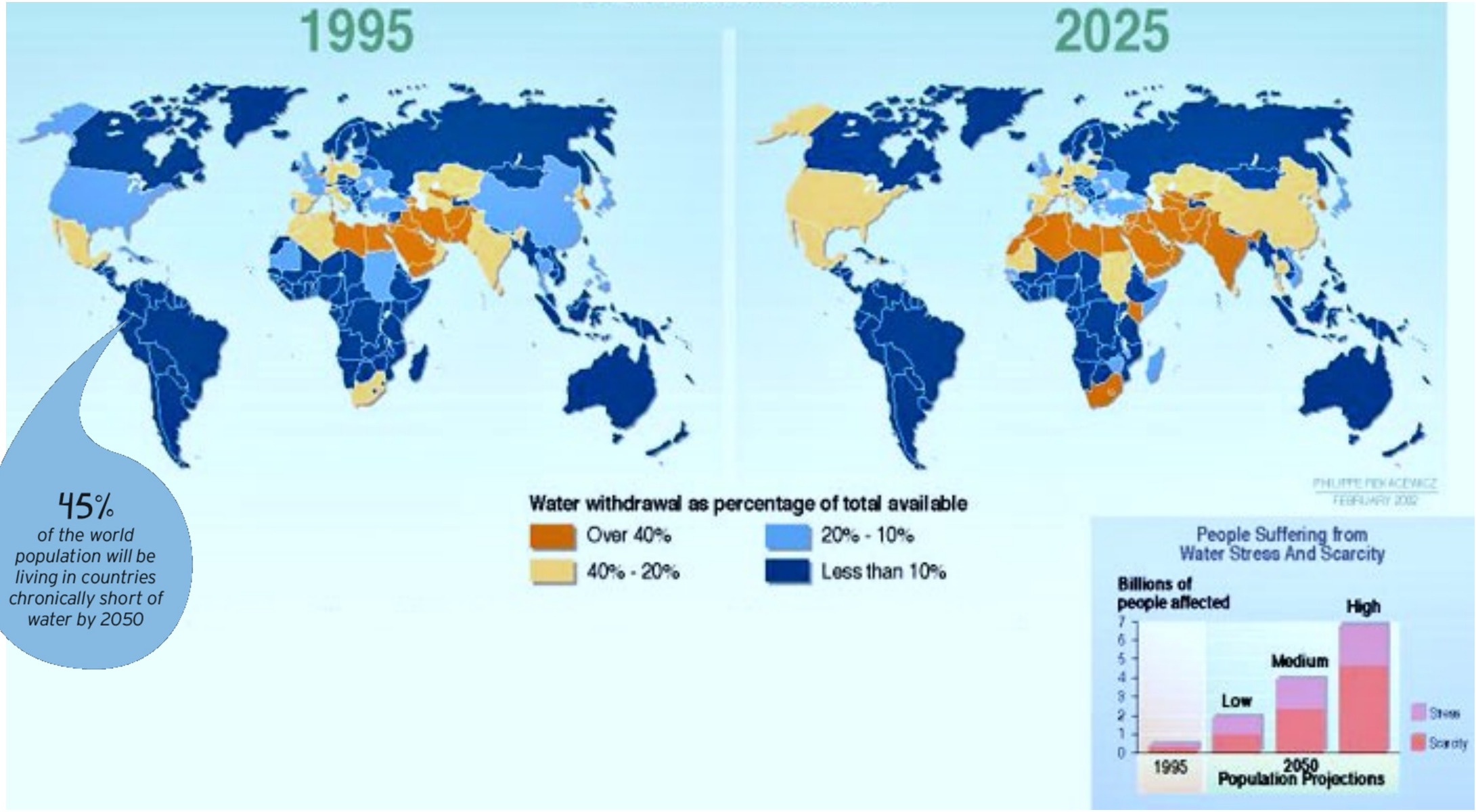
Few anecdotes on WATER:

- ✓ Over the last hundred years, world water consumption has increased ninefold
- ✓ The world population increased fourfold during this period

- ✓ In neighboring Cyprus washing is allowed only one day a week

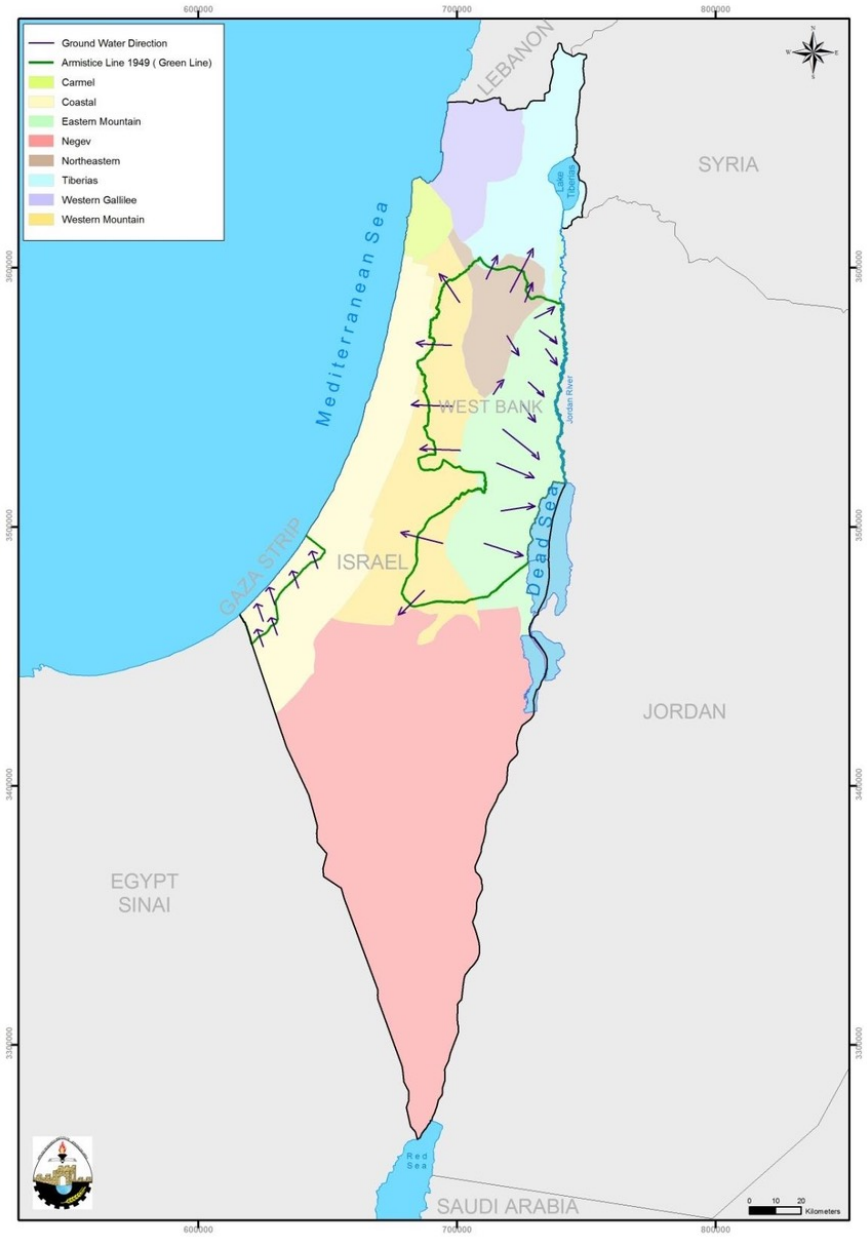
- ✓ During a routine inspection, a hole was found in one of the water pipes near Jerusalem. The size of the hole is 6 mm. The amount of water leaking through it per hour - equivalent to the amount of water, which is found in 1,280 1.5 liter bottles

Freshwater Stress



Data by Israel Water Authority

The main water resources in Isael:



Natural:
The aquifers
The lake of Galile (Kinneret)

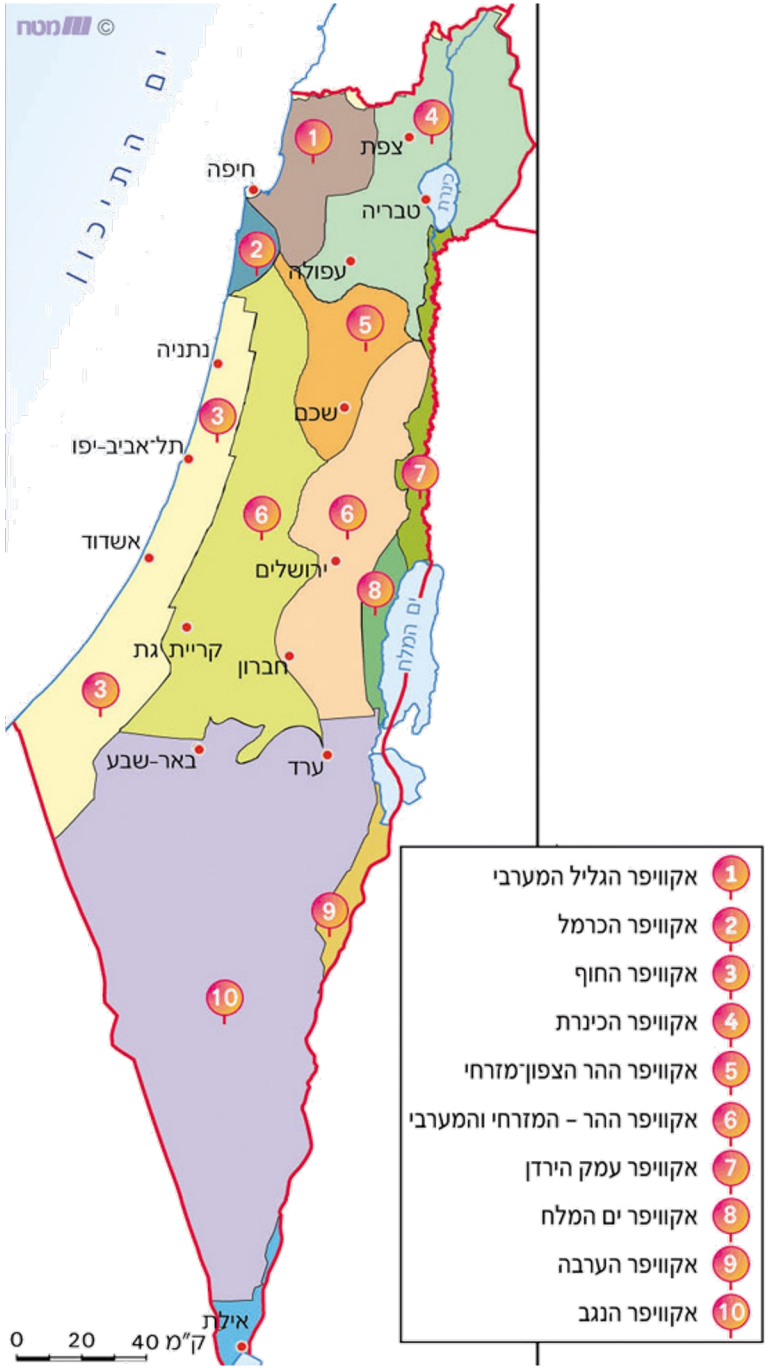
Artificial:
Desal. Water for sea and brackish GW – <u>mainly fro drinking</u>
Recliamed wastewater – <u>mainly fron agricultural irrigation</u>
Runoff – <u>mainly for agricultural irrigation and GW artificial recharge</u>

The sandy Coastal Aquifer

- ✓It stretches from the slopes of the Carmel in the north to northern Sinai in the south.
- ✓Its area within the State of Israel is 1,900 square kilometers, in a strip that is 130 km long and ranges in width from 10 km in the north and 30 km in the south.
- ✓The amount of water pumped from the aquifer is about 550-300 million cubic meters per year
- ✓Seating below the most populated area in Israel
- ✓Suffer from chronic over pumping due to chronic water shortage
- ✓Suffer for chronic pollution due to human activities

The rocky carbonate Mountain Aquifer:

- ✓It stretches from the Northern Valleys to the Be'er Sheva Valley in the south, and from the coastal plain in the west to the Jordan Valley and the Dead Sea in the east
- ✓The water quality in the whole aquifer is very good
- ✓Its waters are used for urban consumption in the center of the country, as well as the consumption of the residents of Judea and Samaria, both Jews and Arabs

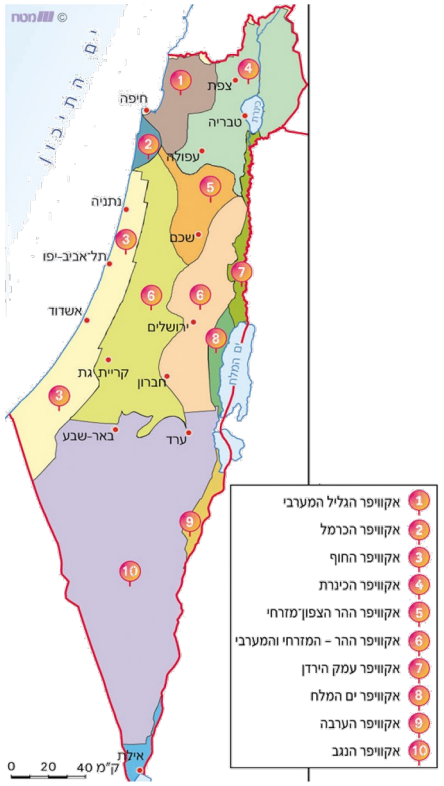


Additional local Aquifers:

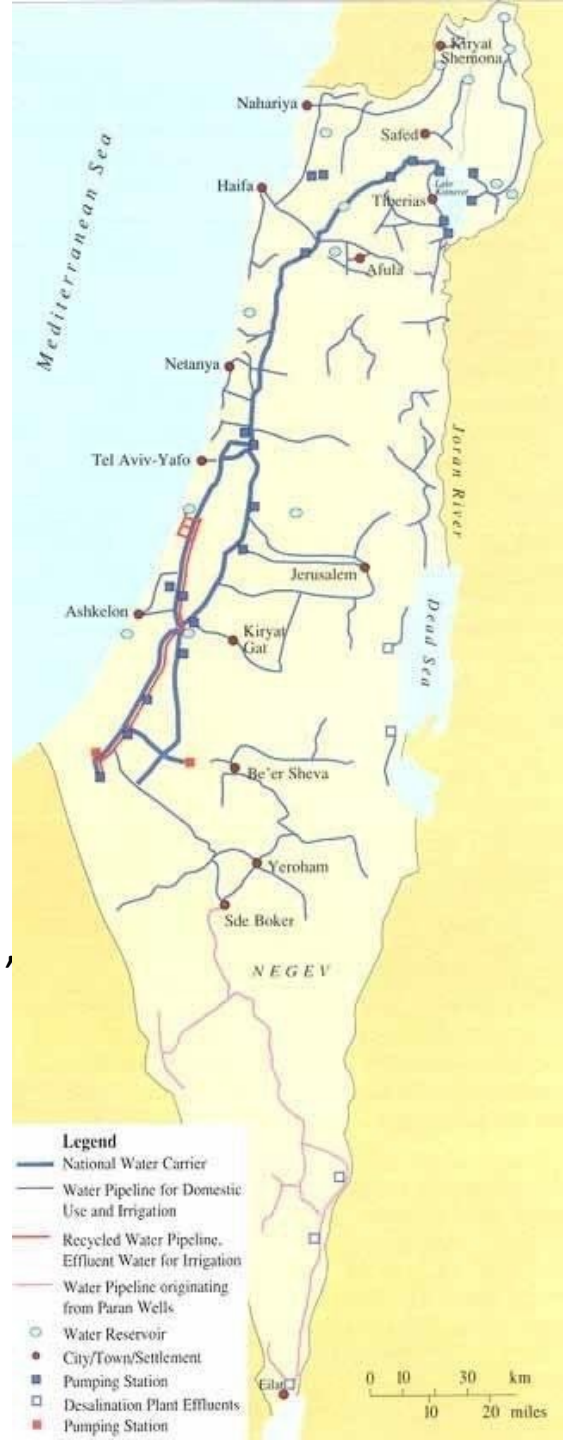
- ✓ The West Galile Aq
- ✓ The Carmel Aq
- ✓ The East Galile Aq
- ✓ The Arava Aq

Mainly for local cosumption- both, drinking (mostly) and irrigation
Usally, high qauliry water

The lake of Galile (Kinneret)



- ✓ The only fresh water lake in Israel
- ✓ Serve for many year as an important water source
- ✓ In 1964 the **National Water Carrier** was established, consuming drinking and irrigation water for the north, center and south of Israel
- ✓ The lake suffer from chronic drought and consequently from water fluctuations
- ✓ The pumping from the lake is under a severe control – red line, black line
- ✓ Upon the desalination era, the water from the Kinneret is barely pumped , mostly for Jordan as part of the peace agreement treaty
- ✓ In the coming future, access of desal water will transfer to the lake via the National Water Carrier (flow backwards in the opposite direction), to serve as a storage reservoir and to increase the water supply to Jordan



Water development in Israel:

Traditionally,
Israel depends on:
1 Surface water lake,
3 main aquifers
and several local aquifers

90'S – Severe water shortage and severe water pollution
As a result, Rabin Gov' (92-95) Starts a revolution:

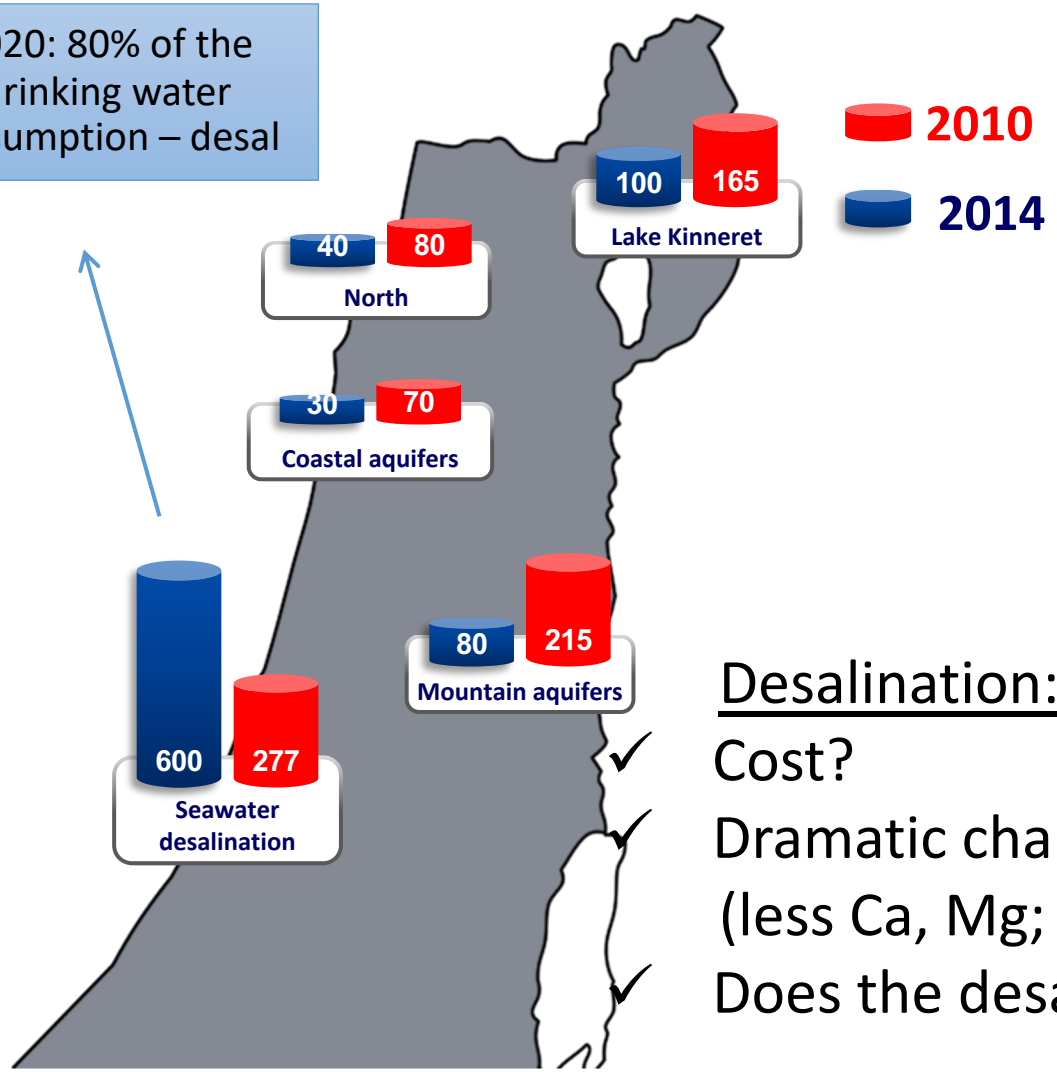
Change occurs due to:

- ✓ Droughts
- ✓ Increase the water demands for all sectors
- ✓ Impossible water management which was depends on unstable political situation (frequent changing of Ministers, which were in charge of the water commissioner)

- ✓ Reclaimed – reuse water
- ✓ The Era of Desalination
- ✓ Adopted technologies

Desalination revolution

2020: 80% of the drinking water consumption – desal



~1 Million Cubic Meters of Water Daily

Desalination has serious environmental (increased salinity of large bodies of water) and energy costs

Desalination:

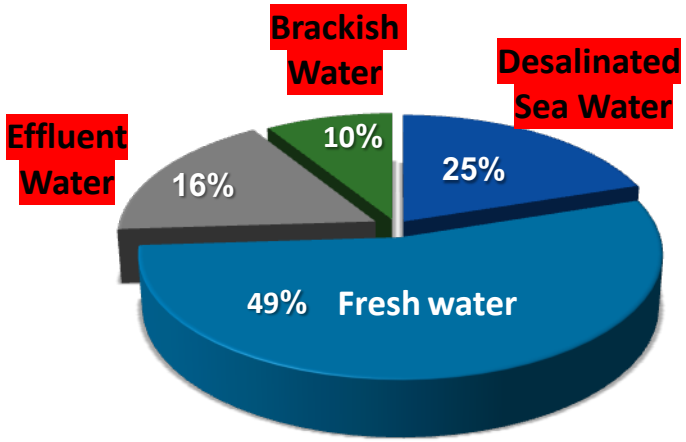
Cost?

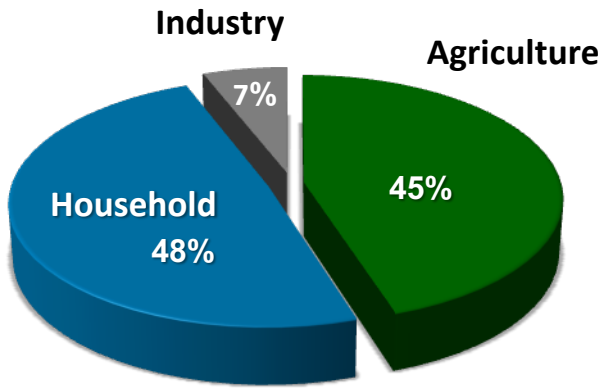
Dramatic change in drinking water qaulity and the local water cycle (less Ca, Mg; dilution with contaminated GW wells)

Does the desal water affect metal pipe – is Pb leaching occurs?

The Uniqueness of Israel's Water Supply System

The Supply of Water for Various Uses/Sectors





1.4 billion m^3 water supplied per annum

70% of the total water supply in Israel

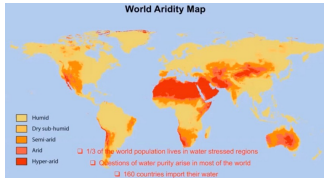
Data by Israel Water Authority

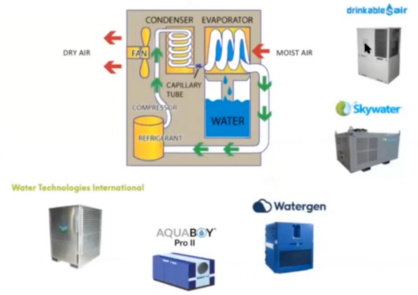
3) Applying technologies

Home-scale solutions

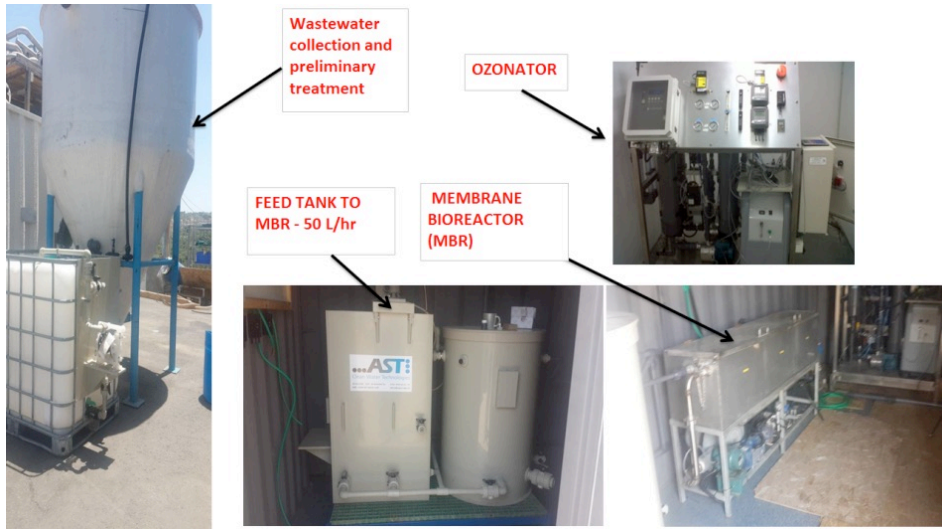


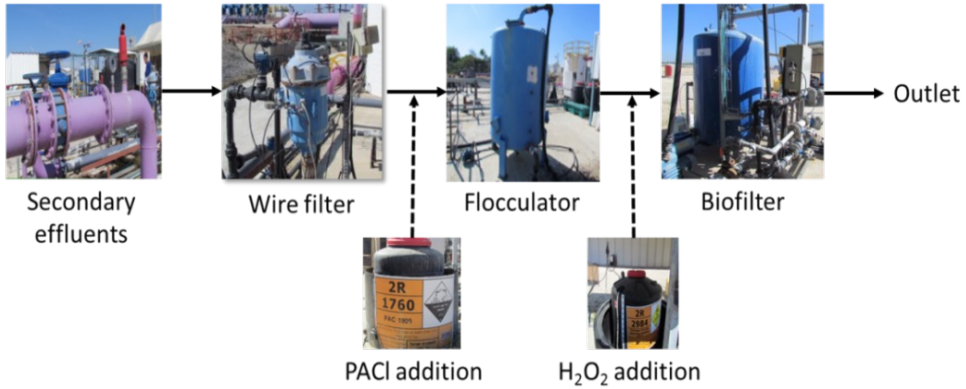

Producing water from the atmosphere

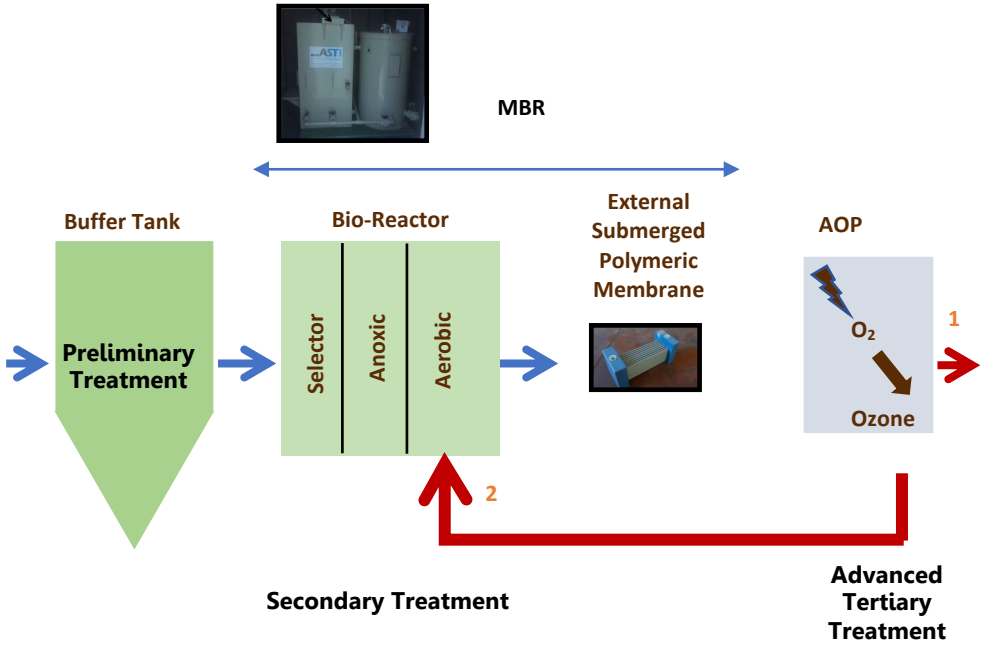




Developing innovative technologies:





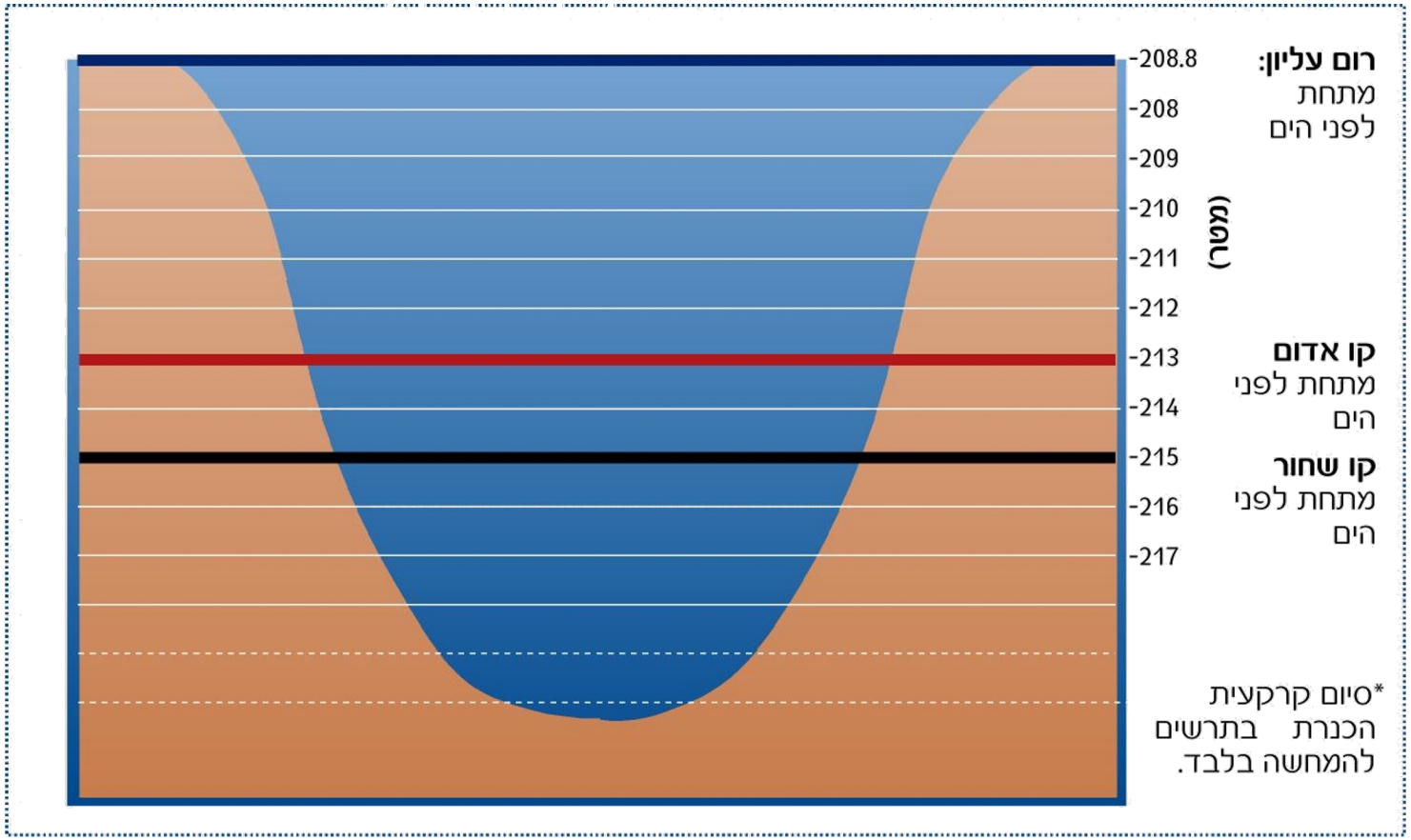


Q & A

நன்றி

Asante sana

Water level – how to pump?

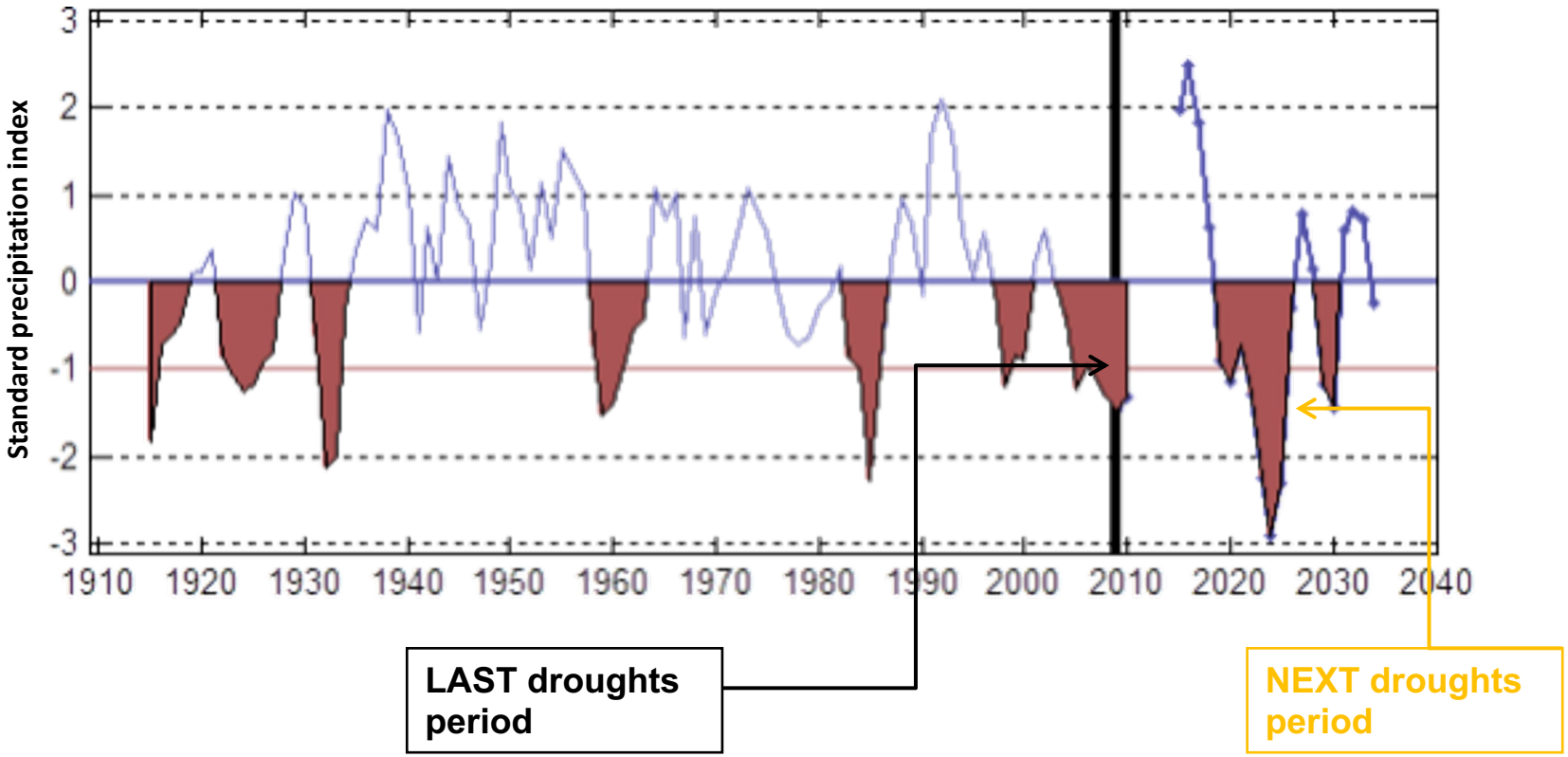


Lower level (red line): Permitted according to regulations is 213 m below sea level.
Any drop below this line could upset the salt and the ecological balance of the Sea of Galilee. In years of drought the Water Commissioner decides, depending on the state of the reservoirs, whether to lower the red line for a limited period of time

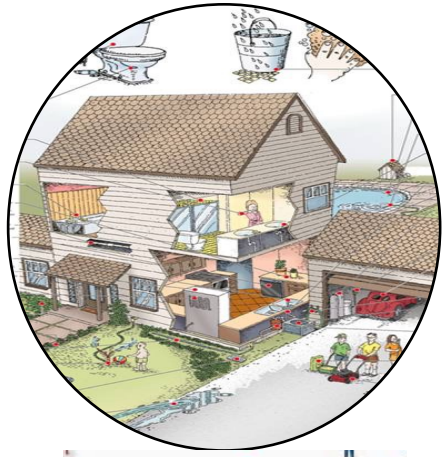
Lower level (Black line): It was assumed that this level is a dangerously low level that can create irreversible ecological problems, including an increase in the water's salinity and algae blooms.

Simulated and expected droughts

Drought magnetite, intensity and duration are expected to increase in the future



Annual Water Supply - 2 billion m^3

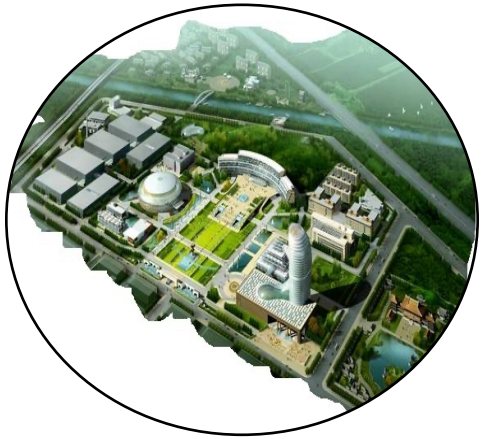


9 million

Residents

Over 200,000 Hectares

Irrigated Fields



Over 1,000

Industrial Plants

Data by Israel Water Authority

Past:

Ministry of Agriculture

Israel Water commissioner

Today (changed in 2000's):

Ministry of Infrastructures, Energy and Water

Israel Water Authority

Consumers

- Agriculture
- Nature
- Households
- Industry
- Future Generations
- Jordan Palestinian Authority Gaza Strip

Suppliers

- Mekorot
- Regional & Municipal Water Utilities

Data by Israel Water Authority

Comprehensive Solutions

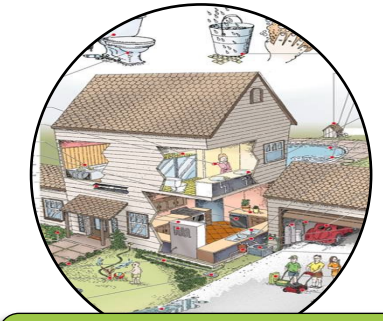
- Governance & Regulation
- Integrated Water Resources Management
- Reuse of treated effluents
- Brackish water for agriculture and industry
- Seawater and brackish water desalination
- Development of the national and regional infrastructure

Data by Israel Water Authority

Water resources ⟵ ⚖ ⟶ Water consumption

Israel:

Annual Aquifer recharge 1700 MCM Actual need 2200 MCM Gap: ~500 MCM
Population growth – needs more water
Export water for peace agreements (Jordan)
Contamination process – decrease the available water



Domestic consumption 32%

Agricultural irrigation 50%

Industry 18%

How do we fill the gap? **Producing alternative water sources**

Improve & maintain the natural water sources; Reclaimed – reuse water; Desalination; Adopted technologies

Raw wastewater is WORLDWIDE "number 1" **source of pollution**, Contaminates various and many water sources such as:

- ✓ **Rivers, streams:** **source for** drinking water, irrigation, food, transport, recreation & tourism, natural aquatic ecosystem
- ✓ **Lakes:** **source for** drinking water, irrigation, food, transport, recreation & tourism, natural aquatic ecosystem
- ✓ **Groundwater:** **source for** main source for drinking water, agricultural irrigation (food production)
- ✓ **Seawater:** **source for** food, recreation & tourism, natural marine ecosystem

The contaminants/materials constitute only: 0.1-1 % in raw wastewater!!

The rest is water! Raw wastewater (sewage) = 99%- 99.9% water

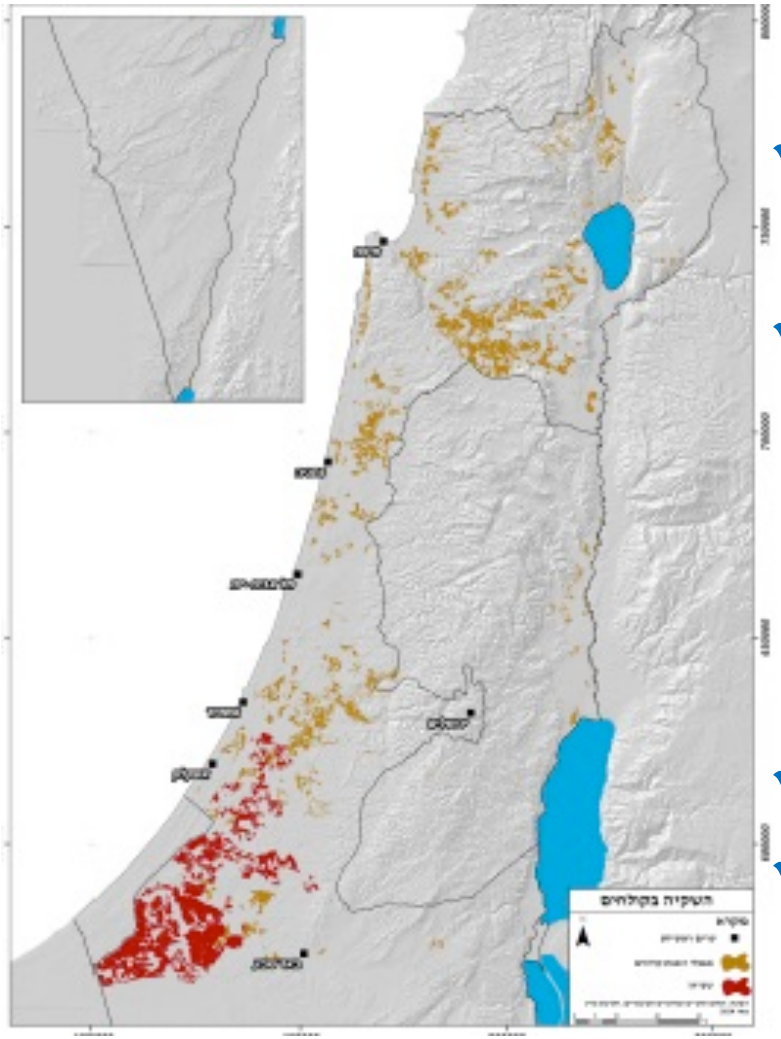
Results in…

- ✓ **The need** - Increasing need for water reuse (Treated/Reclaimed wastewater)
- ✓ **The source** – Wastewater (from 3 sectors) as a major source
- ✓ **The risk** – **contaminants still exist** in treated wastewater (effluent) as persistent compounds, which are not easily & sufficiently biodegraded

1) WW recycling revolution

3R's: Reuse, Recycle and Reduce

Regions of effluent irrigation



- ✓ 1992 revolution
- ✓ Effluent recycling as an additional water resource
  (3/4 from domestic use becomes WW).
  it is an indipendent source (droughts, shortage) –
  Became the main source for agriculture irrigation
- ✓ Consequently, more available fresh water for drinking
- ✓ Eliminated the # 1 environmental threat

The need & the source: Wastewater reuse in Israel

- ✓More than 98% of WW is treated
- ✓More than 85% of treated WW is reused after secondary and tertiary treatment for irrigation (for both, non-potable and potable reuse)






Israeli agricultural use 2010 vs 2050