Participatory water saving management and water cultural heritage: Cyprus country report

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PARTICIPATORY WATER SAVING MANAGEMENT AND WATER CULTURAL HERITAGE: CYPRUS COUNTRY REPORT

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SUMMARY - Cyprus is the third largest island in the Mediterranean with an area of 9,251 km^2. Cultivated land represents approximately 67% of the total agricultural land, non-cultivated land covers 30%, while the rest 3% is fallow land. The total agricultural land covers about 200,000 hectares. From these, 46.5% represents temporary crops and 20.8% permanent crops. Water is the most important resource and a prerequisite for progress. Its scarcity has acted as a limiting constraint for the development of agriculture and for other economic activities such as tourism. Irrigated land accounts 38,200 hectares or 19.2% of the total area enumerated and 57% of the annual amount of water for irrigation purposes is provided mainly from Government Irrigation Schemes. In the Government schemes the sources of water are both surface water, groundwater and reclaimed water. As a rule, the water demand in the non- Government schemes is satisfied by groundwater. The scarcity of water together with the high cost associated with collecting and using the limited surface rain water for irrigation, have become real constraints for our irrigated agriculture. Because of this, particular emphasis is placed on the water use efficiency and modern irrigation technology. Modern irrigation systems have been used in Cyprus agriculture for the last 30 years. It is estimated that currently over 95% of the total irrigated land of the country is being served by modern irrigation methods. In making the supply meet the demand the Government policy has encouraged and adopted management measures as water rationing, increase of public awareness for water conservation measures and water pricing for improvements in the water use efficiencies. The main measures as well as the new Government water policies are discussed in this paper.

Key words: water saving, water management, irrigation water, irrigation methods, water supply, water demand, water policies.

INTRODUCTION

Total area of the country

Republic of Cyprus is located at the East Mediterranean basin, 75 km south of Turkey, 105 km west of Syria, 380 km north of Egypt, 380 km east of Rhodes (Greece). Cyprus is the third largest island in the Mediterranean and is situated at geographic latitude of 35 degrees north and longitude 33 degrees east. The maximum length of the island is 224 km from east to west and the maximum width is 96 km from north to south.

The total area of Cyprus is 9,251 km2, of which approximately 18% is covered by forests. These include forests of conifers, such as Calabrian pine, Black pine, Cedar, Cypress and small scale plantations of Eucalyptus. Cultivated land represents approximately 67% of the total agricultural land, uncultivated land 30%, while the rest 3% is fallow land.

In Cyprus, water is the most important resource and a prerequisite for progress. Its scarcity has acted as a limiting constraint for the development of agriculture and for other economic activities such as tourism.

Cultivable areas

The total agricultural land covers an area of about 200,000 hectares. From these 92,300 hectares represent temporary crops (46.5%) and 41,300 hectares are covered by permanent crops (20.8%). The remaining 55,400 hectares represent fallow, uncultivated, grazing, forest and scrub or deserted land with 5%, 24%, 1% and 3% respectively (Table 1). From 1985 to 2001, the agricultural land has decreased by 6% mainly due to urban development (Agricultural Statistics, 2001).

Types of crops cultivated

The main temporary crops were cereals with 61% of the total area under temporary crops, followed by fodder crops with 27,4% and vegetables with 10,5%. The main permanent crops are grapes with 44.1% of the total area under permanent crops, followed by olives and carobs with 24.5%, citrus with 13.1%, nuts with 9.4% and fruits with 8.7%.

Irrigated land accounts 38,200 hectares or 19.2% of the total area enumerated. Of this 51% was irrigated from water pumped from boreholes, 39.2% from dams, 6.3% from rivers and 3.5% from springs.

Table 1: Use of agricultural land and irrigable area in Cyprus (Source: Department of Statistics and Research, 2003).

LAND USE	Irrigable Area (*1000 hectares)	Total Area (*1000 hectares)
CULTIVATED LAND	35.2	133.6
Temporary crops	*19.2*	*92.3*
Cereals	*4*	*56*
Legumes	*0.5*	*0.8*
Industrial Crops	*0.5*	*0.5*
Fodder crops	*4.5*	*25.3*
Vegetables and melons	*9.7*	*9.7*
Permanent Crops	*16*	*41.3*
Vines	*2.5*	*18.2*
Citrus	*5.4*	*5.4*
Fresh fruit	*3.6*	*3.6*
Nuts	*1.2*	*3.9*
Olives and Carobs	*3.3*	*10.2*
FALLOW LAND	1.5	9.5
GRAZING LAND	0	1
UNCULTIVATED LAND	1.5	47.8
SCRUB AND DESERTED LAND	0	6.6
TOTAL	38.2	198.5

IRRIGATION

Origin of irrigation water

57% of the annual amount of water for irrigation purposes is provided mainly from Government Irrigation Schemes. In the Government schemes the main source of water for irrigation is surface water and then groundwater and reclaimed water. As a rule, the water demand in the non-Government schemes is satisfied by groundwater.

Surface water represents the main source of water for irrigation in Cyprus. Although the capacity of all the main dams is 273.6 MCM, the average annual amount of water available for use is estimated to be about 101.5 MCM. Out of 101.5 MCM, 82 MCM are used within Government Projects, 14.5 MCM for domestic use (after treatment) and 5 MCM for ecological areas. During the dry year of 2000 the contribution to irrigation of all dams was only 28.5 MCM.

Groundwater extraction is estimated to be about 127.4 MCM on an annual basis. From this amount, 100.4 MCM are used for agriculture (26 MCM are within the Government Irrigation Schemes and 74.4 MCM are outside the Government Schemes). Such figure does not mean the safe yield of the aquifers, which is much lower.

Springs contribute very little, amounting to 3.5 MCM per year, mainly for the domestic use of the mountainous villages.

Desalination units are relatively important source of water and, at present, contribute up to 33.5 MCM per year.

Treated sewage effluent are presently used in very limited volumes of about 3 MCM, from which 2 MCM are applied for agriculture and the rest for landscape irrigation.

Types of irrigation methods (surface, sprinkler, micro-irrigation, etc.)

Modern irrigation systems have been used in Cyprus agriculture for the last 30 years. Due to the relatively high installation cost the drip method was initially used for irrigation of high value crops, such as greenhouse vegetables and flowers. At a later stage, the installation cost was reduced, and the use of drippers, mini sprinklers and low capacity sprinklers was expanded for irrigating trees and field vegetables. Proper hydraulic design of the irrigation systems, offered free of charge by the Ministry, coupled by a subsidy of the installation cost, resulted in a rapid expansion of the new irrigation systems.

The farmers have extensively adopted modern irrigation systems. The new technology introduced is continuously being tested by the Agricultural Research Institute in order to evaluate the different systems under local conditions and select the appropriate irrigation method for each cultivation (Metochis and Eliades, 2002). It is estimated that currently over 95% of the total irrigated land of the country is being served by modern irrigation methods.

Improving the water use efficiency at farmers level is the major contributor to increase food production and reverse the degradation of the environment, or avoid irreversible environmental damage and allow for sustainable irrigated agriculture (Papadopoulos, 1996). In the same line, in scheduling irrigation it is also important to identify the critical periods (stages) during which plant water stress has the most pronounced effect on growth and yield of crops, since this is also directly related to the nutrients requirement by the crop (Chimonidou, 1996). With the improved irrigation systems and the scheduling of irrigation based on experimental work of the Agricultural Research Institute, the overall water use efficiency at farm level is above 80%.

Moreover, with the introduction of efficient irrigation systems, fertigation became feasible as a means for high yield, good quality of the produce and even more important protecting environment and public health. Fertigation is recommended as an appropriate means to overcome environmental problems associated with fertilization and some times with chemigation under intensive irrigated agriculture (Papadopoulos and Chimonidou, 1997).

Irrigated crops and water demand

The percentage of water demand for permanent and annual crop is 59% and 41%, respectively (Fig. 1). This accounts 95.8 MCM/year for permanent crops and 65.5 MCM/year per annual crops.

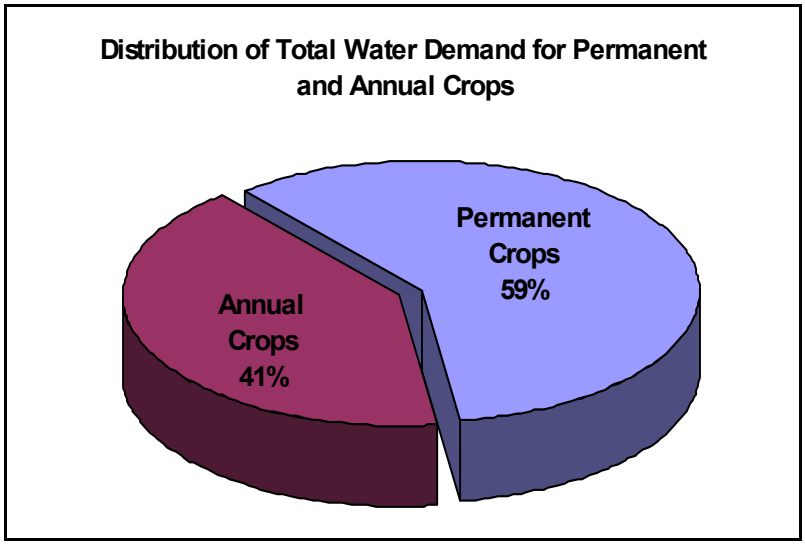

Fig. 1. Distribution of total water demand for permanent and annual crops

The irrigation water demand of is distributed by crops as presented in Fig. 2 distinguishing also between the Government Irrigation Schemes and other schemes, while a territorial distribution of annual irrigation water demand is given in Fig. 3. The total irrigated areas of the whole country are presented in Table 2 by crop and also distinguishing between the Government and non-Government schemes.

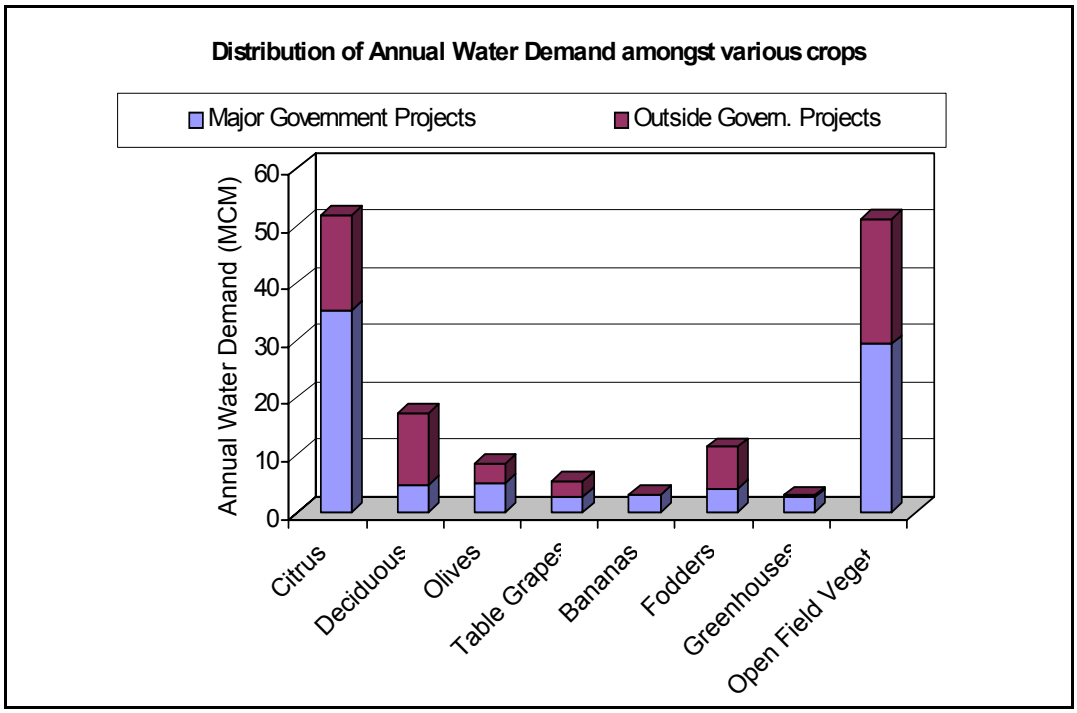

Fig. 2. Distribution of annual water demand among crops (Source: Water Development Department and Food and Agriculture Organisation, 2001).

From 35,200 hectares of irrigated crops, 19,200 refer to temporary crops, while 16,000 refer to permanent crops. The main irrigated temporary crops were vegetable and melons with 27.6%,

followed by fodder crops with 12.8% and cereals with 11.4%. The main irrigated permanent crops were citrus with 15.3% followed by fresh fruits with 10.2%, olives and carobs with 9.4% and Vines with 7.1%.

Table: 2 Distribution of irrigated areas by crop between major Government Irrigation Schemes and other schemes (Source: Water Development Department and Food and Agriculture Organisation, 2001).

	Irrigated areas in hectares			
	Major Government Irrigation Schemes	Outside Govern. Irrigation Schemes	TOTAL	%
Permanent Crops				
Citrus	4766.2	2317.7	7083.9	26%
Deciduous	648.3	1832.6	2480.9	9%
Olives	1137.5	847.2	1984.7	7%
Table Grapes	1043.8	963.6	2007.4	7%
Bananas	289.9	1.0	290.9	1%
Remaining areas		1400 (estimated)	1400	5%
Total Permanent crops	*7885.7*	*7362.1*	*15247.8*	*56%*
Annual Crops				
Fodders	237.7	626	863.7	3%
Potatoes	3545.7	724.1	4269.8	16%
Greenhouses	289.3	31.5	320.8	1%
Open Field Vegetables	3135.4	3282.7	6418.1	24%
Total Annual crops	*7208.1*	*4664.3*	*11872.4*	*44%*
GRAND TOTAL	*15093.8*	*12026.4*	*27120.2*	*100%*

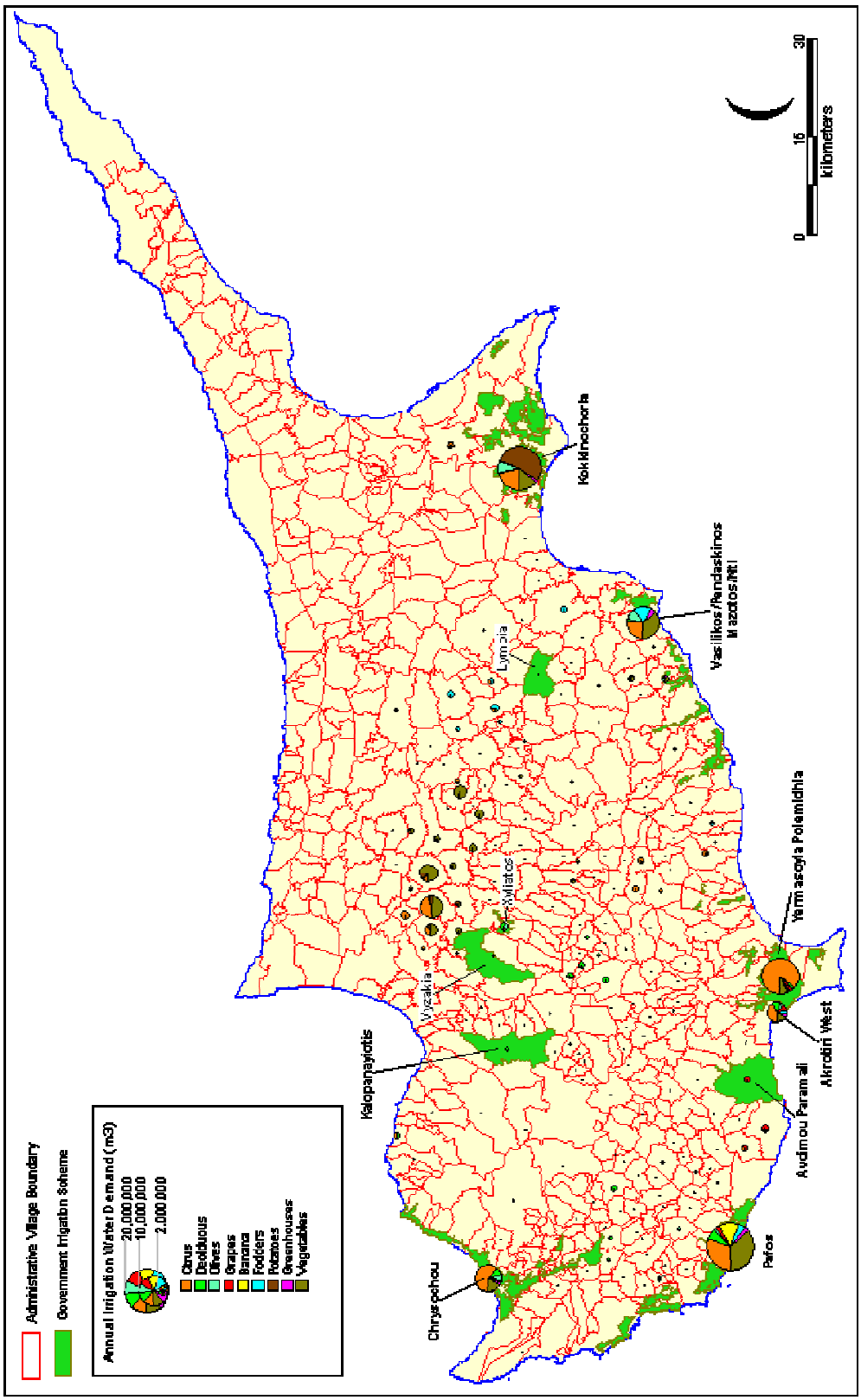

Fig. 3. Annual irrigation water demand (m^3) for Government Irrigation Schemes and villages per crop

WATER RESOURCES ASSESSMENT AND WATER POLICY REVIEW

Water Supply

The mean annual long term precipitation is 513 mm (1916-2000 average, see Fig. 4) which corresponds, for the whole island, to approximately 4600 million cubic meters (MCM) of water per year. More than 80 percent of this returns to the atmosphere through evapotranspiration. Only the remaining 20 percent i.e., about 900 MCM can be considered as the actual water available for use. From this, 600 MCM is surface water and the rest i.e., 300 MCM, flows into the aquifers. The above are estimates of 1970 and refer to the whole island. They are based on rainfall-runoff and groundwater hydrology relationships of past years. Since then rainfall has decreased considerably, more than 13 percent, see Fig. 4. Consequently there is a marked decline of the surface and groundwater sources. It is estimated, that the reduction may be as high as 30 to 40 percent. A reassessment of both the surface and subsurface hydrology is urgently needed, for meaningful planning and management of the water resources of the island.

The drastic reduction of the water supply couple with the concurrent increase of the demand for water have brought about the full utilization and even overuse of the available traditional water sources, i.e. groundwater and surface water. Groundwater is reliable, clean and cheap when compared to other sources. The result is that all aquifers in Cyprus are today exploited beyond their safe yield which is estimated at 230 MCM per year. The excess pumping over natural recharge is in the order of 40 MCM per year. The result is sea intrusion into most of the coastal aquifers. The Government of Cyprus embarked in 1960, the first year of its independence, into an ambitious program of tapping the surface waters that used to be lost into the sea. This program was in essence a comprehensive water resources program that was produced in 1967 to 1970 with the technical help of the United Nations Development Programme. Thanks to this program the storage capacity of surface reservoirs has reached 304,5 MCM from a mere 6,1 MCM in 1960. The yield of these reservoirs is about 130-150 MCM/year. This value is now rarely reached because of the decline in rainfall and hence of runoff.

Now, as the conventional water sources are reaching saturation in their development, the Government is planning to increase the use of treated sewage as the additional main source for water supply for agriculture and the use of desalination water for domestic purposes. The first large sewage treatment plant in the Government controlled areas started operation in Limassol in summer of 1995. Sewage treatment plants are now under design or construction in all the major cities and sensitive mountain villages of Cyprus. All municipal sewage treatment plants have provisions for tertiary treatment. Projections estimate that the volume of reclaimed sewage effluent will increase from 5 MCM of today to 13 MCM by the year 2005 rising to 25 MCM by the year 2020.

Desalination of sea water was first introduced in Cyprus on a large scale basis, on the 1st of April 1997, with the operation of the 20,000 m^3/day reverse osmosis Dhekelia plant. Due to the drought prevailing at the time the plant was soon expanded to 40,000 m^3/day. The plant operates on a Build-Own-Operate-Transfer (BOOT) basis and the desalinated water is presently sold to the Government, at source, at a varying unit price which is about £0.54/m^3. A new sea water desalination plant, of 51,667 m3/day nominal capacity, has being constructed next to the Larnaca airport. It is scheduled to start normal operation by the end of February, 2001. This too, is a reverse osmosis BOOT type plant. The cost of the water from this plant will be only £0.43/m^3. However, the present situation demands the construction of another 30,000 to 40,000 m^3/day sea water desalination plants. In this way the domestic water demand for water will be almost independent on the vagaries of the weather.

Other, tertiary or exotic sources of water supply, such as, importation of water from abroad, artificial rainfall, undersea fresh water tapping, underground deep drilling and evaporation suppression from water surfaces are not economically justifiable and/or risky and unreliable (Socratous, 2003).

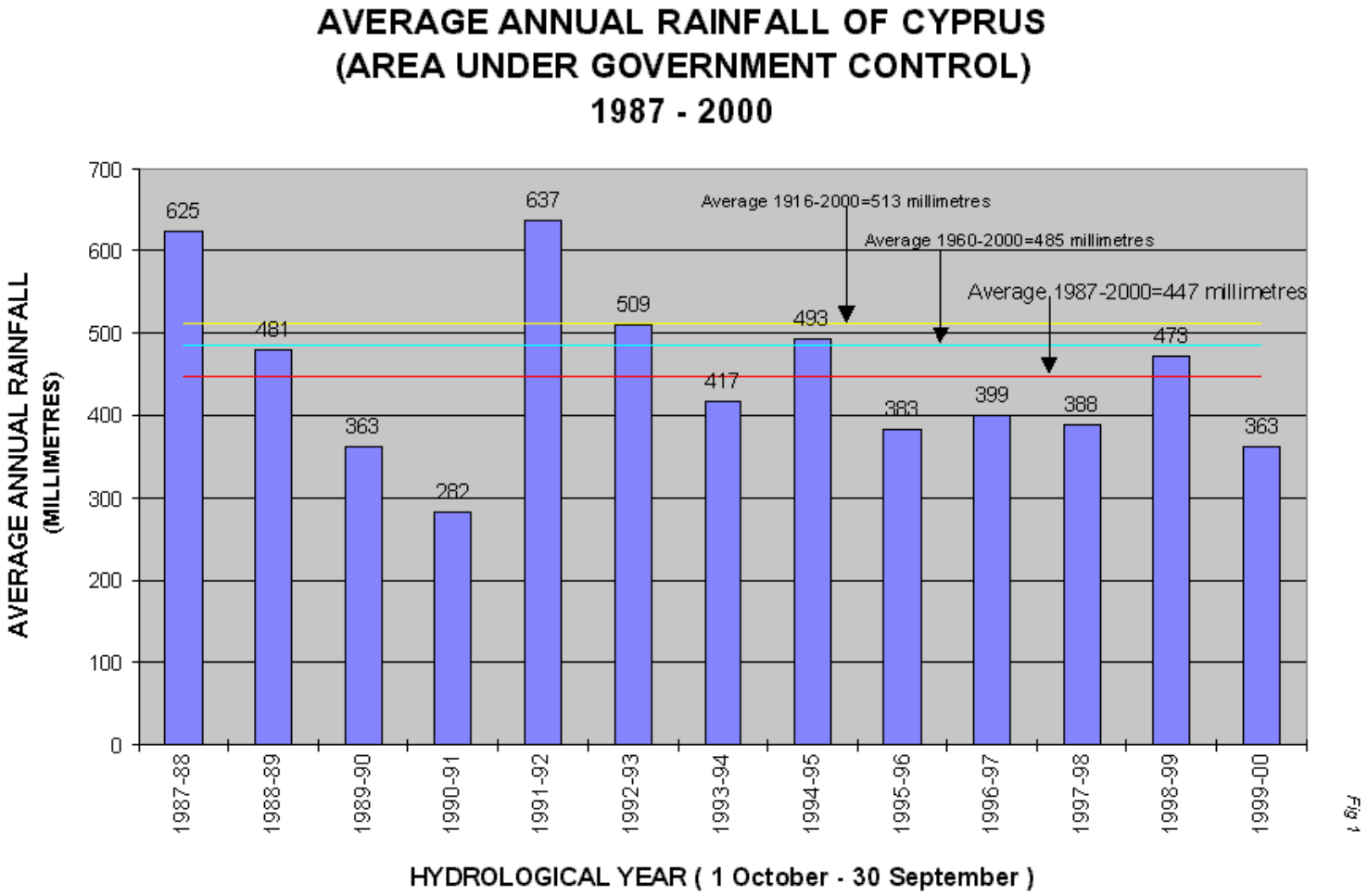

Fig. 4. Mean annual long term precipitation (Source: Socratous, 2003)

Water Demand

Domestic use and irrigation are the two main sectors of water demand. The total water consumption in the Government controlled areas in 1994, a year having no appreciable water supply restrictions was 235 MCM of which 55 MCM was for the domestic sector. The industrial and touristic demand were 6 and 11 percent respectively of the total domestic consumption.

Gross and net domestic consumption of water was 220 l/person/day and 140 l/person/day respectively. This compares well with consumption in most European countries. However, as the tourist industry seeks new forms of recreation (e.g. golf facilities) the water demand for recreation will be increasing. It is conservatively estimated that the domestic water demand will rise to 100 MCM in 2020.

Irrigation water use in 1994 in the Government controlled areas totalled to 180 MCM i.e., 77% of the total water demand. More than half of this amount was supplied from Government water works. The demand for irrigation water will increase to 225 MCM by 2015. Thereafter is expected that the demand for irrigation water will remain stable (Socratous, 2003).

Water Management

In making the supply meets the demand, the Government policy has encouraged and adopted such management measures as water rationing, increase of public awareness for water conservation measures and water pricing for improvement of water use efficiency and water saving.

Water rationing has been extensively applied in an attempt to curtail the demand in periods of drought. In the last years, this has allowed the authorities to reduce the water supply by 20% of the normal demand for domestic purposes and by 67 percent for irrigation purposes. Water conservation measures include subsidies for use of inferior quality groundwater or the treatment of the grey water from households for the flashing of toilets and irrigation of house gardens in the cities. Furthermore, the campaign for raising the “water awareness” of the public towards water conservation proved to be successful.

Now, water pricing is an integral part of the Government policy on water. Water for municipal including industrial, commercial and tourist purposes is sold at full cost, while irrigation water is heavily subsidized by as much as 77 percent. The Governments´ policy towards agriculture is very generous and this has contributed to the selection of non-efficient cropping patterns and even to the wastage of water. It should be noted that in the last six years the water tariff for the domestic sector does not reflect the full cost as is formed with the recent introduction of the comparatively expensive desalinated water. The subsidy is as high as 34 percent. The present price of the water to agriculture and domestic sector is 6.5 c/m^3 and 33.5 c/m^3 respectively (Socratous, 2003).

NEW WATER POLICY AND INSTITUTIONAL ENVIRONMENT

New Water Policy

It is apparent, by a simple comparison of the supply and demand, that the current water situation is not sustainable. The recent droughts of 1989/91 and 1995/2000 demonstrate quite convincingly how critical the water situation may become. A new water policy is warranted that will bring about sustainability. The new water policy should include the following specific measures:

a. Secure additional sources of supply,
b. Ensure efficient use of available water,
c. Modify the current irrigation water allocation matrix,
d. Built up strategic water reserves,
e. Maintain and enhance the quality of the water,
f. New effective/efficient management procedures through the establishment of a Water Entity.

These measures should be holistically applied. Each measure compliments the other. For the detailed and meaningful implementation of this policy a study is being conducted by the Water Development Department (WDD) in cooperation with the Food and Agriculture Organisation (FAO) of the United Nations for the thorough reassessment of the islands´ water resources (Table 3). The study will be limited to the Government controlled area because our compatriots, the Turkish Cypriots, have not shown any interest in joining this study (Socratous, 2003).

Table 3. The New Water Policy and its Measures (Source: Socratous, 2003)

No.	*Main Measures of the New Water Policy*	*Details of the New Measures*	*Additional Yield in MCM/Yr*	*R e m a r k s*
1	Additional sources of water supply	a: New surface sources	20	12 large dams of 85 MCM capacity. Some of the rivers to be tapped flow into the Turkish occupied area. Co-operation of the Turkish side is warranted.
		b: Desalination of sea and/or brackish water	50	*Domestic water needs:*- Four desalination plants (Dhekelia, Larnaca, Limassol, Paralimni) totaling 150 m^3/day nominal capacity. Constant supply, no more rationing of water. *Irrigation needs*: Only for high cash crops. Proposal is under study.
		c: Recycling of effluent water	10	Primary & secondary treatment are compulsory by law. Tertiary treatment cost is low, about 6.5 c/m^3 but transportation costs are high due to the long distances involved. Most of the recycled water, -60%- will be used for hotel gardens, parks, football and golf fields. Only 40% or 10 MCM for agriculture.
		d: Evaporation suppression from reservoirs	Almost nil	The chemical (fatty alcohol) may be toxic and unsafe to humans. Technique to be confined to those reservoirs allocated solely for irrigation.
		e: Tapping of undersea fresh water sources, Tapping of deep aquifers, Importation of water from abroad (Crete), Artificial rainfall (silver iodide).	Nil	Methods not yet proven to be reliable. Worthwhile investigating these methods further. In Israel they claim good results.
2	"Water Demand" management	a: Water tariffs	4	*Irrigation water tariff:* £0.065/m^3, is only 23% of the total cost. *Domestic Water Tariff* Rural areas : £0,335/m3 is only 66% of the total cost. Urban areas : £0.27/m^3 is only 53% of the total cost. *Policy:* a) gradual increase in the price to levels approaching the actual cost b) progressive, seasonal & over consumption tariffs. Possible new policy: Introduction of "Water markets".
		b: Water use efficiency	4	*Irrigated Agriculture*: Increase of water use efficiency in hilly areas and in some non-government schemes. Subsidies for new advanced irrigation systems. New advanced agronomic practices, i.e., timing & quantity/irr. applic. *Domestic Sector* "Unaccounted for water" to be reduced from 30%-40% down to 15%, especially in rural areas.
		c: Water conservation measures and public awareness	2	Strengthening the campaign for "water awareness" Subsidies for introduction of new water economizing technologies.

Table 3. The New Water Policy and its Measures (continuation)

No.	*Main Measures of the New Water Policy*	*Details of the New Measures*	*Additional Yield in MCM/Yr*	*R e m a r k s*
3	Modification of the Irrigation water allocation matrix	a: Modification of the current cropping patterns		Substitute water intensive crops such as bananas, citrus, kolokasi summer vegetables with less water demanding crops such as flowers, aromatic plants winter crops. Agric. Research Institute to experiment with new profitable crops. Dept of Agric. to help farmers in the modification process.
		b: Limitation of irrigated agric. expansion		No further agricultural expansion, except for the on- going projects. New expansion, if any, after “water balance study” is completed. Subsidies not for water but to farmers or for crops.
4	Built strategic water reserves	Recharge of surface water in selected aquifers i.e., Stavrovouni area.		Water stored to be used in case of emergencies. Evaporation and subsurface leaks are limited. Monitoring pumping from the aquifers is warranted. Examples: Stavrovouni & Limassol forest areas.
5	Maintenance and enhancement of the water quality	“Groundwater Protection” Law of 1996 Code of Agr. Practise of 2000		Curtailment of over pumping of the aquifers Against overuse of pesticides/insecticides/fertilizers Public awareness and participation
6	Water Entity establishment	Expansion of Water Development Department into a “Water Entity”		Water resources planning, development, operation and management under one umbrella i.e., the “Water Entity”. Legislation for the “Water Entity” to be submitted very soon to the Parliament.

INSTITUTIONAL FRAMEWORK

Mainly two Ministries, the Ministry of Agriculture Natural Resources and Environment and the Ministry of the Interior carry out the Management of the Water Resources of the Cyprus. Other institutions are involved directly or indirectly with Management of the Water Resources, as presented in Table 4.

Table 4. Institutions involved with Water Resources Management *Source:* (*http://www.emwis-cy.org/Institutions.htm*).

		INSTITUTIONS
A. Independent Organizations		
Indirectly Related to Water	1	House of Representatives
	2	Audit Office
	3	Law Office of the Republic
	4	Planning Bureau
B. Government Organizations		
Directly Related to Water	1	Water Development Department (MANRE)
	2	Geological Survey Department (MANRE)
	3	Department of Agriculture (MANRE)
	4	Agricultural Resource Institute (MANRE)
	5	District Administration Nicosia (MOI)
	6	District Administration Limassol (MOI)
	7	District Administration Larnaka (MOI)
	8	District Administration Famagusta (MOI)
	9	District Administration Pafos (MOI)
	10	Medical Services & Public Health Services (MOH)
	11	General Laboratory (MOH)
Indirectly Related to Water	1	Statistics Service (MOF)
	2	Treasury Department (MOF)
	3	Environmental Service (MANRE)
	4	Meteorogical Service (MANRE)
	5	Land Consolidation Department (MANRE)
	6	Fisheries Department (MANRE)
	7	Department of Secondary Education (MOEC)
	8	Department of Technical & Vocational Education (MOEC)
	9	Department of Primary Education (MOEC)

Table 4. Institutions involved with Water Resources Management (continuation)

C. Semi-Government Organizations		
Directly Related to Water	1	Water Board of Nicosia
	2	Water Board of Larnaca
	3	Water Board of Limassol
	4	Sewage Board of Nicosia
	5	Sewage Board of Larnaka
	6	Sewage Board of Limassol
	7	Sewage Board of Pafos
	8	Sewage Board of Paralimni and Ayia Napa
	9	Sewage Board of Agros
	10	Pafos Municipality
	11	Lakatamia Municipality
	12	Ayia Napa Municipality
	13	Paralimni Municipality
	14	Aradhipou Municipality
	15	Yermasogia Municipality
	16	Deryneia Municipality
	17	Dali Municipality
	18	Lefkara Municipality
	19	Village Boards
Indirectly Related to Water	1	The University of Cyprus
	2	Cyprus Tourism Organization

MANRE: Ministry of Agriculture, Natural Resources and Environment
MOI: Ministry of the Interior
MOH: Ministry of Health
MOF: Ministry of Finance
MOEC: Ministry of Education and Culture

Responsibilities of the aforementioned bodies

The Water Development Department is responsible for implementing the water policy of the Ministry of Agriculture, Natural Resources and Environment with objective to improve the national development and management of the water resources of Cyprus. As treated wastewater is part of the water resources, the Government appointed the Water Development Department as the responsible body for the tertiary treatment as well as the allocation and distribution of this water for agricultural purposes.

The Department of Agriculture, which also belongs to Ministry of Agriculture, Natural Resources and Environment, is responsible for the education of farmers in all matters related to agricultural production with the use of treated wastewater. The selection of crop and the irrigation system to be used as well as preparation of irrigation schedules are amongst the responsibilities of the Department. Also, the follow-up of the guidelines and the code of practice is also responsibility of the Department of Agriculture (Photiou, 2003).

The sewerage boards is a public sector organization and has the responsibility of the concentration, operation and maintenance of the main sewers system which includes the pipes, the pumping stations and the treatment plants. Its main target is to produce treated effluent, which can be used for irrigation purposes. Sewerage boards treat the wastewater up to secondary level and the tertiary treatment is undertaken by the Government. The board is under the control of the Ministry of Interior and its president is the mayor of the city.

The Ministry of the Interior and the Water Boards are responsible for the administration at the consumers level and the distribution of domestic water.

At present there are plans by the Government to reorganize the institutional set-ups of the water sector through the establishment of a water entity to undertake responsibility for the management of all water resources responsible for all the water cycle.

CONCLUSIONS

Water is by far the most precious resource in Cyprus. The quality of life and almost all economic activities depend upon the presence of an economic water supply. The present water situation is not sustainable in spite of the impressive development of the conventional surface water sources in the last four decades. Much has been done but still a lot remains to be done in the realm of water resources development and management. A new approach is presented that ensures sustainability of the water sector of the island.

The targets of this new plans are summarized below:

a. the relief of the domestic sector from the vagaries of the weather,
b. the increase of water tariffs for all uses,
c. the use of recycled water for amenity purposes and irrigation,
d. the formation of underground strategic reserves,
e. the reduction of horizontal expansion of irrigation,
f. the changing of the cropping pattern to less water demanding crops,
g. the preservation and further enhancement of the water quality,
h. the formation of a Water Entity.

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