



CLIMATIC CHANGES AND WASTEWATER REUSE CHALLENGES IN THE MEDITERRANEAN REGION

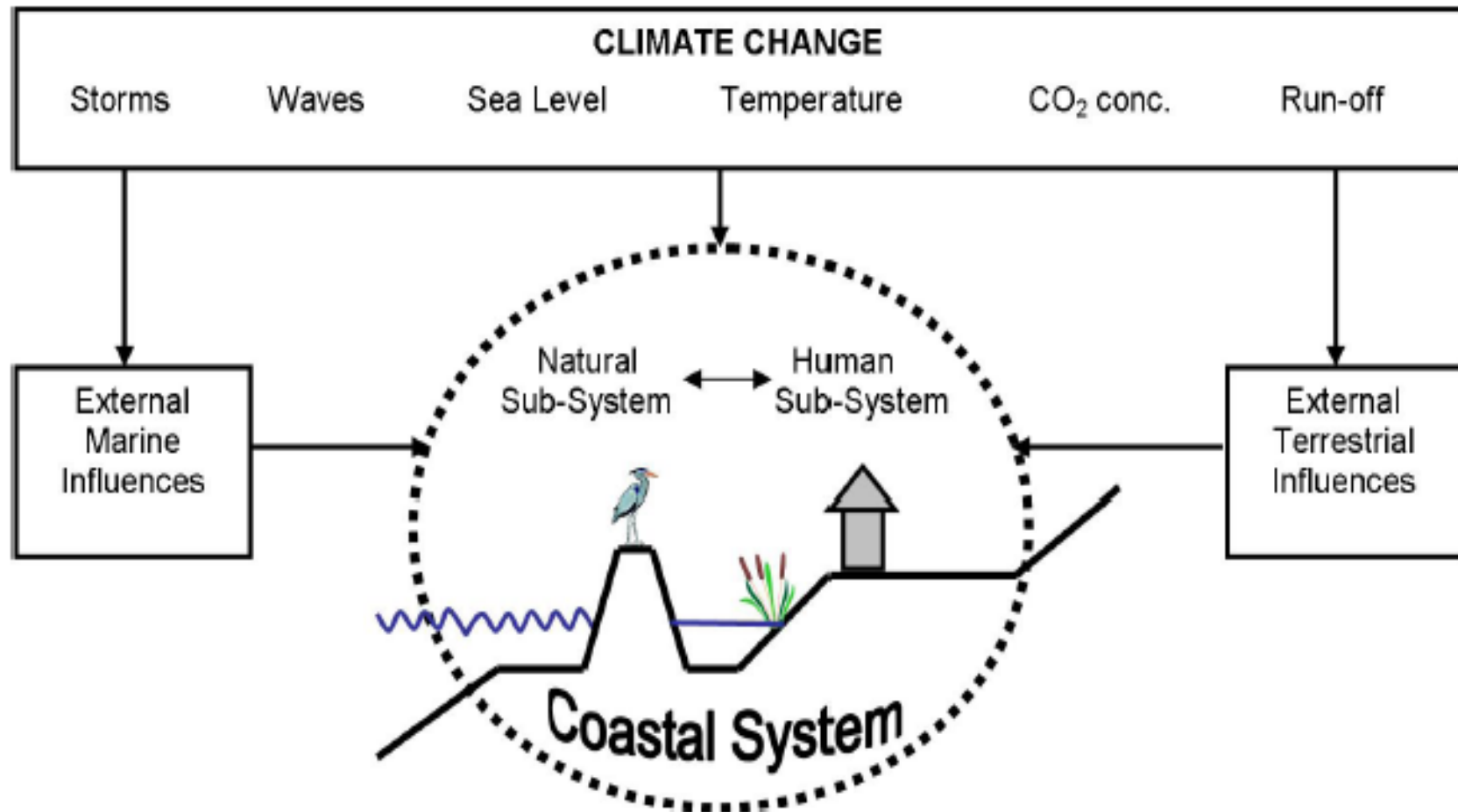
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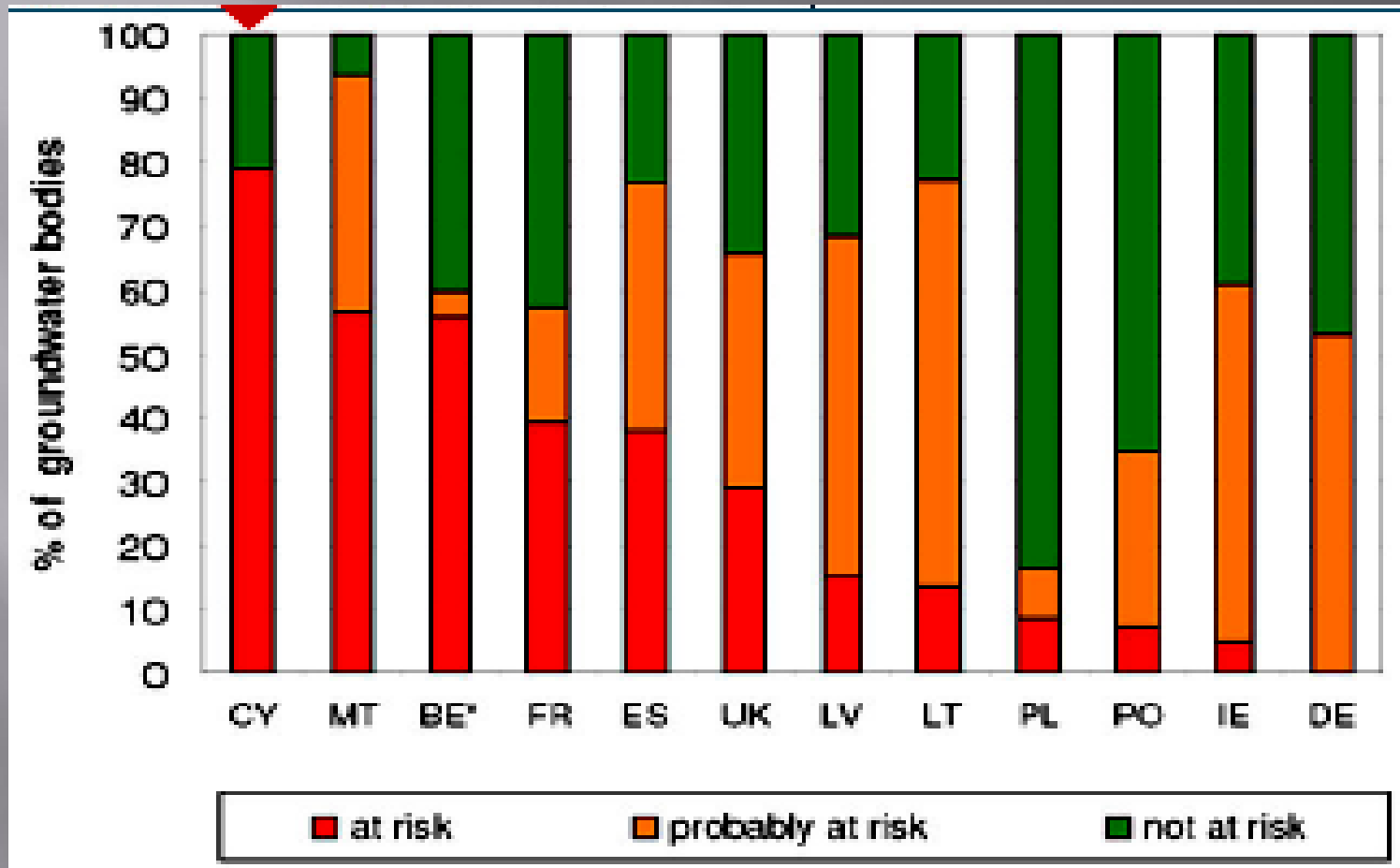
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The Coastal System

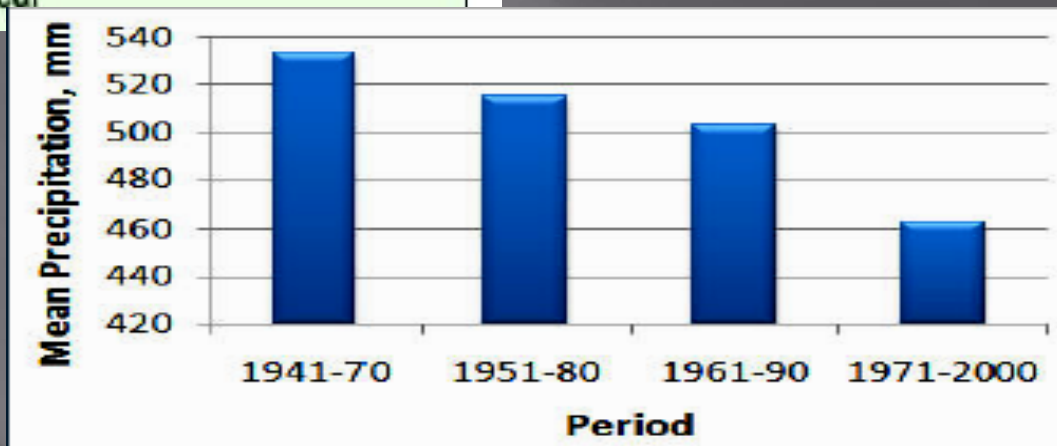
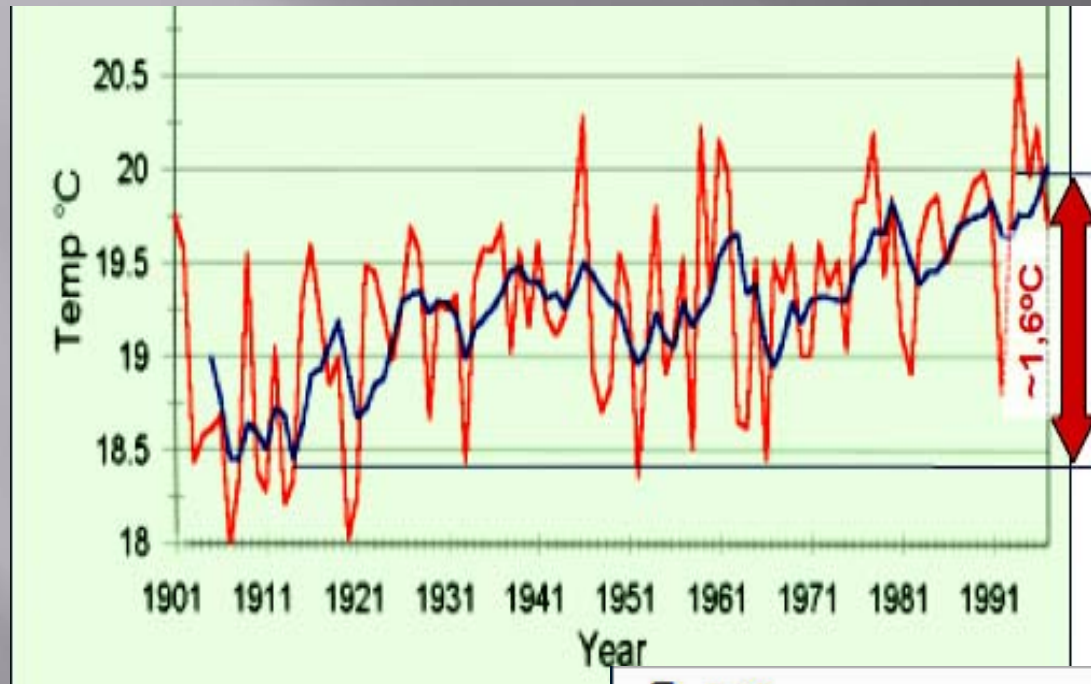
(Ref: Coastal Systems and Low-lying Areas WMO/UNEP)



Water body evaluation for selected EU countries



Temperatures Rise, Rainfall Decreases...

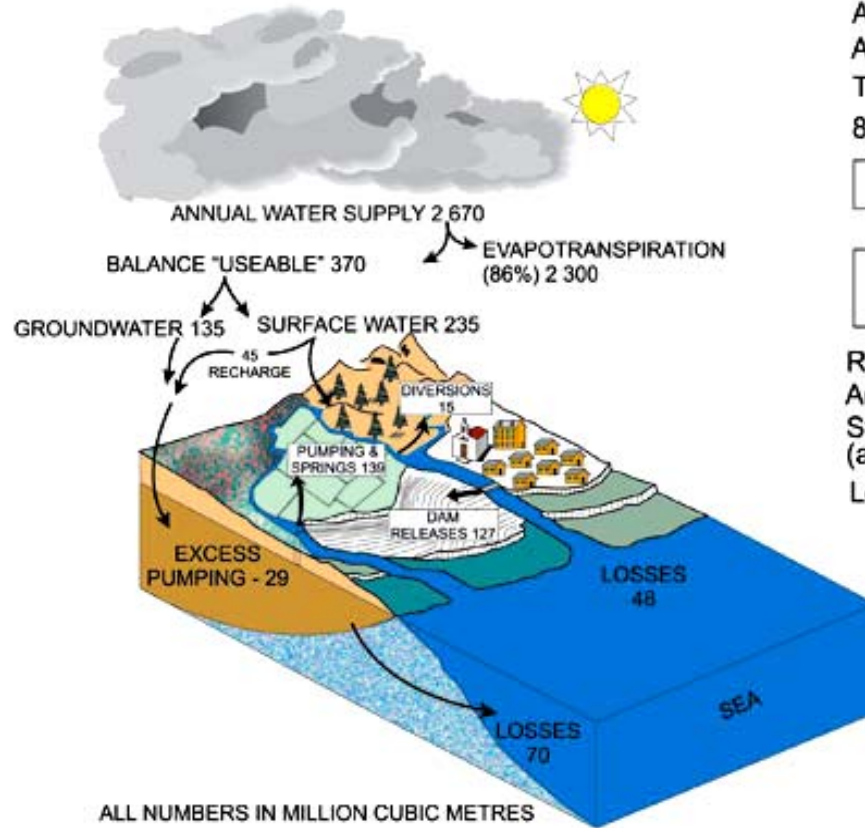


The Mediterranean Basin

- the North or greater Europe: Portugal, Spain, France and Monaco, Italy, Malta, Bosnia-Herzegovina, Croatia, Slovenia, F.R. of Yugoslavia, Albania, Greece;
- the East: Turkey, Cyprus, Syria, Lebanon, Israel, Palestinian territories of Gaza and the West Bank, Jordan;
- the South: Egypt, Libya, Tunisia, Algeria, Morocco.



WATER BALANCE FOR CYPRUS (GOVERNMENT CONTROLLED AREAS)



ALL NUMBERS IN MILLION CUBIC METRES

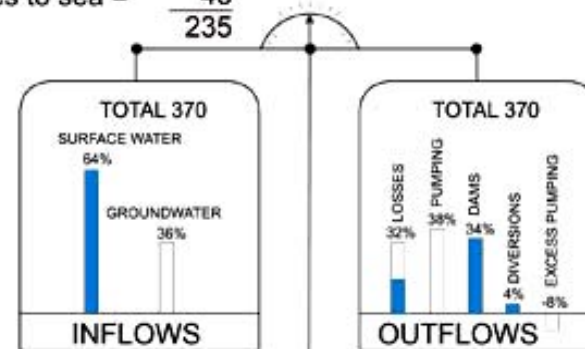
* Includes aquifer recharge from surface runoff

AREA = 5 800 km²
 AVERAGE ANNUAL RAINFALL = 460 mm (1971-2000)
 TOTAL ANNUAL WATER SUPPLY = 2 670 Mm³
 86% EVAPOTRANSPIRATION = 2 300 Mm³

BALANCE "USEABLE" = 370 Mm³

SURFACE WATER 235	GROUNDWATER 135
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Rivers diversions = 15	Pumping } = 139
Aquifer Recharge = 45	Springs }
Stored in dams (and used) = 127	Losses to sea = 70
Losses to sea = 48	Excess pumping = - 29
235	180*



(1971-2000)

Addressing the Problem..

- Water scarcity is a very serious problem for Cyprus, which together with Malta are the "water poor" countries of Europe.
- Like other Mediterranean countries, Cyprus has a semi-arid climate and limited water resources which depend almost entirely on rainfall.
- Rainfall is highly variable with considerable regional variations, droughts occur frequently and water resources are scarce and expensive to exploit.

Climatic Change Consequences

- ▣ Current water supply on Cyprus already strained
- ▣ Cyprus as “champion” in a European comparison
- ▣ Agriculture is a as main water consumer but a minor contributor to the economy of the island.
- ▣ Surface reservoirs largely depleted
- ▣ Current climate condition: warmer and drier
- ▣ Future climate projection: extreme water scarcity
- ▣ And there are additional problems that exacerbate climate change impacts that need to be addressed

Water Availability and Demand - Selected Countries

Country	Water Resources Available (MCM/yr)	Water demand (MCM/yr)	Ratio
Cyprus	300	265.9	0.89
Jordan	780	810	1.04
Turkey	110000	42000	0.38
Palestine	295	354	1.2

Main Mediterranean Concerns

- ▣ Most Mediterranean countries have no well established and effective wastewater treatment plants, neither wastewater reuse standards nor criteria.
 - ▶ An increasing trend in wastewater treatment plant construction and planning is evident in almost all the countries of the Mediterranean basin.
 - ▶ In addition, reuse water standards should be developed in a way that will clearly take into account the local conditions while reasonably safeguarding the population

Water Demand - Cyprus

- ❑ The two main water-consuming sectors in Cyprus are irrigated agriculture and domestic use.
- ❑ Agriculture accounts for about 70% of total water use, while the domestic sector accounts for 20% of water use. Other sectors include tourism (5% of water demand), industry (1%), and amenities (5%).
- ❑ Today the total water demand in Cyprus amounts to 265.9 million cubic meters annually.
- ❑ It is estimated that by 2020, water demand in Cyprus will increase to 313.7 cubic meters, mainly as a result of a rise in the use of domestic water and tourism development (Water Development Department and FAO, 2002).

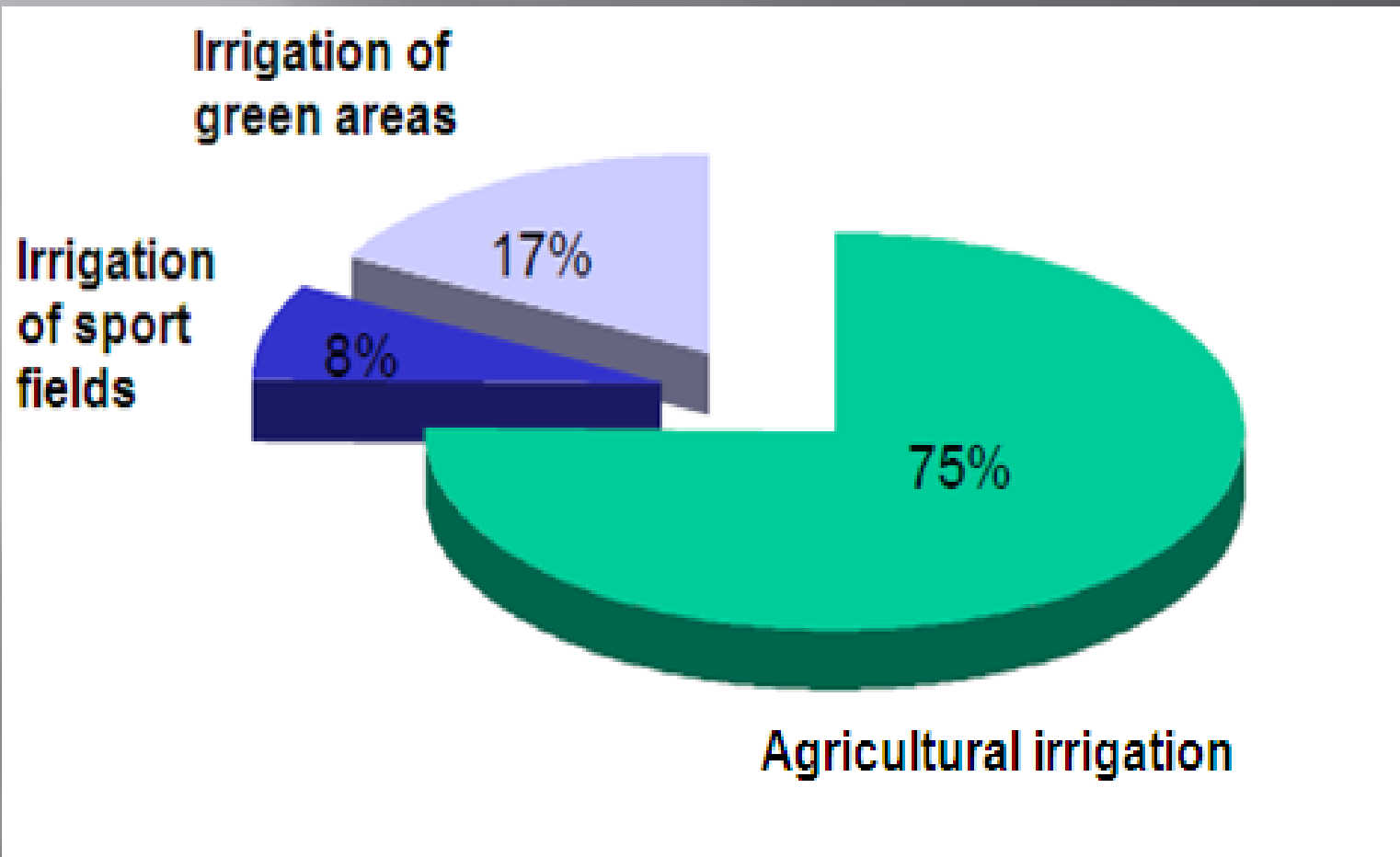
This presents many challenges for water management and conservation in Cyprus.

Current and estimated future treated wastewater production-Cyprus

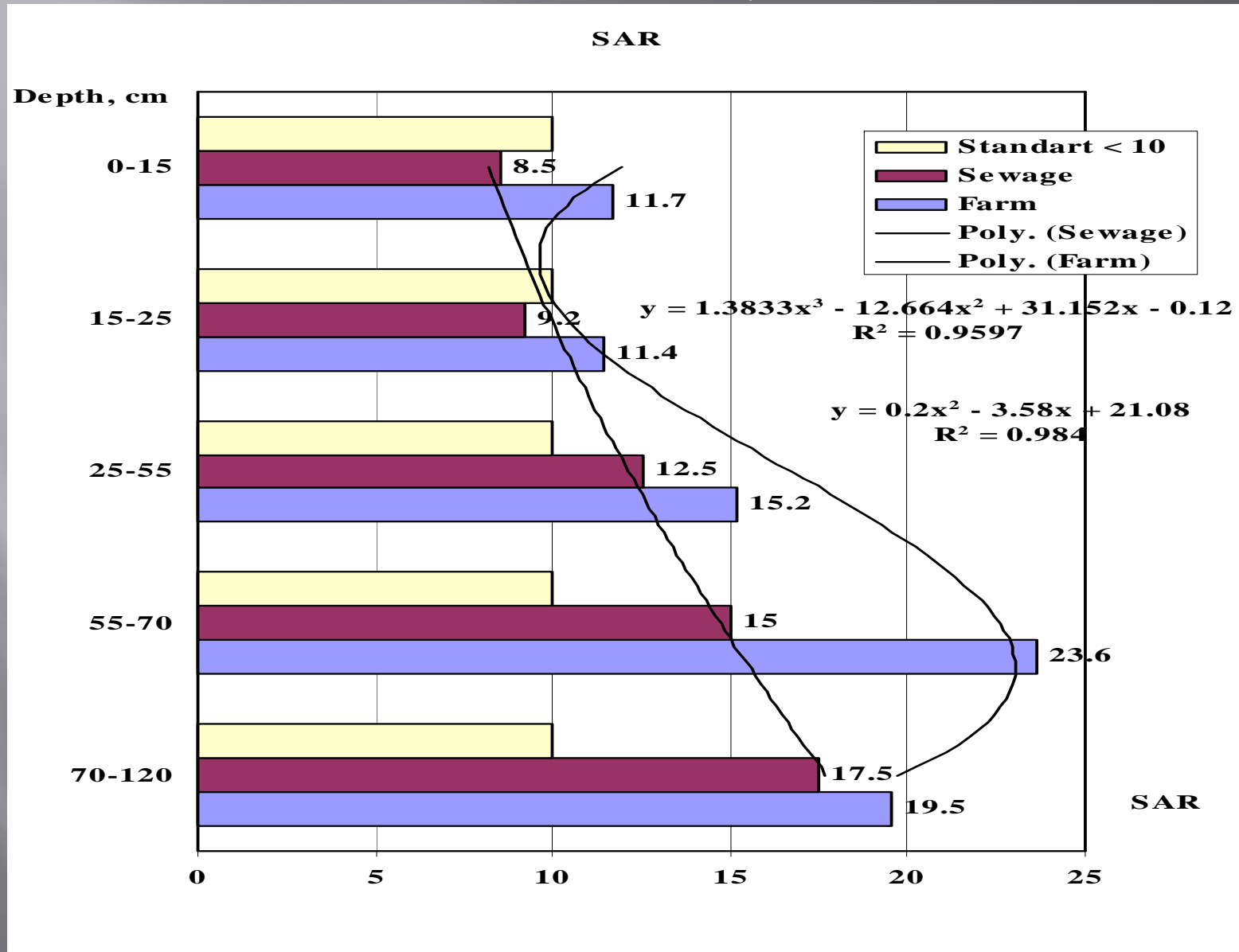
- ▣ Today
 - 5 Wastewater treatment plants in operation
 - 14, 6 MCM of tertiary treated water is produced annually .About 5 MCM is used for aquifer recharge.
 - This covers 8% of water demand for agriculture

- ▣ By 2012
 - 7 Wastewater treatment plants will be in operation
 - 52 MCM of tertiary treated water will be produced annually
 - This will cover 28.5% of water demand for agriculture

Use of Treated Wastewater in 2008



SAR evaluation of an irrigated soil profile



Salinity Evaluation-SAR

- A typical example in the presentation of the results as shown in the previous slide, SAR (sodium absorption ratio) is investigated by the application of various salt evaluation criteria at each increment of the soil profile under investigation. One may notice that the quality of the samples irrigated with groundwater obtained from nearby wells demonstrates higher values of SAR and therefore poses greater salinisation risk. This is due to the fact that most ground waters in Cyprus, due to their high content of calcium carbonate in the soils, present high level of salts. Drop irrigation was used.
- Soils of electrical conductivity below 4 dS/m and high values of SAR, between 13 and 15, are considered as sodic soils. These soils also demonstrate high pH values, usually above 10, and present various agricultural problems, which are however manageable if proper care is given. Next slide shows the sodium and EC evaluation of our profile.

Results of the use of recycled water

The results of the use of recycled water in industrial and agricultural crops in Cyprus was very encouraging, since in most cases both the production and the quality of the product outweigh those watered with fresh water. The use of recycled water has already been accepted by farmers and demand is rising rapidly.

In addition, recycled water contains many nutrients which are directly up-taken by plants, such as nitrogen, phosphorus and potassium and trace elements that help significantly to the development of different crops

Conclusions

- ❑ In view of the serious climatic changes, the use of recycled water for agricultural purposes is considered the best approach from the social, economic and environmental point of view .Establishment of proper standards for influent and effluent wastewater for the Mediterranean region is necessary
- ❑ It is clear that ingredients contained in treated wastewater may create undesirable effects on soils and groundwater. However, careful management including standards and regulations ,may overcome these effects.
- ❑ It has been proved that recycled water has no negative effect on soil salinity and infiltration rates. On the contrary, it improves and conditions organic poor soils.
- ❑ Results suggest that problems detected are manageable and may be handled with proper techniques. Drop irrigation minimizes problems due to salinity.
- ❑ Education of farmers
- ❑ Content of xenobiotics is still an issue in recycled waters which should be further investigated.

THANK YOU FOR YOUR ATTENTION



Salamat sa iyong pansin