

**FOOD, WATER AND ENERGY
IN THE ARAVA VALLEY:
TURNING DISADVANTAGE TO ADVANTAGE IN THE
HYPER-ARID CLIMATE OF THE REGION**

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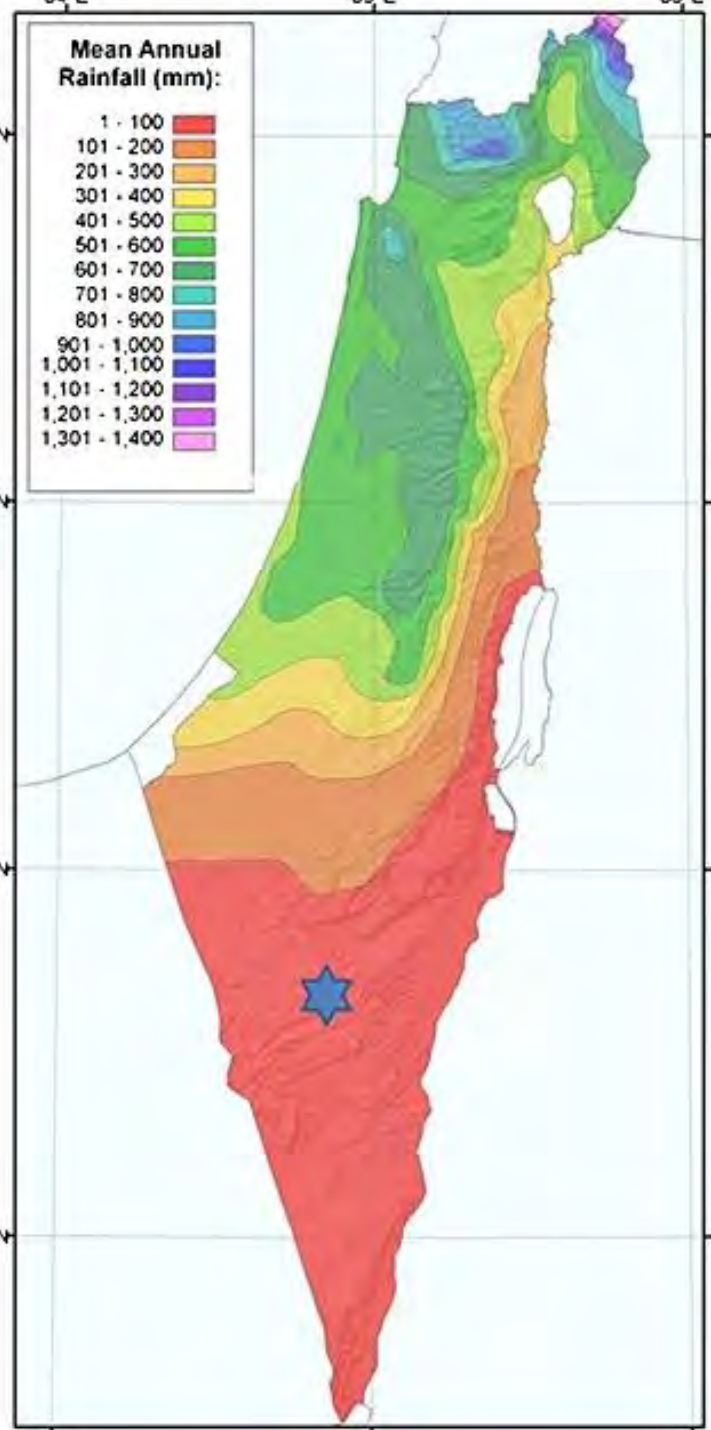
ISRAEL AN OVER-PROMISED LAND

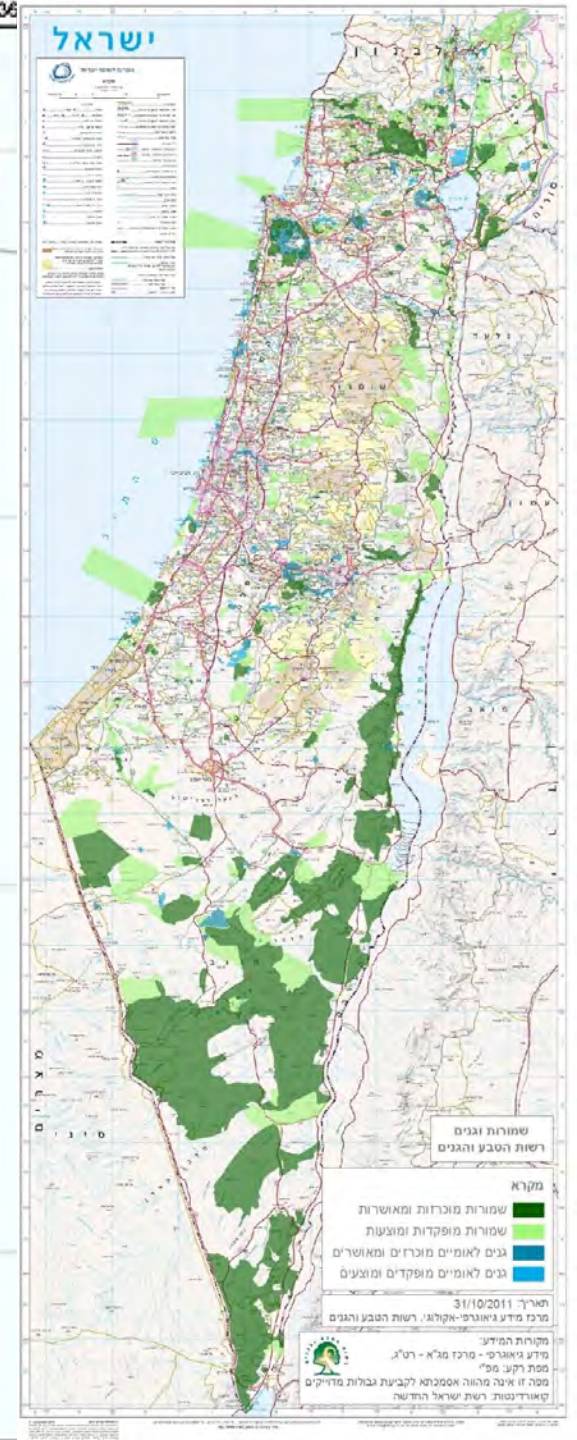
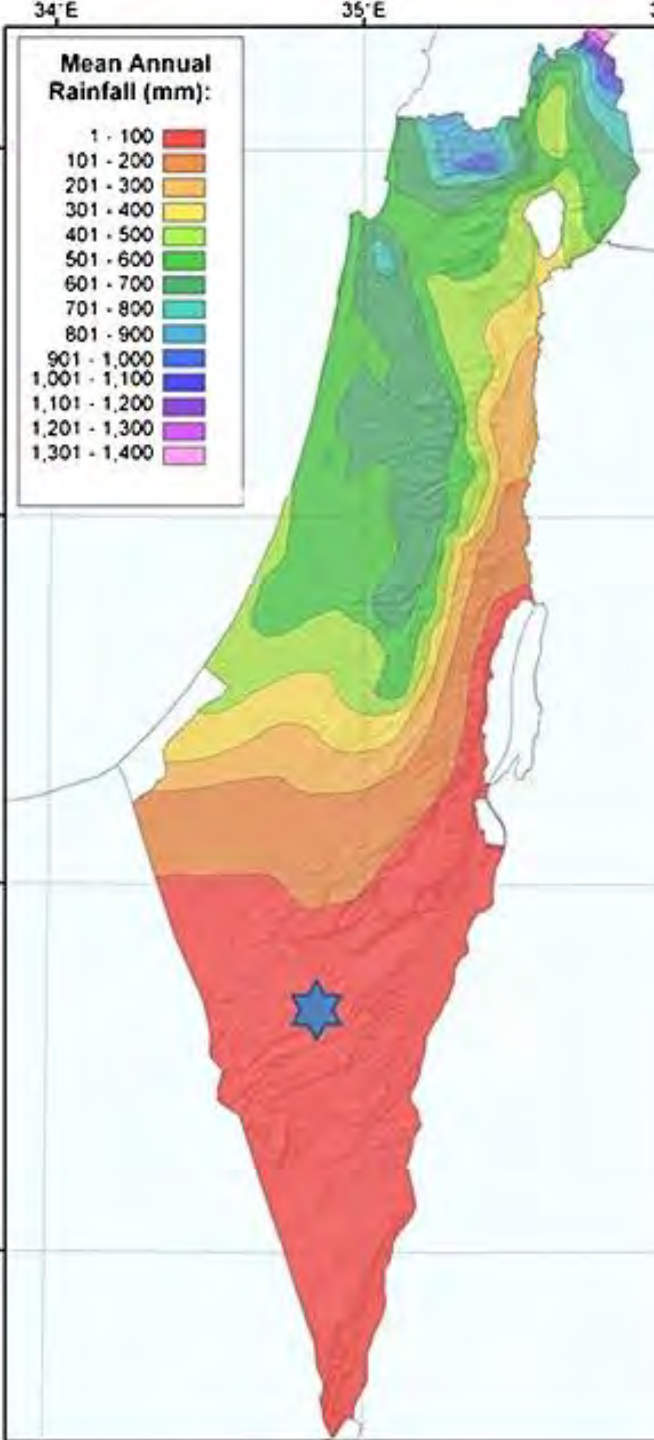
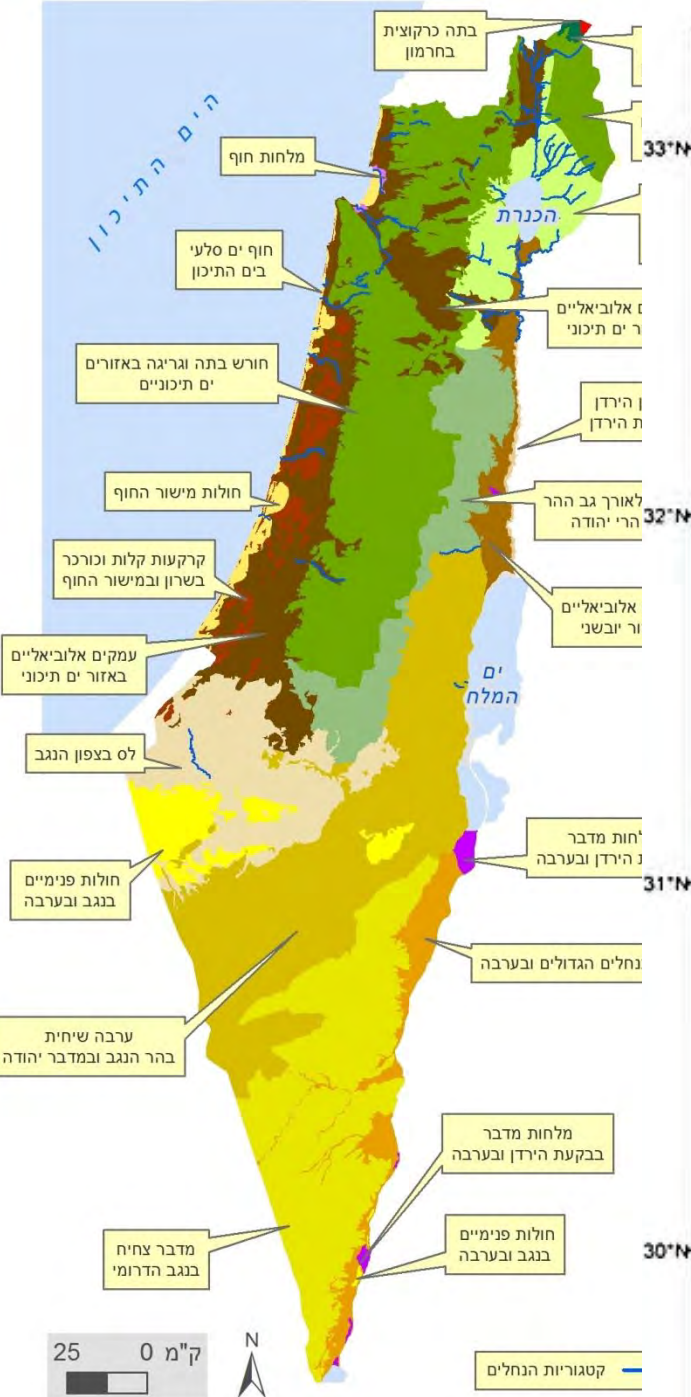
Conservation vs. Development Israeli Palestinian Conflict

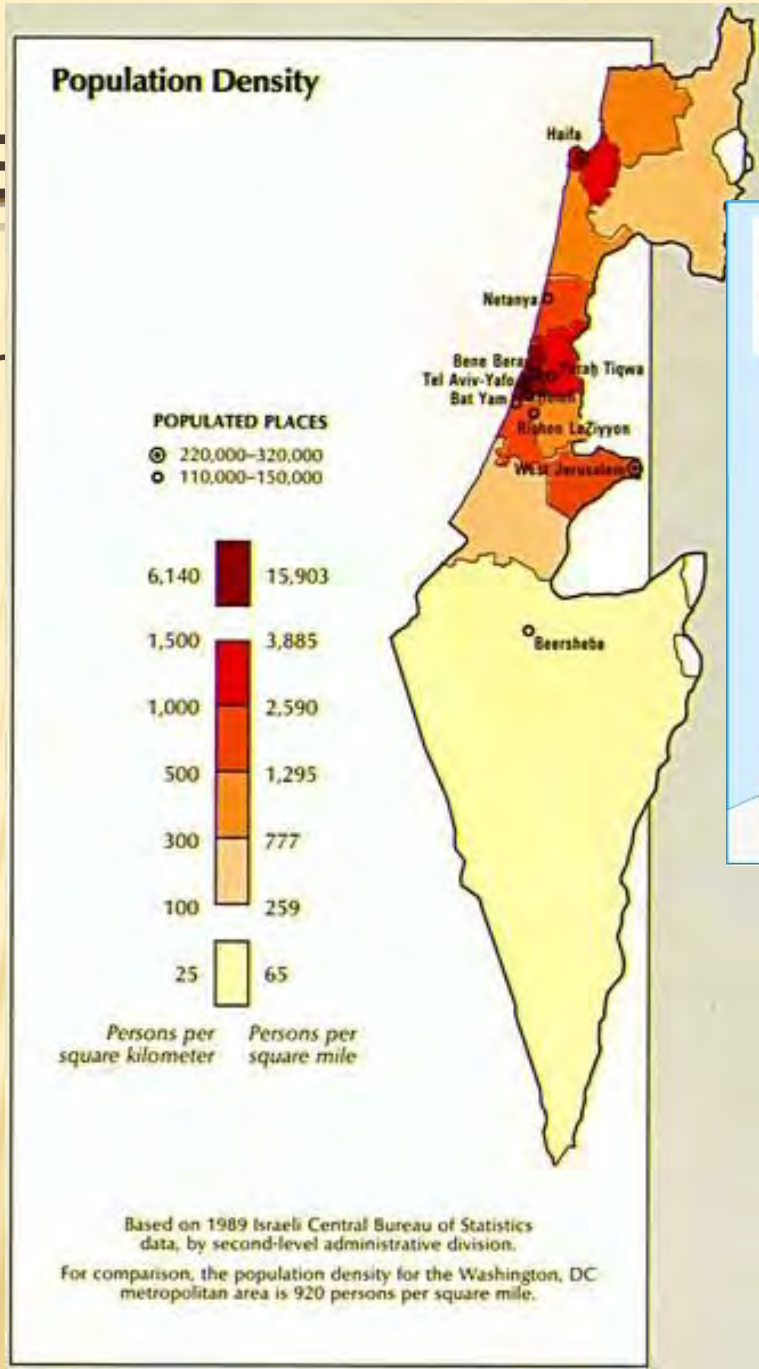
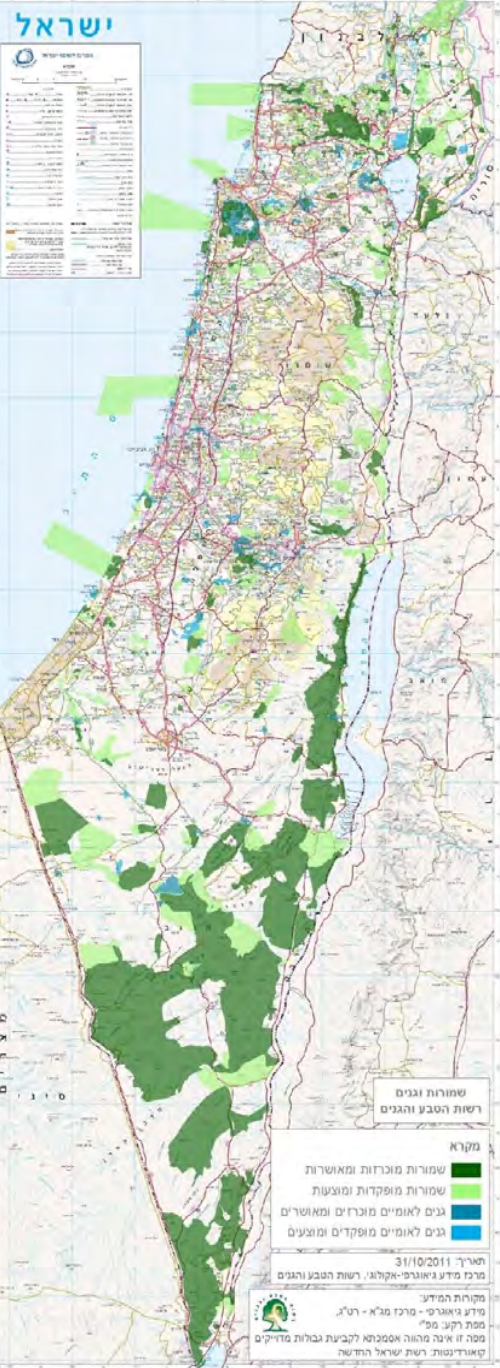
- + Israel - 21,000 km²
- + West Bank & Gaza - 6,000 km²
- + Arizona - 295,000 km²
- + Pima County - 24,000 km²

TH

Co







LAND



THE OVER-PROMISED LAND

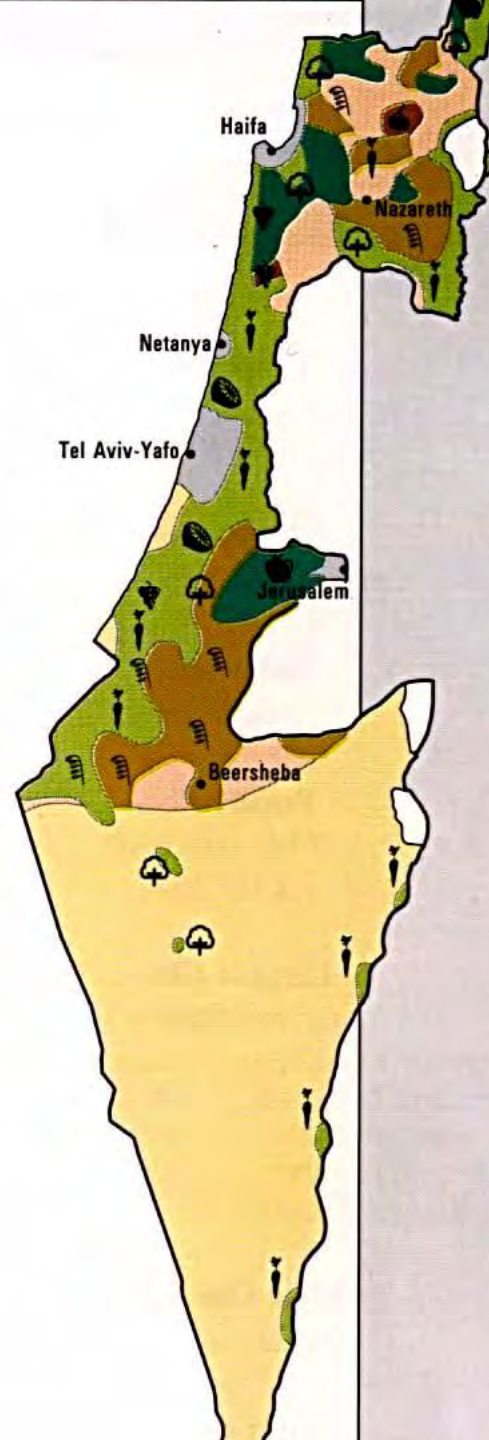
Agriculture in Israel

- ✘ 20% of Israel's land is cultivated
- ✘ 1,000 MCM water – 75% treated waste water
- ✘ 2% of GDP 3.5% of exports
- ✘ Agriculture produces 95% of Israel's needs
- ✘ 4% of workforce – foreign laborers

THE

Land Use

-  Woodland/forest
-  Permanent crops
-  Arable land
-  Irrigated farming
-  Rough grazing/subsistence farming
-  Wasteland
-  Urban or built-up area
-  Cereals (wheat and barley)
-  Citrus
-  Cotton
-  Fruit
-  Grapes
-  Olives
-  Vegetables



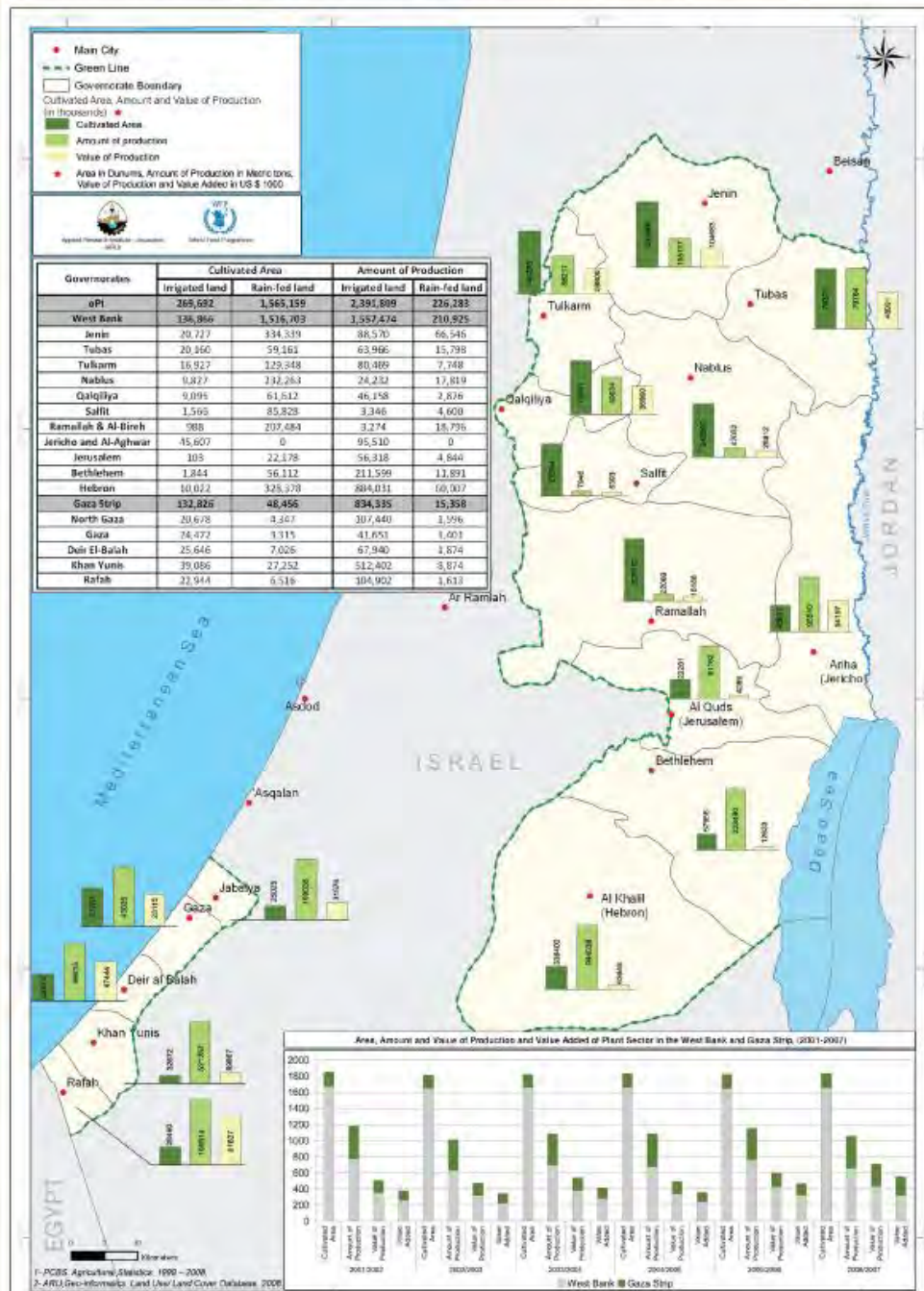


THE OVER-PROMISED LAND

Agriculture in Palestine

- ✘ 26% of Palestine's land is cultivated
- ✘ 150 MCM water – 70 MCM WB 80 MCM Gaza
- ✘ 5% of GDP decreasing
- ✘ Agriculture produces 66% of Palestinian's needs
- ✘ 13.4% of workforce – 90% informally

*CEPR Memo





THE OVER-PROMISED LAND

The Over-Populated Land



THE OVER-PROMISED LAND

Conclusions

- ✘ Cooperation between Agriculture and Conservation to preserve open space
- ✘ Cooperation between Israel and Palestine to maximize the benefit of scarce shared resources

Chronic Water Scarcity in the ME

**In accordance with physical water supply,
availability is:**

Israel => 300 m³/cap/yr

Jordan => 230 m³/cap/yr

Palestinians => 95 m³/cap/yr

Lebanon => 1,300 m³/cap/yr

For Reference:

<1000 m³/cap/yr - Water Poor

<500 m³/cap/yr - Chronic Water Scarcity

U.S. => 9,710 m³/cap/yr



ANNUAL PRECIPITATION (MM)

>700

600-700

500-600

400-500

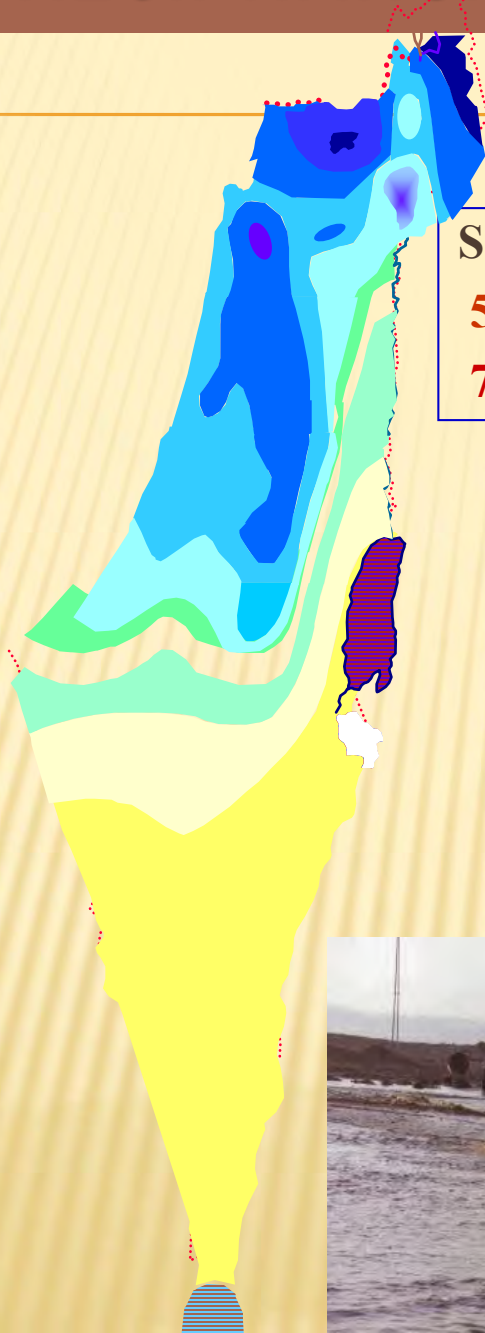
300-400

200-300

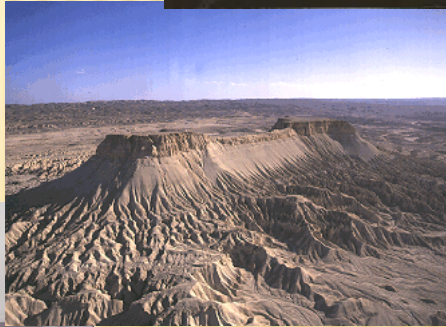
100-200

50-100

<50



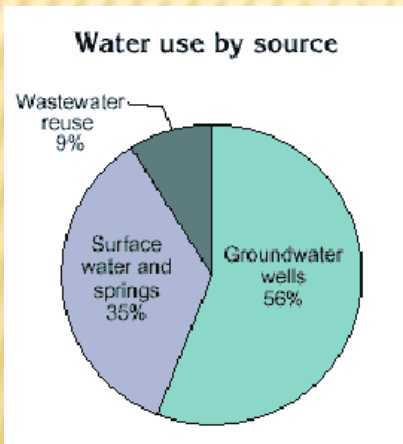
Seasonal variations:
5 - Months RAINY
7 - Months DRY



SOURCES OF WATER

3 Major Sources:

- Jordan River System / Kinneret
- Mountain Aquifer
- Coastal Aquifer

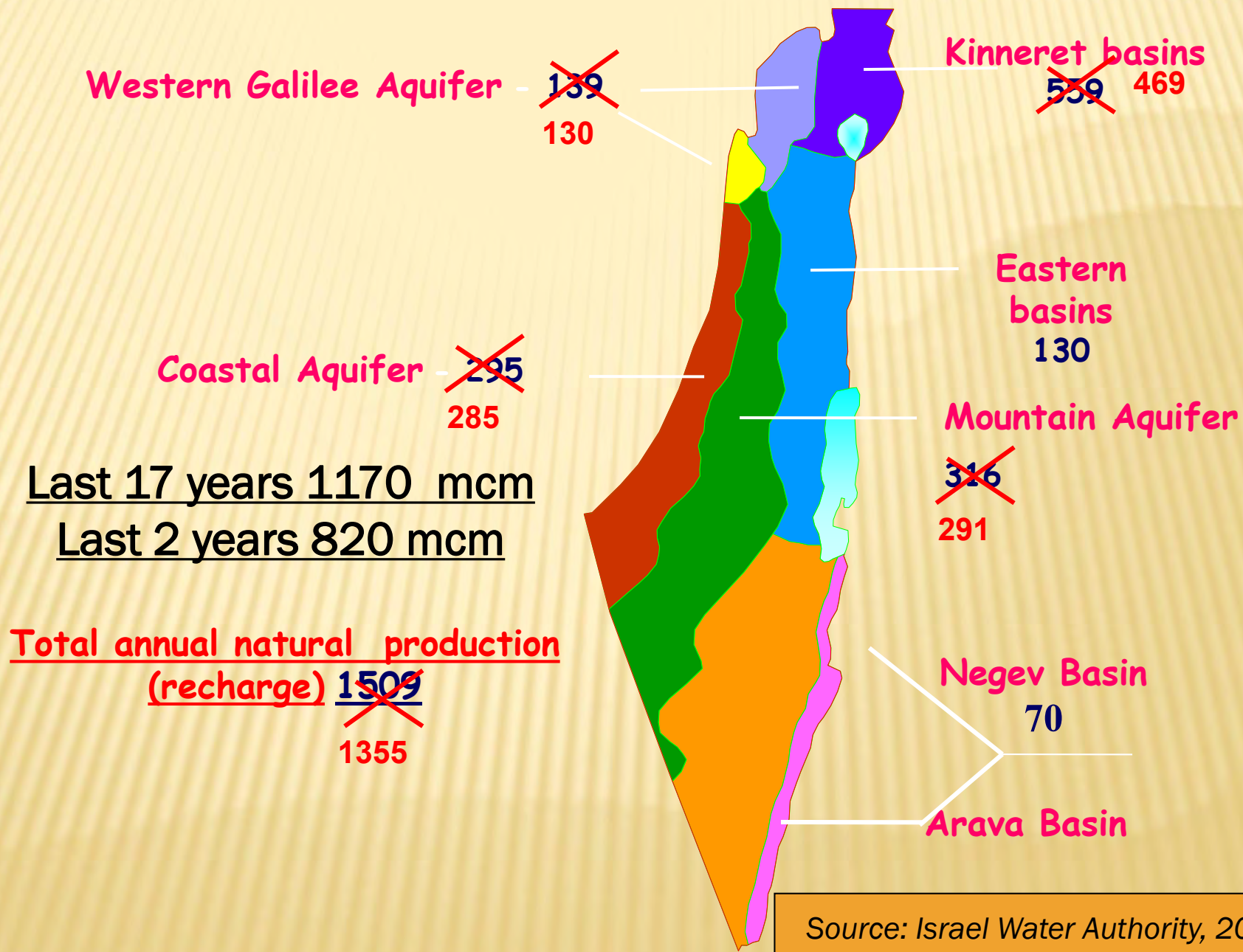


Basing on: Assaf, Karen; al Khatib, Nader; Kally, Elisha; Shuval, Hillel.
A Proposal for the Development of a Regional Water Master Plan.
IPCR: Jerusalem 1993.



Source: Israel Atlas

Past and Present Projected Israeli Water Supply (in MCM)



Source: Israel Water Authority, 2008

WATER RESOURCES



WATER DEMAND

Average total natural enrichment – 1.170 billion m³/annum

Water demand – more than 2 billion m³/annum

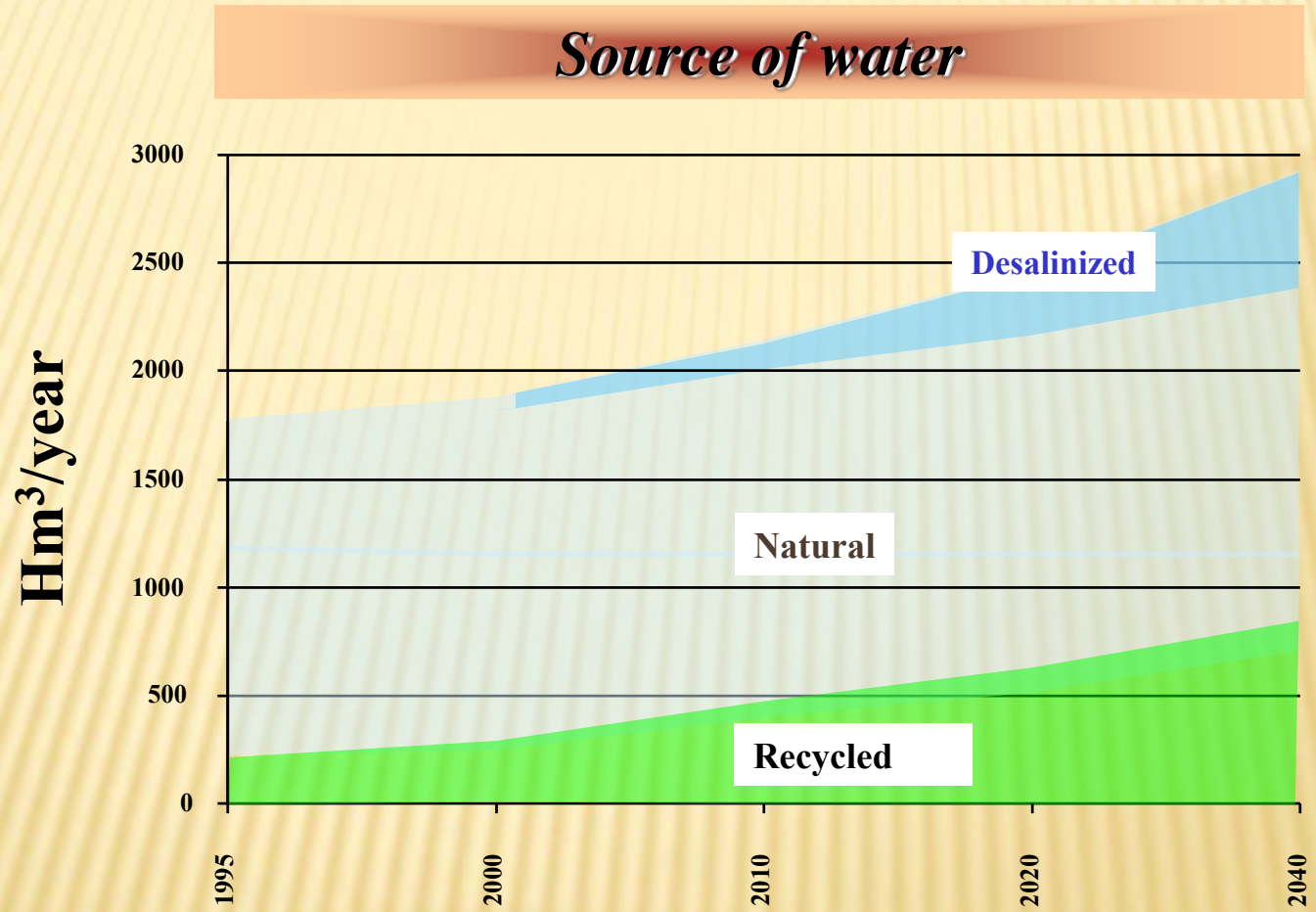
Current potable water demand ~ 1.2 billion m³/annum

Forecast for potable water demand:

- 2020 ~ 1.7 billion m³/annum
- 2030 ~ 1.95 billion m³/annum
- 2040 ~ 2.2 billion m³/annum
- 2050 ~ 2.45 billion m³/annum



SUPPLY

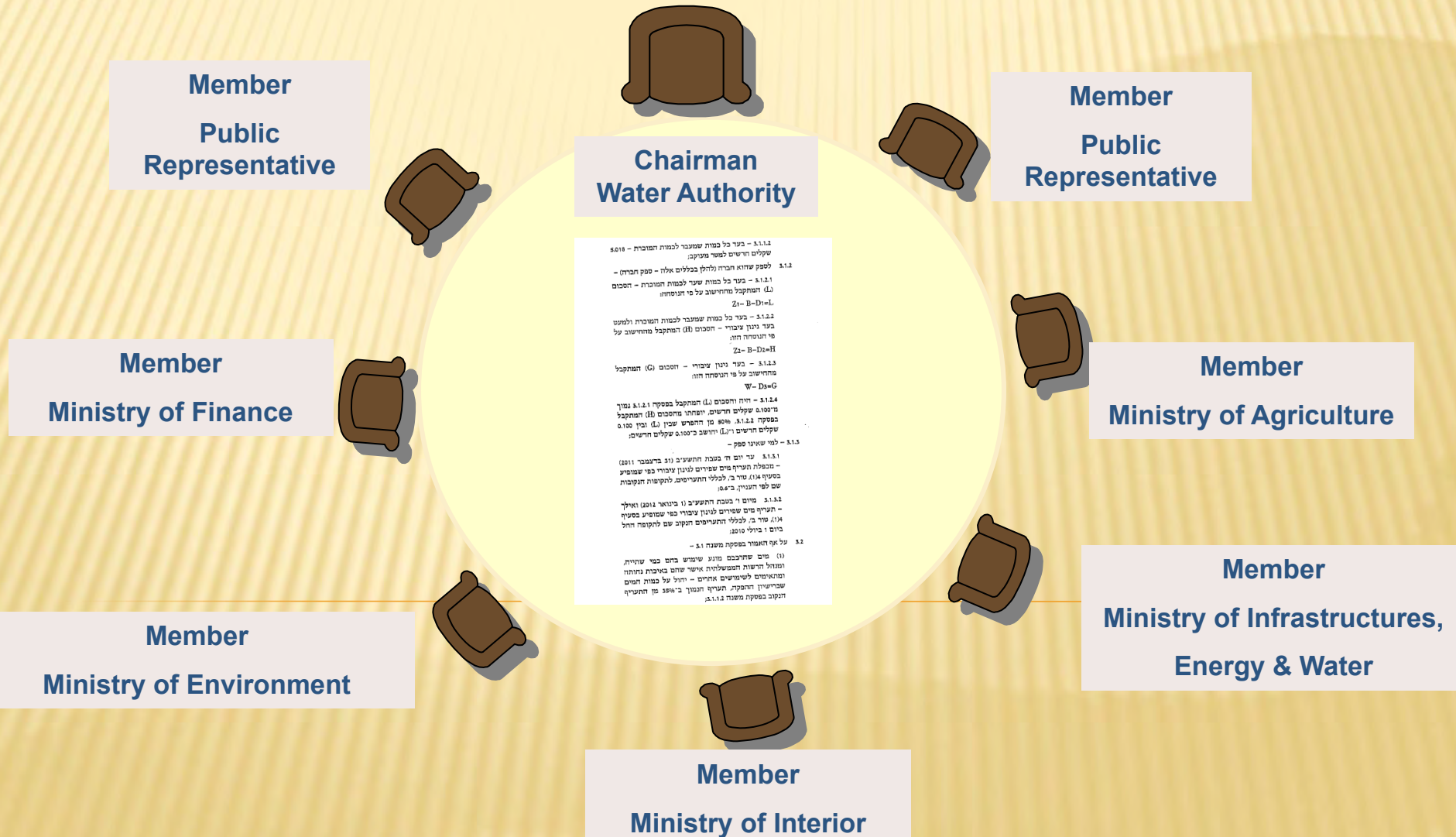


HYDRAULIC MISSION

- ✘ Pre-State Mekorot subsumed into state structure in 1948.
- ✘ Mekorot manages and distributes water.
- ✘ Mandate laws inherited, added to in 1955
- ✘ All water laws recodified in 1959 Water Law
 - + Water as property of the state
 - + Water law required full monitoring of water
 - + Established role of Water Commissioner with power to allocate water
 - + Water Commissioner part of Ministry of Agriculture, then Ministry of National Infrastructure

Water Authority Board

ONE table for decision making



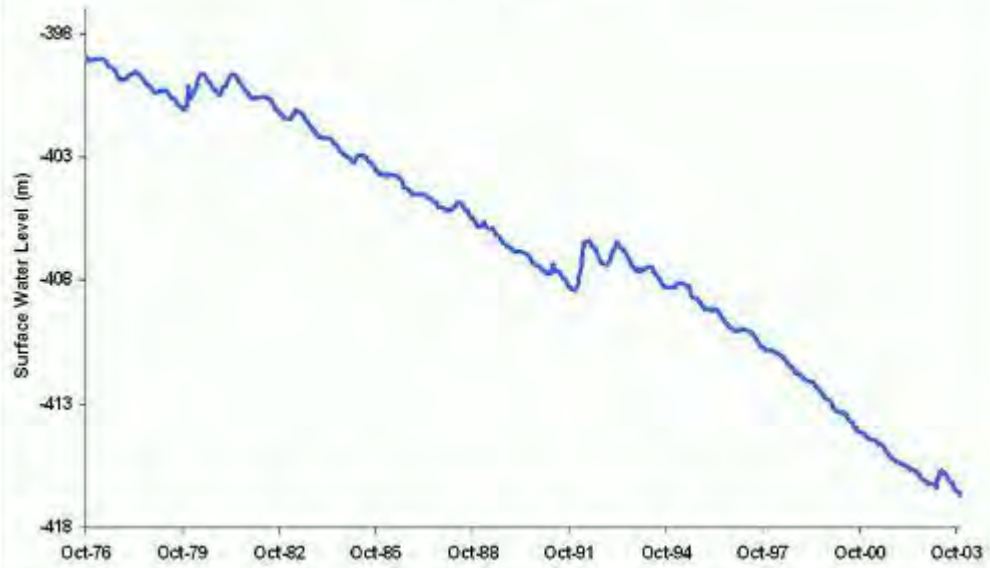
Environmental Costs of the National Water Carrier



- **Diminished flows to the Jordan River**
- **Shrinking of the Dead Sea**
- **Degradation of Water Quality in Sea of Galilee**

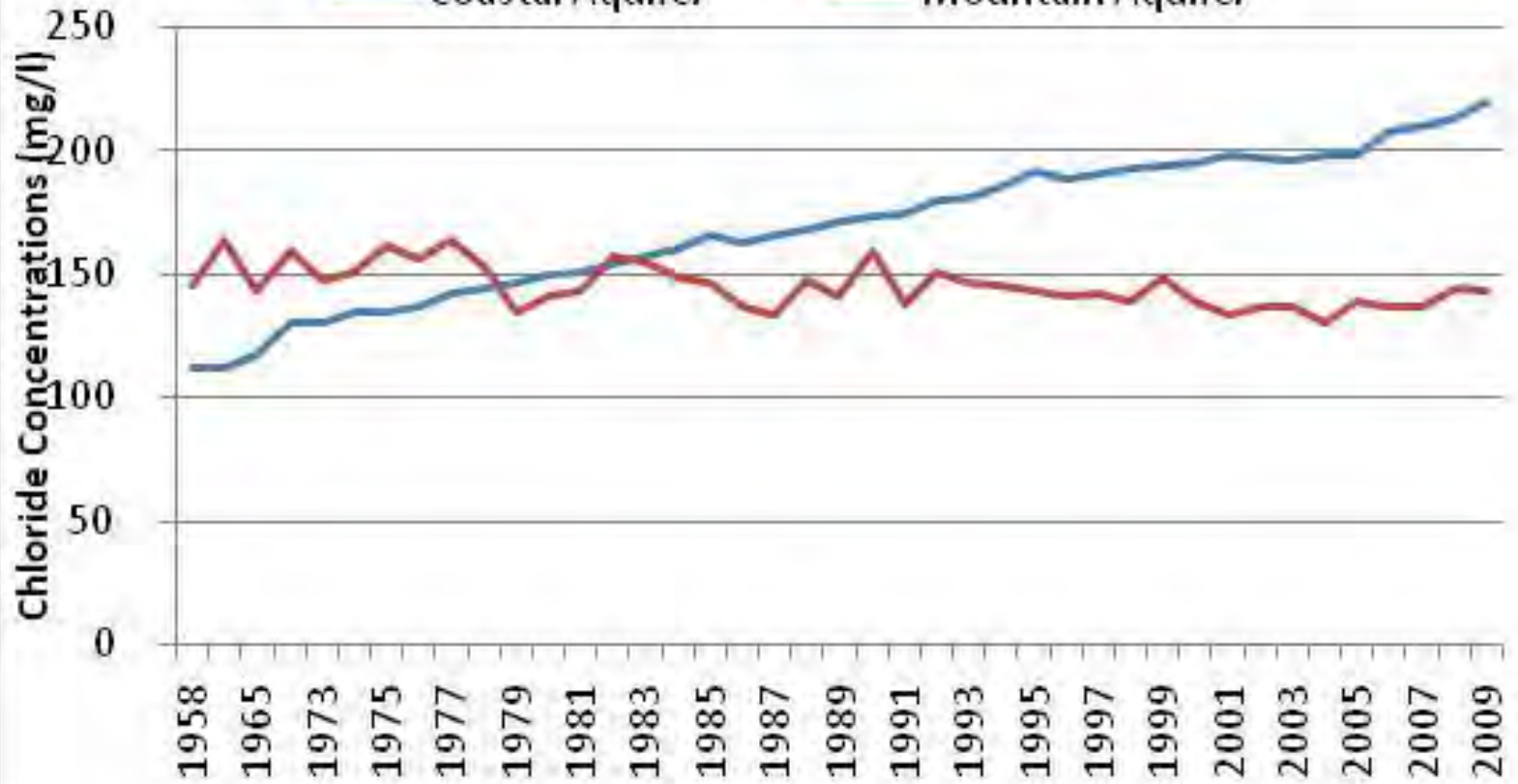


Dead Sea Surface Water Level



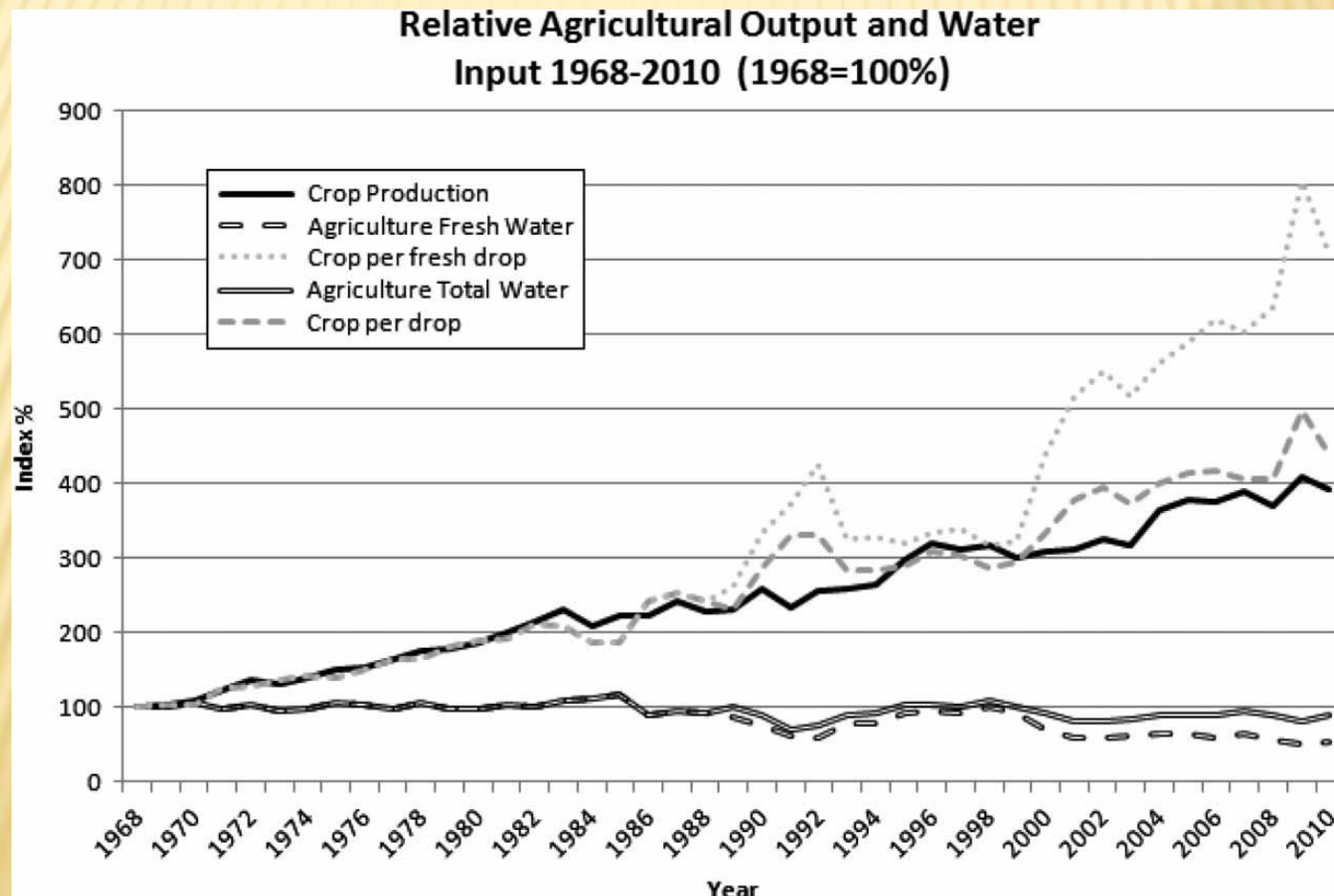
Salt Concentrations in Aquifers

— Coastal Aquifer — Mountain Aquifer



AGRICULTURAL EFFICIENCY

- ✘ Ongoing since 1960s (when major water expansion ended)
- ✘ Enables agricultural industry to grow without growing water



Moving from inefficient irrigation, e.g. Lateral Moves.....



Near Haifa, 2010

... To more efficient technologies, e.g. Drip irrigation



Israel is Drying Up



The Desalination Revolution

ISRAEL: THE WORLD'S LARGEST DESALINATION PLANTS

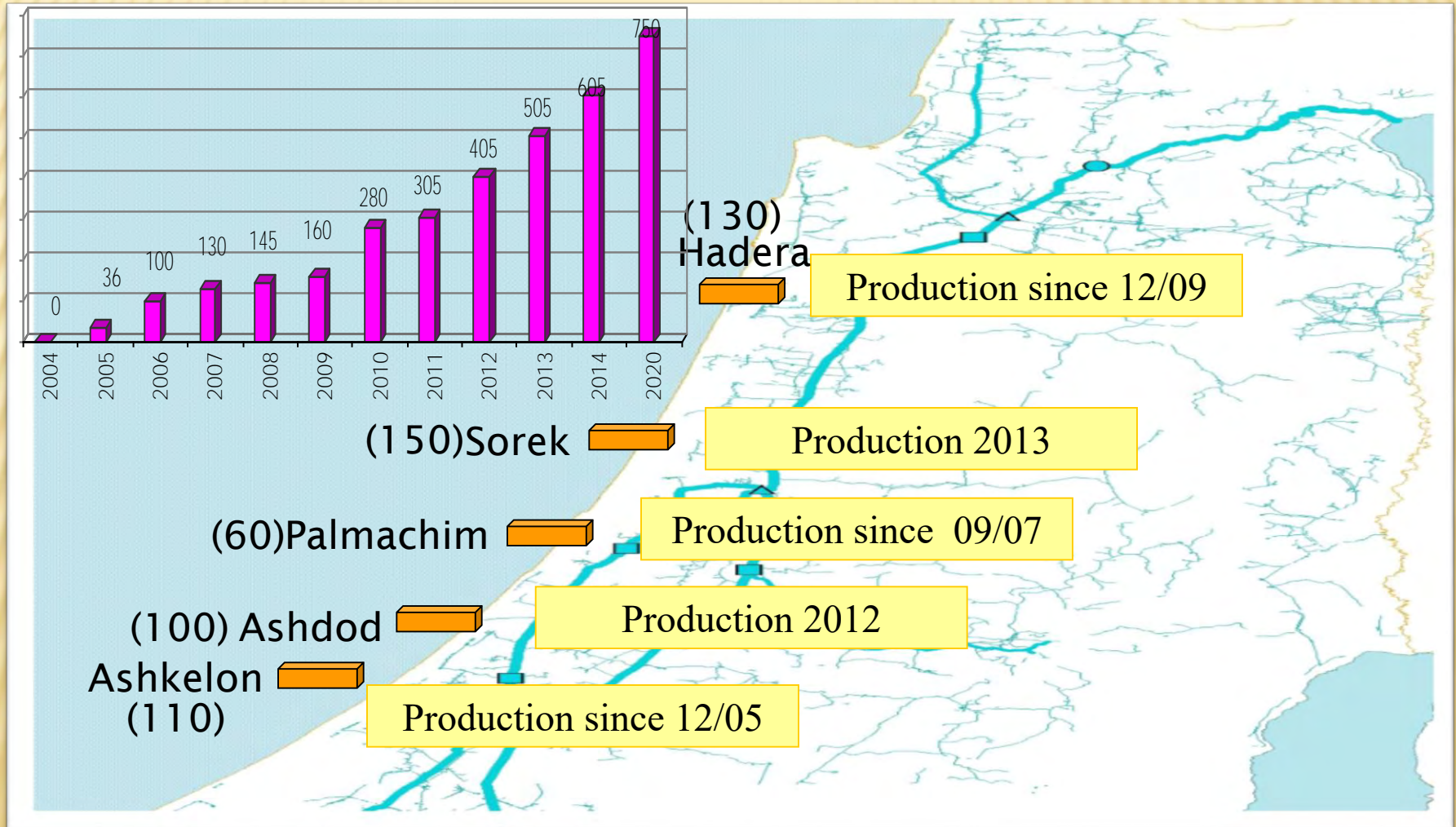
Ashkelon: 100m³ per year

Soreq: 150m³ per year



Desalination in Israel

In 2017, desalination plants will supply 80% of the domestic water consumption



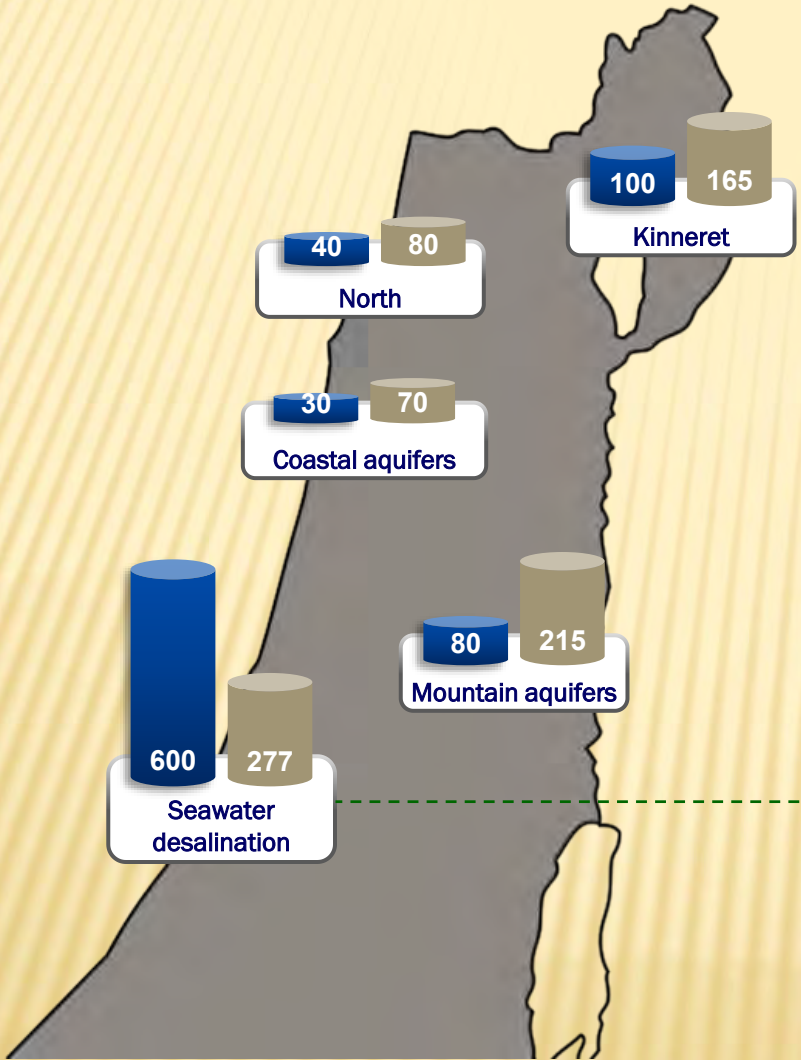
Sea Water Desalination





Year	MCM/year
2005	100
2010	365
2015	500
2020	650

The Water Revolution in Israel

New Era



 Main water resources (Mm³) in the national system in **2010**

 Main water resources (Mm³) in the national system in **2014**

In 2015, 65%-80% of the drinking water in Israel will be supplied by desalination

DESALINATION ENVIRONMENTAL IMPACTS

Good 😊

- ✘ Reduce stress on natural supplies
- ✘ Enable environmental flows/rehabilitation
- ✘ On Demand (reduce storage and evaporation)

Bads 😞

- Energy intensive (fossil fuels)
- Brine disposal at sea
- Impact on coastal environment and prime real estate

WASTEWATER REVOLUTION



Enter: Wastewater Reuse

Number of Large WWTP's in Israel:

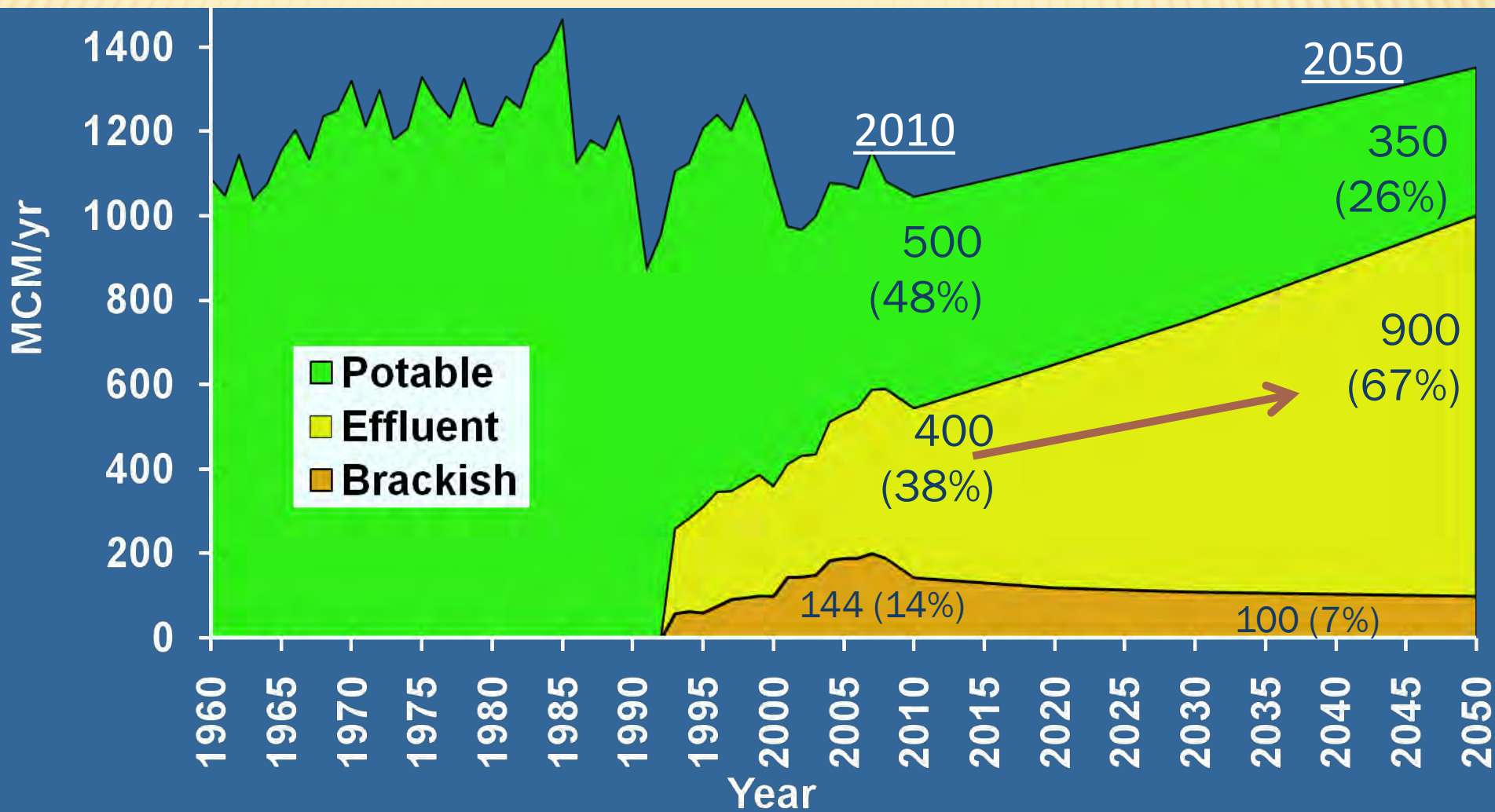
- 1998 - 15
- 2002 - 28
- 2005 - 32

**~ 80% of the total
amount of
wastewater are
treated to at least a
secondary level**



The Jerusalem wastewater treatment plant
2003

NATIONAL CONSUMPTION: AGRICULTURAL SECTOR



If effluent were not used in agriculture, desalinated water production would be required (a more costly alternative) to supply the agricultural sector's needs.

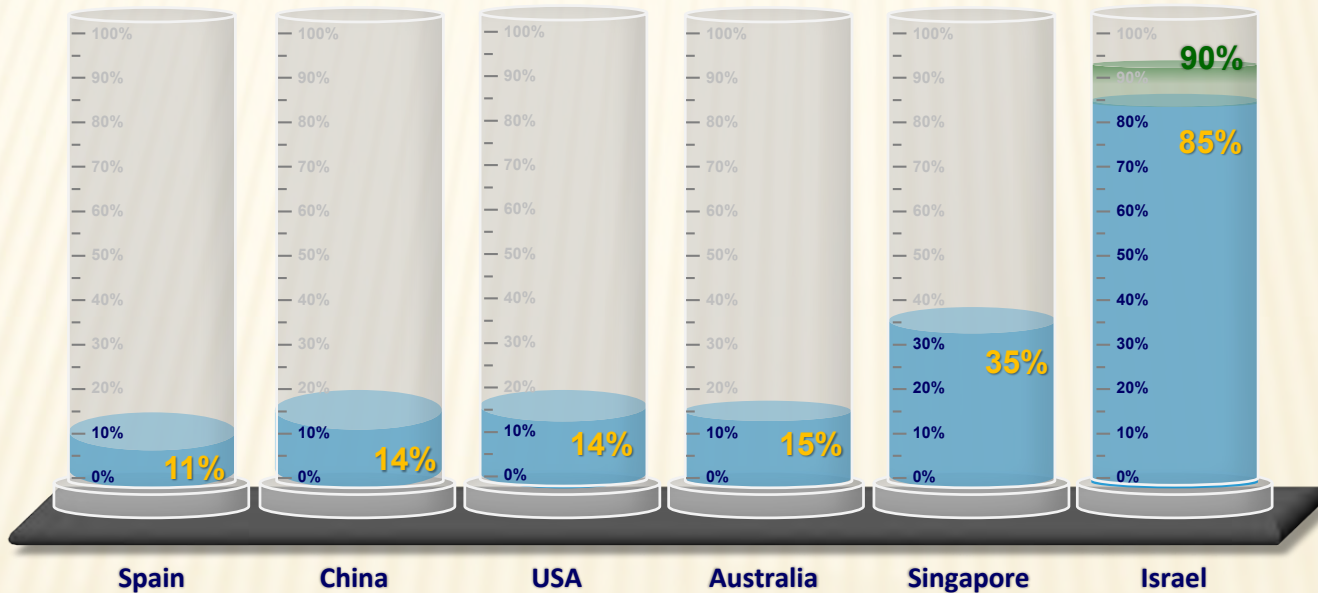
Wastewater Treatment and Effluent Reclamation

Reclamation of 85% of all the effluent in Israel, for agriculture and irrigation.

Ability to supply all the agricultural needs

Quarterly wastewater treatment by means of ultra filtration and desalination

The Goal:
90%
Reclamation



*GWI Municipal Water Reuse Markets 2010

GOODS AND BADS OF EFFLUENT

Good 😊

- ✗ More Water and reduced pressure on natural resources
- ✗ Less sewage impact on rivers and sea
- ✗ Cheaper than desalination
- ✗ Nutrients for agriculture
- ✗ Reduce standing water (mosquitoes etc)
- ✗ Centralised treatment helps public health (Health ministry bans reuse in home)
- ✗ Constant supply for agriculture

Bads 😞

- Possible microorganisms contaminant in crops?
- Hormonal impact on consumers?
- Unknown residual impact on soil/groundwater (dillution)
- Evaporation from storage lagoons



Floodwater Reservoir

Floodwater can be used for 2 purpose:

1. Aquifer recharge

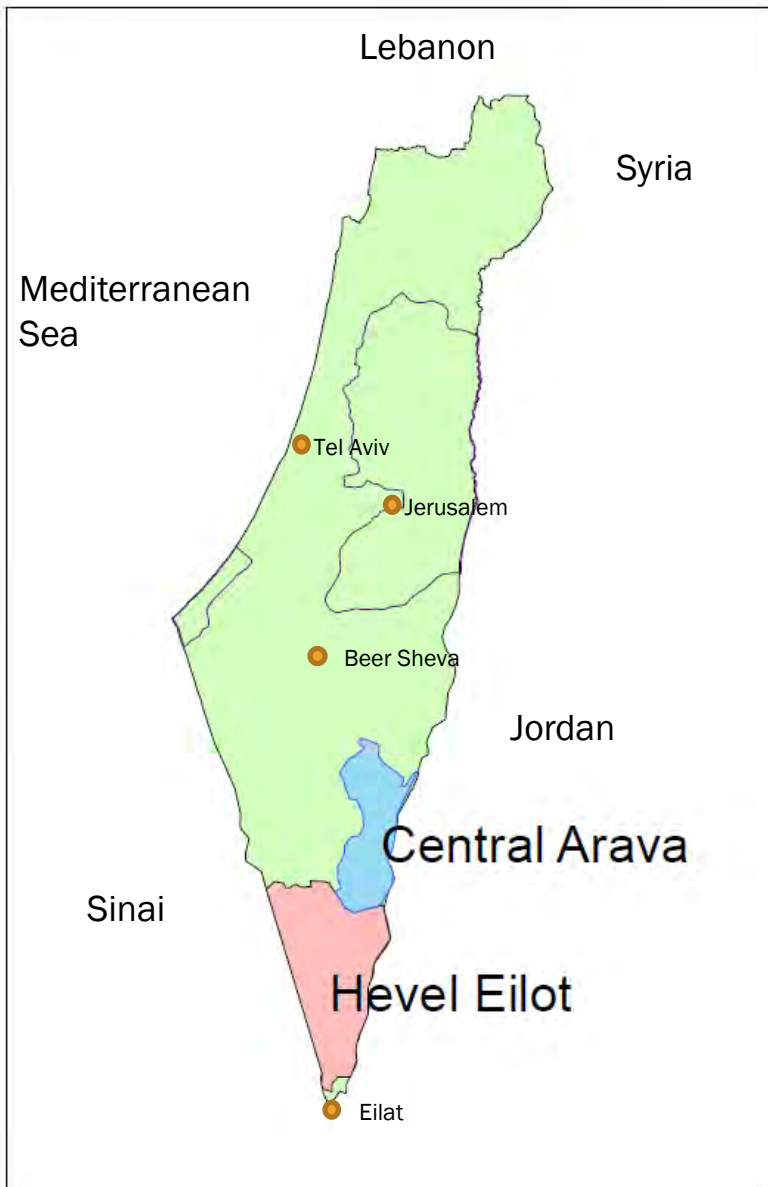
2. Impound floodwaters



TWO REGIONAL COUNCILS IN THE ARAVA VALLEY



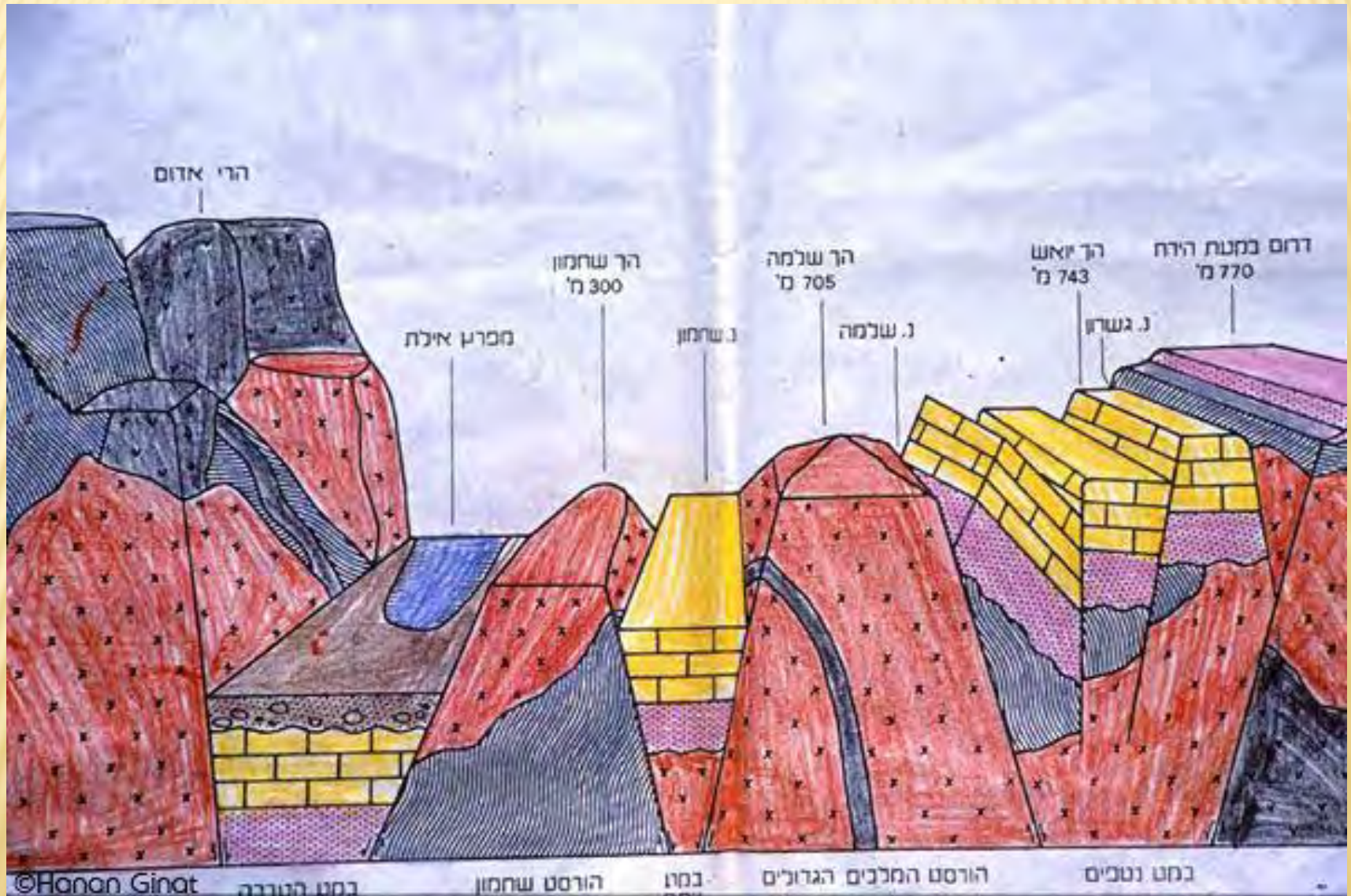
המועצה האזורית הערבה התיכונה



	Central Arava	Hevel Eilat
Area	1,400 km ²	2,650 km ²
Percent of Israel	6.7%	12.6%
Population	3,600	4,500
Population of Israel	8,380,000	
Communities	7	12
Agriculture	Vegetables & Dairy	Dates & Dairy
Other Industries	Tourism	Tourism & Renewable Energy

Sources of Water in the Arava Valley







The Arava Valley



המועצה האזורית הערבה התיכונה

Challenges

Opportunities

Climate

- Arid desert, less than 20 mm rainfall annually
- Long & hot summers 120 °F

- High radiation - long seasonal farming
- Low humidity - less plant diseases
- Climate appropriate tourism most of the year

Isolation

- Long distance to market & distribution centers
- Long distance from centers of business, culture and government

- Quiet, un-crowded undisturbed natural landscapes
- Pest free area
- Quality of Life

Water

- Not connected to national water grid
- Poor & limited water quality & quantity

- Efficient water use
- Drip irrigation - Max production with minimum water use
- Desalination – Red Sea





Arava Valley Agriculture

- Cooperative farming producing 60% of Israel fresh vegetable export
- Israel's leading date producing region – 16% of Israel's Madjool Dates
- World leader in advanced desert agriculture
- Prime example effective water use
- Around 150,000 tons of fruits and vegetables and 5,200 tons of Madjool Dates produced every year.
- Peppers, eggplants, tomatoes, watermelons, melons, onions, mangos, grapes, pineapples, guayabas, squash, lettuce
- Responsible for 80% of Israel's ornamental fish export.
- Producing millions of fingerlings Sea Bream and Sea Bass in Eilat

All these despite a rainfall of less than 1 inch per year



Agricultural Research & Development



Arava Agricultural R&D Centers

Applied research to serve the needs of regional agriculture and farmers in the Arava

Research & Development Centers established in 1985 by the Jewish Agency and the Ministry of Agriculture. Today with the support of the JNF these unique research institutes combine practical research in the fields of Sustainable Agriculture, Water & Soil Management, Desert Plants Research, Aquaculture, Biotechnology and Date Farming

Providing critical knowledge to the regional farming community as well as to other developing countries around the world.

DEPARTMENTS:

Vegetables

Orchard

New Crops

Soil & Water

Post
Harvest

Aquaculture

Plant Protection



Making the desert bloom



The righteous shall flourish as the date..





Desert Tourism



