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National Institute for Agricultural Economics (INEA)
Water Policies and Irrigation Water Management in the Mediterranean Area
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Irrigation Water Management in Palestinian Agricultural Sector: Strategies and Policies

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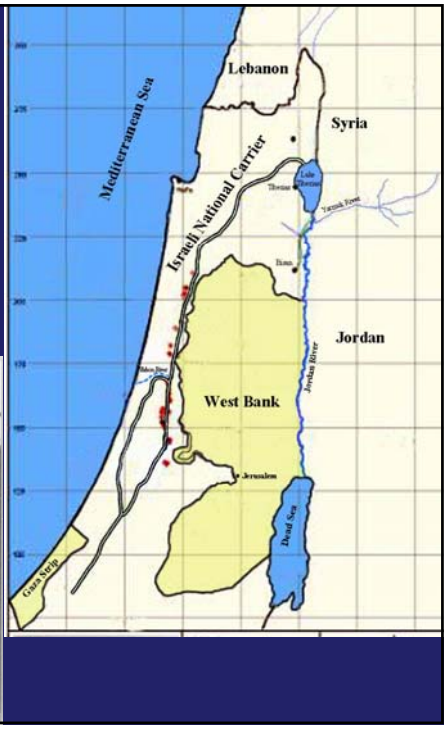
Water Resources in Palestine

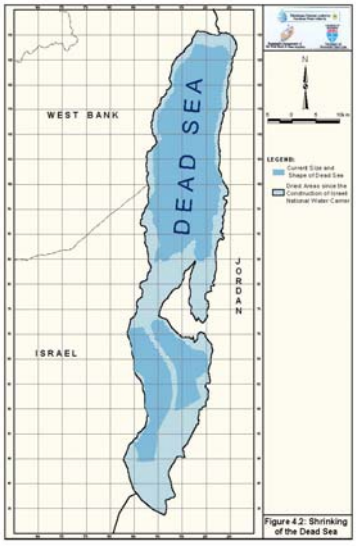
1. Surface Water:
   - Jordan River (200 -250 MCM/Y). 
   - Dead Sea. 
   - Seasonal river and streams (114 MCM/Y). 
2. Ground water:
   - The Mountain Aquifer (Eastern, North-eastern, and Western Aquifer Basins). 
   - the Gaza Aquifer (part of the Coastal Aquifer Basin). 

Jordan River

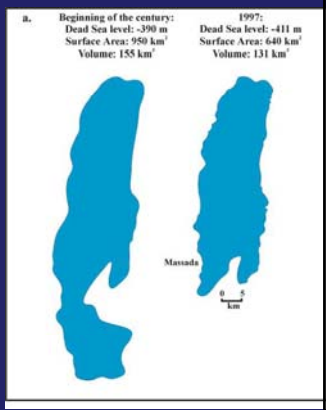
- **Flow in 1960s was 1500 MCM/Y**
- **Now, it is 50- 100 MCM/Y**



Shrinkage of the Dead Sea



The flow of the Jordan River has been so diminished that the shrinking of the Dead Sea at the Jordan river's lower end constitutes another serious ecological, environmental and economic problems



Aquifers in historical Palestine

Basin	Recharge	Abstractions
Coastal Aquifer	476	544
WAB	409	377
W.Galilee	171	123
Carmel	60	48
EAB,NEAB	386	330
Negev, Aravah	32	94
Tiberias	507	454
Total	**2041**	**1970**

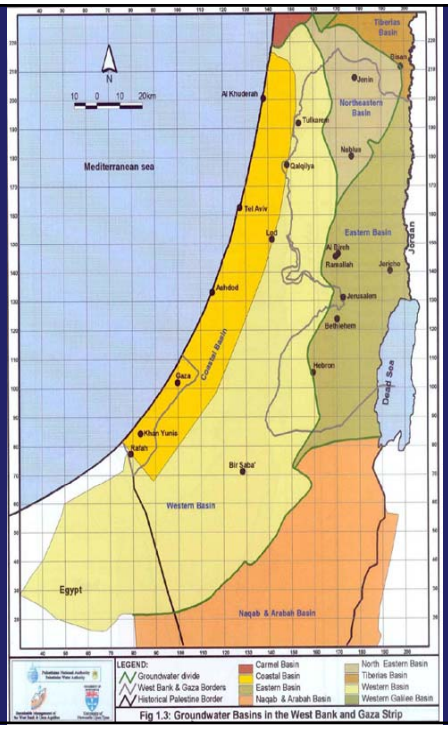
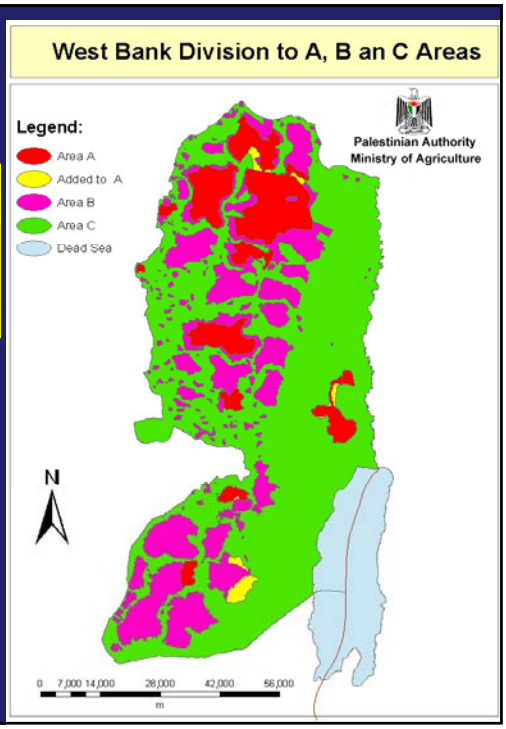


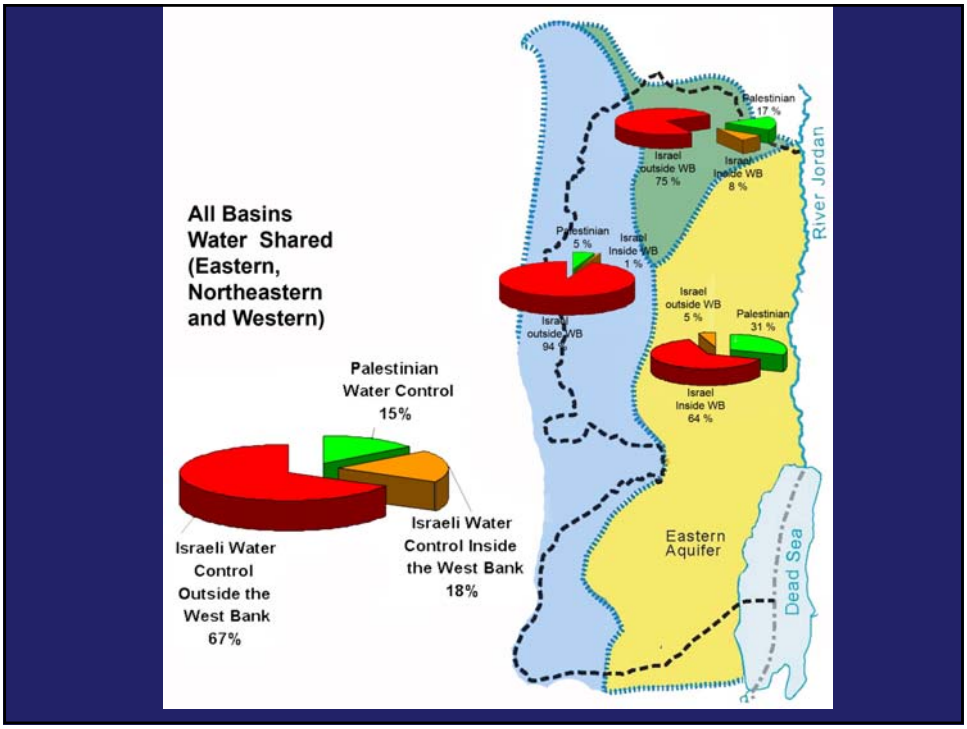
Fig 1.3: Groundwater Basins in the West Bank and Gaza Strip

Natural Recharge of the Palestinian Aquifer Basins

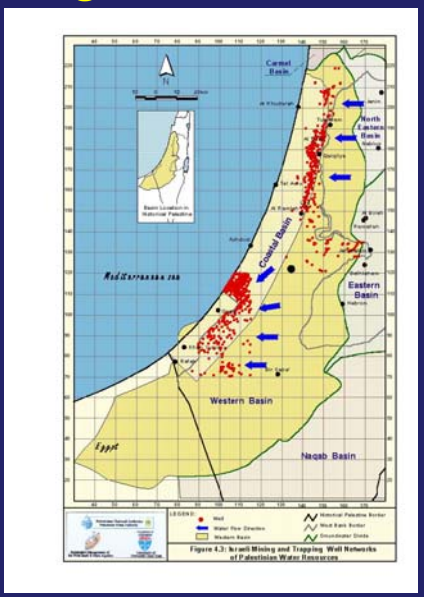
West Bank Basins Recharge	
Basin	**Oslo2 Values**
Eastern	172
Northeastern	145
western	362
Total	679

1. Over 90% of the recharge originates in the Palestinian lands.
2. Israel utilizes 85% of water discharged from the mountain aquifer in West Bank.
3. The Coastal Aquifer Basin recharge is about 304 Mm^3/yr. Only 50 MCM/y is Gaza portion of this recharge.



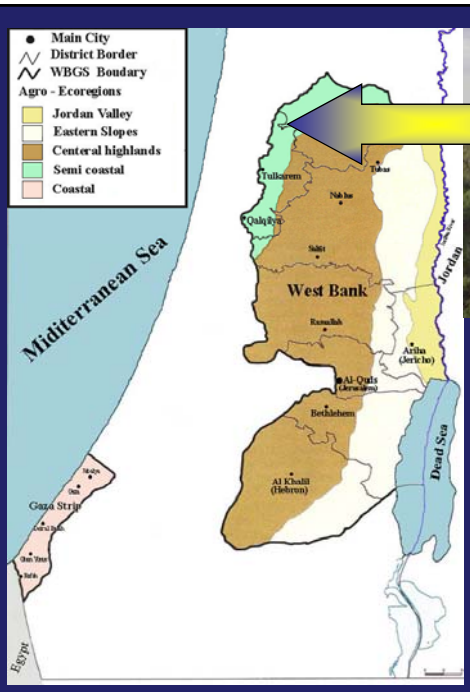


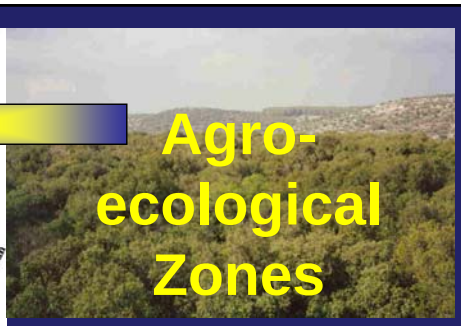
Mining the water of the West Bank aquifers



Over-pumping will cause a decline in the water levels, which will cause wells and springs to go dry.

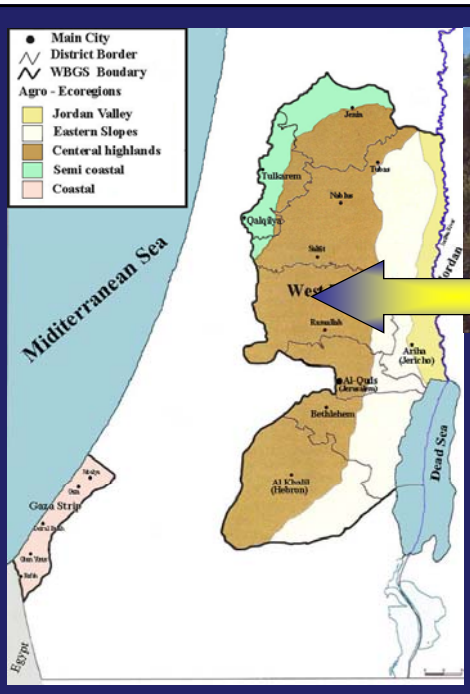
The Israeli networks of wells around the Palestinian borders are causing severe quantity and quality problems to the Palestinian water resources.



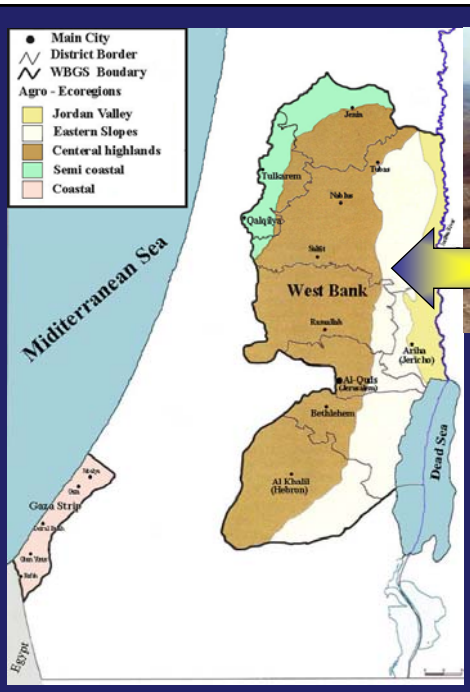


Agro-ecological Zones

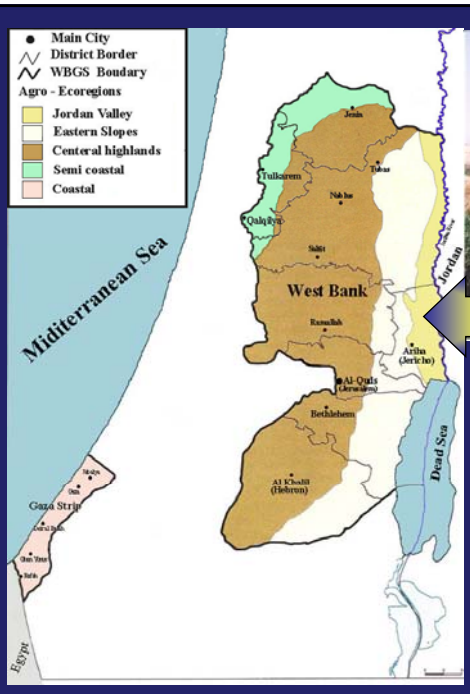
The Semi-Coastal Region is the smallest region, with elevation ranging from 100 to 300 meters above the sea. Rainfall ranges from 400 to 700 mm per year, supporting rain-fed olives, stone fruit and field crops. Limited irrigation water supports vegetable production.



The Central Highlands Region extends the length of the West Bank with mountains ranging from 400 to 1020 meters above sea level, rainfall varying from 300 mm in the southern foothills to 600 mm in the north. Agriculture is primarily rainfed (olives, field crops, stone fruits, vegetables and forage).

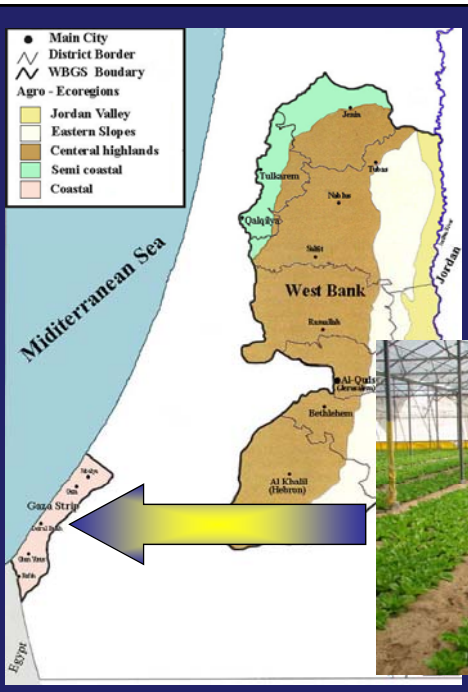


The Eastern Slopes Region is a transitional zone between the Mediterranean and desert climate with annual rainfall of 150-300 mm. Except for small pockets of spring irrigated agriculture, the main economic activity is livestock grazing.



The Jordan Valley Region

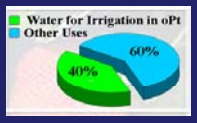
- **90 to -375 meters below sea level,**
- **100-200 mm of rainfall / year,**
- **semi-tropical climate,**
- **soil salinization is a major problem,**
- **irrigation is essential,**
- **winter vegetables and grapes are the main irrigated crops.**

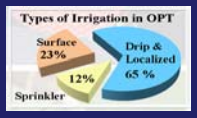


The Coastal Plain is the Gaza Strip. Rainfall ranges from 200 mm in south to 400 mm in the north with fertile soils. Crops include irrigated vegetables, strawberries, flowers and citrus as well as almonds, dates and guava.

Irrigation Water and Irrigated Area in Palestine and Israel

	Palestine	Israel
Population (million)	3.9	6
Water Used in Agriculture (MCM/Y)	150	1300
Water in Agriculture / total water %	40	70
Irrigated Area (ha)	27,000	200,000
Per Capita Irrigated Area (m^2)	68	370
Per Capita Irrigation Share (CM)	40	222
Contribution of Agriculture to GDP %	8.2	2.6
Employment in Agriculture %	14	2.5





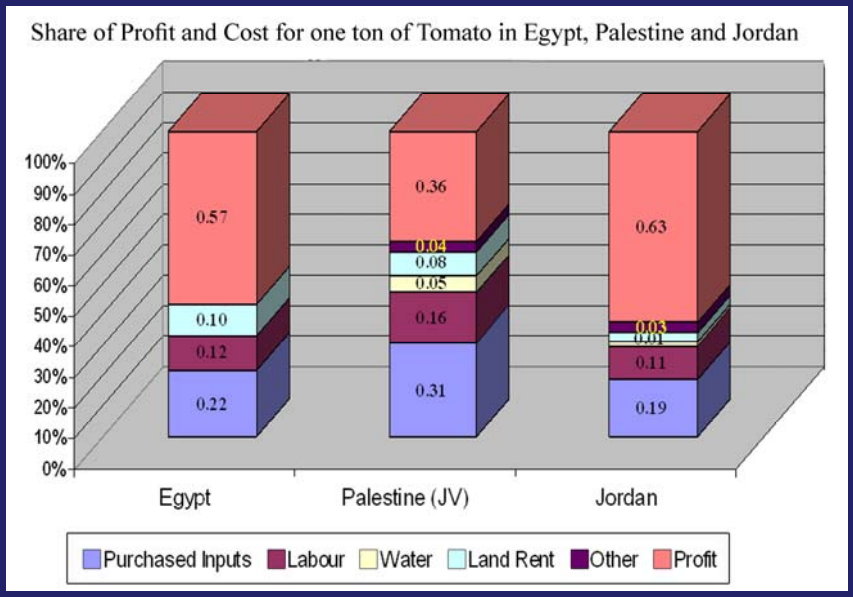
GTZ, 1996, Middle East Study
Israeli Central Bureau of Statistics 2008
PCBS, 2008

COST-RECOVERY PRINCIPLES

- Which water costs are to be recovered and what mechanisms can be used to recover them (have to be specified: direct project costs , or environmental costs, or marginal user costs)?
- What percentage of total costs should be paid by farmers?
- What are the Governmental Policies.
- What is the type of water project

WHY COST-RECOVERY RATES ARE LOW?

- The political situation and the interfere of Israeli occupation forces.
- Palestine Farmer and well owners relationship in Palestine.
- No link between fees collected and funds allocated to an irrigation project.
- Lack of farmer participation in project planning and management.
- No user penalties for nonpayment of water charges.
- Low priority given to fee collection, efficient water use, and system O&M.
- Small size and very low incomes of irrigated farms.



The DRC and Economic Water Efficiency (Jordan Valley)

	DRC		Irrigation Water		
	Value	Ranking	Consumption	Efficiency	Ranking
Spring Irrigated vegetables					
Tomatoes	0.51	2	600	4.08	3
Cucumbers	0.403	1	400	7.01	1
Potatoes	0.518	3	350	5.08	2
Squash	0.654	4	500	2.06	4
Autumn Irrigated vegetables					
Tomatoes	0.65	4	1000	1.79	4
Cucumbers	0.577	3	500	3.07	3
Potatoes	0.55	2	450	3.73	1
Squash	0.528	1	450	3.3	2
Green Houses					
Tomatoes	0.466	2	1500	6.34	3
Cucumbers	0.391	1	900	9.98	1
G. Peppers	0.493	3	700	6.65	2
Irrigated Fruit Trees					
Oranges	0.721	3	1000	1.24	3
Grapes	0.574	1	1200	1.97	1
Bananas	0.679	2	2200	1.25	2

Source : Agriculture Strategy Chapter 5

The Policy Analysis Matrix

The DRC and Economic Water Efficiency (Gaza)

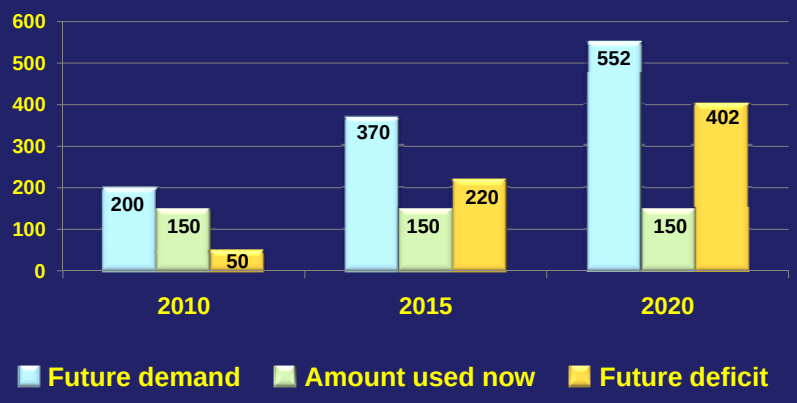
	DRC		Irrigation Water		
	Value	Ranking	Consumption	Efficiency	Ranking
Spring Irrigated vegetables					
Tomatoes	0.454	2	500	4.9	2
Cucumbers	0.391	1	360	8.04	1
Potatoes	0.568	3	360	4.74	3
Squash	0.603	4	360	3.6	4
Autumn Irrigated vegetables					
Potatoes	0.616	3	480	3.26	3
Onions	0.471	2	600	4.64	2
Cauliflower	0.547	1	360	4.04	1
Plastic Tunnels					
Squash	0.433	1	450	7.78	1
Strawberry	0.558	2	1000	6.88	2
Greenhouses					
Tomatoes	0.446	2	800	10.99	2
Cucumbers	0.372	1	720	12.89	1
G. Peppers	0.603	3	700	4.88	4
Cut-Flowers	0.722	4	1500	5.7	3
Irrigated Fruit Trees					
Oranges	0.57	1	800	2.29	2
Olives	0.585	2	300	3.87	1
Rainfed Fruit Trees					
Grapes	0.591		-	-	-
Olives	0.773		-	-	-
Almonds	0.845		-	-	-

Source : Agriculture Strategy Chapter 5

The DRC and Economic Water Efficiency (Semi-Coastal)

	DRC		Irrigation Water		
	Value	Ranking	Consumption	Efficiency	Ranking
Spring Irrigated vegetables					
Cucumbers	0.506	1	350	5.58	1
Potatoes	0.507	2	350	5.42	2
Autumn Irrigated vegetables					
Potatoes	0.547	2	450	4	2
Cauliflower	0.458	1	400	4.43	1
Irrigated Fruit Trees					
Oranges	0.864		750	1.14	
Rainfed Vegetables					
Tomatoes	0.775	2			
Squash	0.774	1			

Future Deficit in Irrigation Water



Constraints and difficulties

1. **Israeli Military Occupation**
2. **Technical issues related to Natural Resources and Environment**
   - Limited water and agricultural lands and increasing competition among economic sectors.
   - Excessive use of chemicals, particularly pesticides.
   - Deterioration of quality of water used in irrigation.
3. **Social and economic factors.**
4. **Institutions and legislation.**
   - Laws, Bylaws and regulations.
   - Guidelines and standards.
   - National Water Council.

Agricultural Strategies

Efficient Management of irrigation water to maximize the net profit of each cubic meter of water

- Develop and enhance water supplies.
- Improve water use efficiency.
- Strengthen legal and institutional frameworks for water management.
- Enhance good water governance in irrigation water management.
- Build the institutional and technical capacities in research and extension.

Develop and enhance water supplies

- Gain the Palestinian water right.
- Rehabilitate the water infrastructure.
- Reuse of non-conventional water resources.
- Desalinize the brackish and saline water.
- Enhance the water harvesting on small and medium scale.

Improve water use efficiency

- Enhance the economic feasibility of agricultural water.
- Rehabilitate the conveyance and distribution systems.
- Introduce advanced and modern irrigation technologies.
- Enhance the supplementary irrigation.
- Use of deficit irrigation technique during drought.
- Install the meteorological stations net for precise crop water requirement estimation.

Strengthen legal and institutional frameworks

- Improve negotiation skills and tools.
- Activate the National Water Council.
- Organize the utilization of water.
- Allocation of water among users.
- Encourage the formulation of Water User Association.
- Implement a good water tariff for agricultural water.
- Encourage the investment in agricultural water sector.

Enhance Good Water Governance

- Enhance the participatory planning and management approaches.
- Empower the farmers, women, and marginalized groups.
- Improve the accessibility of data and information.
- Enhance the involvement of civil communities and private sector in decision making process.
- Enhance accountability and credibility perceptions.

Build the institutional and technical capacities in research and extension

- Improve research and extension services.
- Introduce drought and saline resistance crops.
- Build the capacity of farmers.
- Improve data and information quality and accessibility.
- Improve information system on water economy in agriculture.
- Encourage the involvement of private sector in research activities.
- Prepare public awareness in rationalization of irrigation water.
- Improve the national, regional, and international cooperation in IWRM.

Interventions and Programms

1. **Develop and enhance water supplies:**
   - Secure the Palestinian water rights (L).
   - Rehabilitate Wells and springs (S).
   - Drill new wells (L).
   - Use of treated Wastewater and brackish water in irrigation (S & L).
   - Develop water harvesting techniques (S & L).
   - Desalinize the brackish and saline water (S).

Interventions and Programms

2. **Improve water use efficiency**
   - Convert open canal to closed systems (S).
   - Construct and rehabilitate conveyance systems (S & L).
   - Construct water storage facilities (S).
   - Install and maintain water meters (S).
   - Improve irrigation management techniques (S & L).
   - Encourage the supplementary Irrigation practices (S & L).
   - Construct retention wall and terraces (S).

3. **Strengthen legal and institutional frameworks for water management**
   - Implement public awareness campaigns (S & L).
   - Demonstrate the cultivation of drought and saline resistance crops (S&L).
   - Organize and control illegal wells (S).
   - Formulate water user associations (S).
   - Implement irrigation water tariff systems (L).

4. **Build the capacity and improve the research and extension services**
   - Water economy studies (feasibility of desalination of water).
   - Introduce new cash crops.
   - Install the agricultural drought early warning system (M).

Conclusion

- *Contribution of Irrigated agriculture to production, food security and poverty alleviation is important*
- *Low cost recovery and poor maintenance caused the deterioration of infrastructure and low efficiency of water distribution and irrigation performance.*
- *Past policies reached their limits to ensure adequate financial balance and to control water demand.*
- *After the formulation of the Palestinian state, the formulation of irrigation water tariff is needed after solving all issues related to water right.*
- *The proposed pricing policies on cost recovery and farmers revenues should be analyzed carefully (research)*
- *Cost recovery is very important in water demand management policies.*
- *Uses of nontraditional water in agriculture and adopting good water governance approach have to be considered in integrated irrigation water management.*


THANK YOU
FOR
ATTENTION