

*Impacts of Water Management and  
Climate Changes on the Agricultural  
Production in Nile Delta*

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# Major Challenges of Water Resources

- ▣ **Population Growth**
- ▣ **The Fixed Nile Water Quota**
- ▣ **Deterioration of Water Quality**
- ▣ **Climate Change and its Impacts on Nile Water Availability in Egypt**

## **1.2 CAUSES OF WATER SCARCITY**

**Scarcity is heavily influenced by policies, institutions, and behavior. Most of the following causes of scarcity are more or less influenced by human factors:**

**a) Climate change**

**b) Population growth when combined with economic growth leads to increased per capita demand.**

**c) Modifications in landscape and land use. Includes diverse types of changes, such as:**

- **Urbanization leading to increased runoff.**
- **Desertification.**
- **Silting water reservoirs.**
- **Large-scale water diverse to new lands developments**

**d) Water pollution reduces the usable and reusable supply.**

**e) Financial or institutional shortcomings in water systems planning or management.**

# **Water Scarcity Management Approaches**

## **Supply management and demand management**

**Supply augmentation measures applicable to Nile Delta include:**

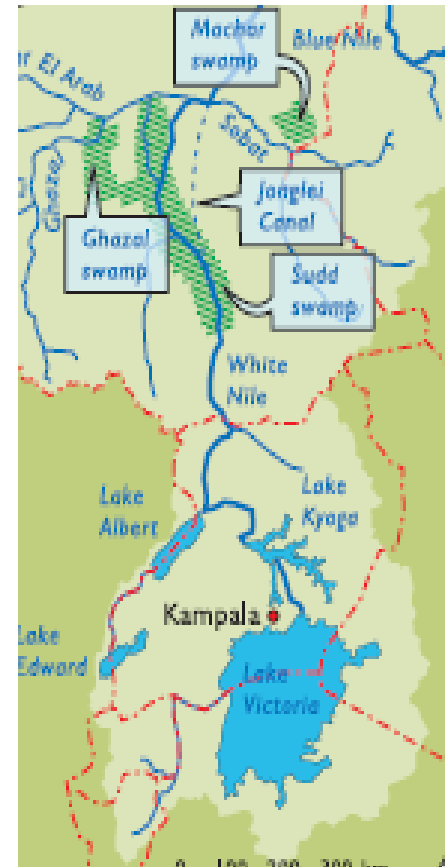
- Rain water capture and storage.
- Surface water capture and storage.
- Increased abstraction from existing groundwater sources.
- Development of new groundwater sources (deep mining), with population transfer or large-scale water transfer.
- Desalinization.
- Increasing share of international waters.
- Virtual water import.

# *Measures for solving the issues:*

- I** Developing additional water resource.
- II** Making better use of existing water resources.
- III** Protecting public health and environment which impact on the green Economy.

# Developing Additional Water Resources

- ▣ Options to further increase the amount of Nile water are mainly related to upstream water conservation schemes in the White Nile basin.
- ▣ Another measure to increase the Nile water availability from Lake Nasser is to change the reservoir operation.



Swamps of Sudd, Bahr El Ghazal and Marchar



## **continue:**

**□ Nile Water:** continue the co-operation with the riparian countries in the Nile Basin and investigate the possibilities to increase the supply of Nile water in particular with Sudan and Ethiopia.

### **□ Ground water:**

✓ **Deep groundwater development in the Western desert, including close monitoring.**

✓ **Investigate potential of deep groundwater development in Sinai and Eastern Desert.**

✓ **Study development potential of brackish water for aquaculture and agriculture (pilot projects).**

## □ *Rainfall and flash flood harvesting:*

✓ Stimulate small-scale rainfall harvesting along the Mediterranean coast.

✓ Carry-out feasibility studies on flash flood harvesting in Sinai in combination with flood protection.

## □ *Desalinization in coastal areas:*

✓ Increase brackish/salt water desalinization in line with demands.

## **II. Making Better Use of Existing Water Resources**

- ✓ Municipal and Industrial water.**
- ✓ Demand management.**
- ✓ Reduction of unaccounted for water losses.**
- ✓ Reuse of treated wastewater.**

**❑ Improve overall water use efficiency in agriculture**

**✓ Horizontal expansion .**

**✓ Improvement of irrigation efficiency.**

**✓ Reuse of drainage water**

**❑ Improve water allocation and distribution of Nile Delta water:**

**✓ Institutional: establish water boards.**

- ✓ **Water allocation: equal opportunities.**
- ✓ **Improvement physical infrastructure for proper water distribution.**
- ✓ **Human resources development: training and dissemination the New information related to water use efficiency and crop water management through Extention activities.**
- ✓ **Maintenance.**

# *There is a need for specific actions in terms of:*

## Demand Management:

- ◆ More crop per drop;
- ◆ Use of new irrigation methods to reduce losses;
- ◆ Public awareness campaigns.



## Supply Management:

- ◆ Reuse of agricultural drainage water and treated municipal wastewater ;
- ◆ Virtual water ;
- ◆ Desalinization of brackish groundwater and/or seawater.



Imports of V.W.

Total V.W. (Billion m <sup>3</sup> )	Imported Agricultural Products (2005-2025) (Eq. V.W. Billion m <sup>3</sup> )				Year
	Oil Vegetables	Sugar Beat	Maize	Wheat	
13.754	1.712	1.341	4.248	6.453	2005
15.127	1.855	1.597	4.810	6.865	2010
16.447	1.989	1.874	5.369	7.215	2015
17.711	2.114	2.173	5.924	7.500	2020
18.932	2.232	2.492	6.474	7.734	2025

Exports of V.W.

Total V.W. (Billion m <sup>3</sup> )	Exported Agricultural Products (2005-2025) (Eq. V.W. Billion m <sup>3</sup> )						Year
	Orange	Water Melon	Botato	Tomato	Rice	Cotton	
1.315	0.103	0.016	0.013	0.022	0.986	0.175	2005
1.629	0.110	0.017	0.015	0.025	1.070	0.392	2010
1.464	0.113	0.019	0.017	0.029	1.082	0.204	2015
1.714	0.117	0.021	0.019	0.032	1.148	0.417	2020
1.795	0.120	0.023	0.021	0.035	1.166	0.430	2025

## **Integrated Water Resources Management Approach.**

- **To increase the economic growth of the country and to increase employment.**

- **To increase the inhabited space of Egypt outside the Nile Valley and the Delta among others by:**

- ✓ Developing new cities

- ✓ Developing the Eastern Delta and Sinai (i.e. the El Salam Canal)

- ✓ Developing New Valley areas in Southern Egypt (i.e. Toshka project; East Owenat, project)

- ✓ Developing Irrigation Water treatments stations.



**•To protect public health by means of provision of safe drinking water and adequate sanitation facilities.**

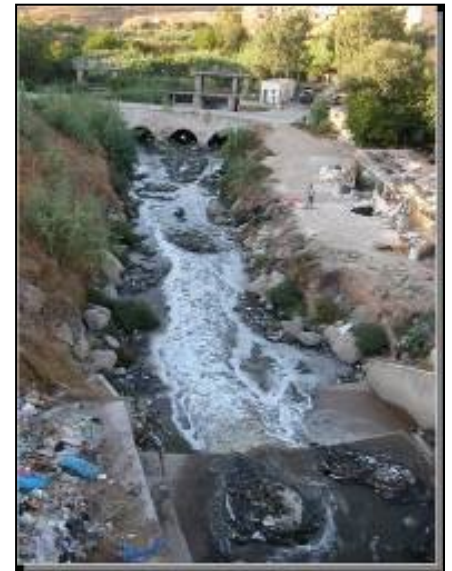
**•To protect the Nile and other fresh water resources from pollution.**

## **Major measures under consideration up to 2030 include:**

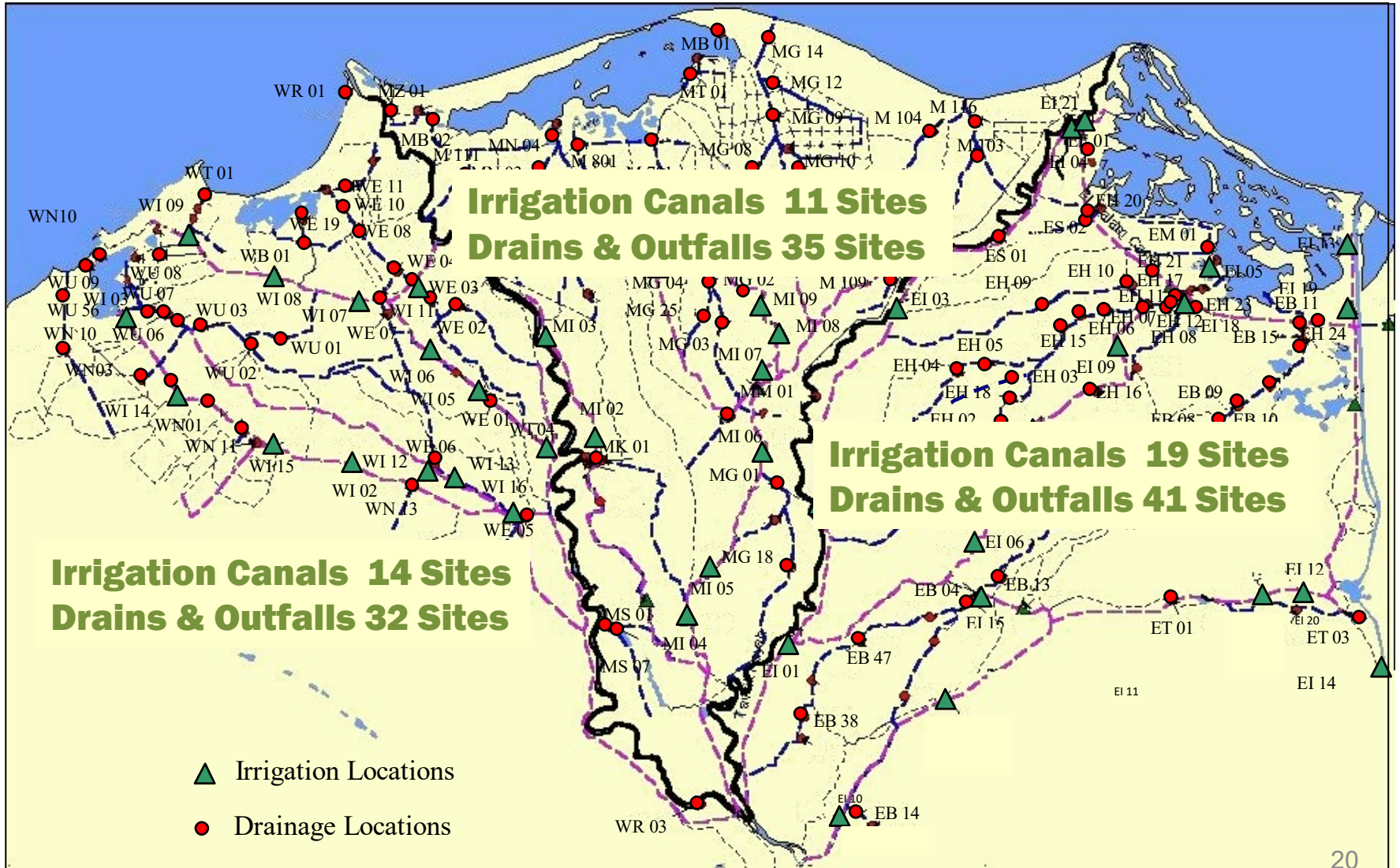
- \* Deep mining of non-renewable groundwater**
- Desalinization**
- Modern irrigation system approach.**
- \* Biotechnology applications to agriculture**
- \* International cooperative Nile Basin projects**
- \* Water pricing.**

# Water Quality Deterioration and its impact on the environment Protection

- **Pollution caused by fast growing cities and industries**
- **Insufficient wastewater treatment facilities**
- **Poor or non-existing solid-waste management**



# National Water Quality Monitoring Program Monitoring Sites in the Nile Delta



# **Integrated Crop and Land Management concepts, to sustain the Agricultural production**

- **Plant Breeding And Genetics**
- **Land use, management and degradation**
- **Higher plant populations**
- **Improved varieties:**
- **Annual intercropping system**
- **More attention should be given**
- **Agrochemical: Fertilizers and pesticides are used in small quantities.**
- **Farm processing and Agro-industries.**
- **Organic manure**
- **Natural pesticides**

# ***On Farm water management Practices (Water, crop and soil) at on -farm level.***

## ***The main goal***

- **To provide Egypt with replicable and adaptable system for on-farm water & soil management practices that are environmentally sustainable economically sound and social acceptable.**
- **Men and women in the agricultural communities in the pilot areas apply environmentally sustainable, economically sound, socially acceptable and nationally adaptable water, soil and crop management practices at the On-farm level.**

# ***Water management practices.***

- Laser land leveling technology, (benefits, implementation)
- Furrow lengths and basin dimensions
- Marwa improvement technology.\* Water application methods at On-farm level.
- Operation and maintenance of irrigation distribution system.
- Irrigation needs (Irrigation requirements & scheduling)
- Water leaching requirements.
- Lining marwa and canals.
- Maintenance of drainage conditions.



# ***Crop management practices***

- ✓ **High yielding and short-duration varieties.**
- ✓ **Drought and salinity-resistant varieties.**
- ✓ **Proper farming practices (seed bed preparations, method of planting and harvesting,...).**
- ✓ **Crop pattern, Intercropping and Planting at appropriate times.**
- ✓ **Integrated pest management and Safe use of chemicals.**



# ***Soil management practices***

- Fertilizer recommendations (type, dose and timing).
- Organic manures / Compost.
- Soil salinity and alkalinity control.
- Soil management practices (tillage, land leveling, deep plowing..... etc).

# ***Expected outputs***

- Increasing crops yields.
- Increasing on farm irrigation efficiency and water saving.
- Increase of cultivated land
- Improving agriculture performance.
- Saving time& farm labor and increase income return.
- Improving drainage condition and soil properties.
- Improving environmental condition.
- Overcome the problems caused by diseases.

# Impact of Climate Change on Agricultural Resources



- **The Nile delta region, the most fertile land of Egypt, is highly vulnerable to the impacts of sea level rise, salt water intrusion and soil salinization.**
- **Reduced irrigation supplies from the Nile**
- **Shortage of water resources delays many agricultural developmental plans.**

# **Climate Change and Impacts on Nile Water Availability in Nile Delta**

- **There is low confidence of climate change on the direction affect of the future rainfall change in the Nile Basin.**
- **However the higher temperatures for agricultural water use in Egypt (and also upstream in Sudan) could also be very high, as losses are likely to increase from the Nile, the extensive system of irrigation canals, and possibly from crop water use.**

## ***Effect of climate change on the productivity for some Egyptian crops.***

- ❖ Egypt is truly the gift of one , great river, the Nile.
- ❖ Egypt civilization can be said to be the civilization of the Nile river system.
- ❖ The Nile flow is the main source of the life in Egypt, provides the country with 96% of its water
- ❖ 1959 Nile agreement, between Egypt and Sudan allocated 55.5 BCM to Egypt.
- ❖ Compared to the water demand, Egypt's share has become very limited and is already almost fully exploited

# Change in crop yield [%]

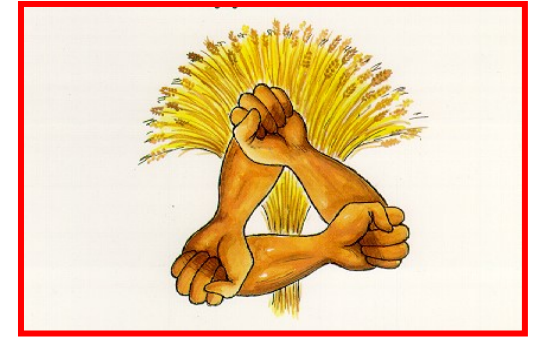
Crop	Change %		Reference
	2050s	2100s	
<b>Rice</b>	<b>-11%</b>		<b>Eid and EL-Marsafawy (2002)</b>
<b>Maize</b>	<b>-19%</b>		<b>Eid et al. 1997b</b>
	<b>-14%</b>	<b>-20%</b>	<b>Hassanein and Medany, 2007</b>
<b>Soybeans</b>	<b>-28%</b>		<b>Eid and EL-Marsafawy (2002)</b>
<b>Barley</b>	<b>-20%</b>		<b>Eid et al. 1997b</b>
<b>Cotton</b>	<b>+17%*</b>	<b>+31%*</b> *	<b>Eid et al. 1997a</b>

\* *Temperature increased by 2°C*

\*\* *Temperature increased by 4°C*

# Major Actions to Face Challenges in Nile Delta

- ◆ carrying necessary institutional reform
- ◆ Emphasizing good governance
- ◆ Building Capacity
- ◆ Participation of all stakeholders
- ◆ Empowering women role in water management
- ◆ Improving the performance of existing water supply systems



# ***CONCLUSION***

**-EGYPT is now fully utilized its share of the Nile water and is effectively reusing drainage water, treated wastewater and shallow groundwater.**

**-The rapid population and economic growth are exerting pressures on the existing water resources.**



**A more efficient use of the available water resources**

**\*Development of additional water resources**

**\*improvement of water quality to protect public health and environment**

**\*Implementation of measures requires in many areas, that the institutional setting for integrated water resources management will have, to be improved.**

# **The institutional reform policy includes**

- Transfer authority to water boards.**
- Transfer management to WUAS.**
- Apply private sector participation in infrastructure and land reclamation.**

- **Enhance the exchange of data between different authorities.**

- **Second treated waste water can be used for irrigating oil crops without significant reduction in yield while blended drainage water can be used in salt tolerant crops production.**

- **Using alternative irrigation under drip irrigation can minimize the adverse effects of marginal water in soil, plant pollution and soil salinity build up and save about 50% from fresh water.**

**•Socio-economic evaluation must be implemented to identify the impact of reusing marginal water on soil, plant, and environment and human health.**

**•Shortage of water resources delays many agricultural developmental crops.**

**•Modification of cropping pattern; New tool of plant breeding and Genetics Research to met the climate change in the future.**

**•Future adaption strategies to climate change may involve the development of new more heat, drought and salinity tolerant cultivars to increase water and land use efficiency to reduce. Food Gap in the near east, North Africa countries.**

Thank you

