European Territorial Cooperation Programme
Greece - Italy
2007-2013

INVESTING IN OUR FUTURE

Co-funded by the European Union (ERDF) and by National Funds of Greece & Italy

Efficient Irrigation Management Tools for Agricultural Cultivations and Urban Landscapes

IRMA

WP4

Final evaluation report

www.irrigation-management.eu

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WP4: Survey of irrigation practice

Final WP4 evaluation report

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INTRODUCTION

Water scarcity is both a natural and an anthropic phenomenon. There is enough freshwater on the planet for seven billion people but it is distributed unevenly and too much of it is wasted, polluted and unsustainably managed (Nations & Singer, 2006).

There are great differences in water availability between regions: in some of them water availability, both regarding quantity and quality, is severely affected by climate variability and climate change, with irregular precipitation in and more extreme weather events. At the same time demand is increasing as a result of population growth and other demographic changes (in particular urbanization) and agricultural and industrial expansion following changes in consumption and production patterns. As a result of those ongoing processes, some regions are now in a perpetual state of demand outstripping supply and in many more regions that is the case at critical times of the year or in years of low water availability.

The sustainable use of water - conservation, environmental friendliness, appropriateness of technologies, economic viability, and social acceptability - is a priority for agriculture, especially in water scarce regions.

Policies and practices of water management for irrigation under scarcity conditions must focus on specific objectives according to the causes of water deficiency. On the one hand, an integrated environmental, economic, and social approach is required in assessing water value. On the other hand, technical and scientific knowledge is essential to develop and implement the appropriate irrigation management practices relative to demand and supply side management.

Information on agricultural and urban water employees is essential to know the status of water and the level of efficiency in its use and to make appropriate plans focused on improving water management for a better water productivity.

The "2013 irrigation practice survey" is one of the major outputs of the IRMA project. The purpose of the survey was to gather information in Italian and Greek study area about the water management in agriculture and in urban landscape in public and private sectors. Questionnaires were addressed to Land Reclamation Consortia (LRC) and farmers for agriculture and to Local authorities, managers of sports facilities and citizens in the urban context. The survey collected quantitative information on water use, quality and water sources used, irrigation methods and practices, water management, water costs and legislative framework. The goal of the survey was to review irrigation practices in pilot area, collecting data about irrigation system and identifying good irrigation practices, to better understand the demands of waters for irrigation and its uses in agricultural sector and urban landscape.

The results want to promote active stakeholder involvement in developing and implementing water management strategies and plans in agricultural and urban areas.

This Report provides details on the methodology for creation of the questionnaire and the outputs of the survey and it is structured in six sections. Section 1 describes the irrigation in Italy and Greece, Section 2 gives information about the legislative framework concerning water management in the two States, Sections 3 describes the methodology and the preparatory works for conducting survey, Section 4 presents the results in a summarize form of the three study areas.

1. IRRIGATION IN ITALY AND GREECE

The IRMA project is applied in the Region of Apulia (Italy) and the Regions of Epirus and Western Greece (Greece) (Fig. 1).

In Greece, the total area of arable land and permanent crops is about 3 and 3.5 Mha (EEA, 2014; FAO-Aquastat, 2015a) and almost 40% of it is irrigated (FAO-Aquastat, 2014a) consuming about 7,000 hm3 (70-80%) of water per year (OECD, 2008; FAO-Aquastat, 2014a). These facts do not include irrigation of urban and recreational landscapes. According to the literature findings (Karamanos et al., 2005), surface irrigation methods cover about 7% of the irrigated area while sprinkler and drip irrigation covered 49% and 44% respectively.

In Italy, the total area of arable land and permanent crops is between 9 and 9.5 Mha (EEA, 2014; FAO-Aquastat, 2014b). One third (2.7 Mha) of the total agricultural area is irrigated (Bartolini et al., 2010; Lupia, 2013). In 2007 the most used irrigation method was the sprinkler one covering about 37% of the total irrigated area of Italy, while surface irrigation (borders, furrows) ranged at the second place covering about 31% of that area and micro-irrigation in the third place covering 21.4% of the total irrigation area. However, in the southern regions of Italy like Apulia, where the climate is dry, micro-irrigation covered more than 50% of the irrigated area (Lupia, 2013; Massarutto, 2013).

FIGURE 1 REGION OF APULIA (ITALY) AND REGION OF EPIRUS AND WESTERN GREECE (GREECE)

2. LEGISLATIVE FRAMEWORK IN WATER MANAGEMENT

At European level the Water Framework Directive (WFD) represent the cornerstone of EU water protection policy, which requires that all EU waters should achieve good status by 2015. It seeks to provide a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. In doing so the WFD aims to help improve freshwater quality and quantity, protect the environment and ecosystems and reduce water pollution. One of the major challenges to achieve these objectives is represented by the pollutants released into the aquatic environment from a variety of sources including agriculture, industry and incineration. That's why the WFD requires the production of detailed management plans at River Basin level (then at District level), setting out objectives and proposed measures, for all river basins within the European Union.

The River Basin Management Plan (RBMP) is a detailed account of how the objectives set for a river basin (ecological status, quantitative status, chemical status and protected objectives) are to be reached within the timescale required. Economic issues, such as Economic analysis of water use and Full Cost Recovery principle (including environmental and resources costs) plays a key role in a sustainable management approach both under environmental and economic point of view. As a matter of fact, the leading principle of the WFD says that water is a common good, which need to be protected and conserved for future generations.

From 2010 European Union started a monitoring program on the efficiency of European water policies stating that almost 50% of European water bodies will not achieve Good ecological status under WFD by 2015. This led to the publication in 2012 of "A Blueprint to Safeguard Europe's Water Resources", that design future strategies to achieve European objectives mainly focusing on:

- knowledge of water balances;
- knowledge of soil impacts of water management, mainly in agricultural sector;
- attention to water efficiency (in management and distribution systems);
- promoting of reuse in agriculture and industrial sites;
- monitoring and control of volumes applied (to obtain efficient rates)
- economic analysis and adoption of economic principles in water management (Full cost recovery) implementation of sectoral economic policies.

Focusing on agricultural sector, water policies are strictly linked to climate change policies as well as to Common Agricultural Policy (CAP). The CAP gives an important role on the management of water resources, particularly considering the objectives Rural Development Plans in the planning period 2014-2020, focused on improving the quality of the environment. The greater integration between the environmental and agricultural policy, are pursued through prescriptive instruments such as eco-conditionality, ex-ante conditionality and greening. The protection of water resources is in fact considered in the new planning strategy a key point to the realization of sustainable development, both for the pollution reduction and for objectives related to the improvement of management and increasing in the efficiency of the use of resources. In light of the fact that improving the efficiency of resource use for irrigation has become an essential goal of the new programming, the integrated planning of water use and programming of cross-sectoral interventions, as well as the integration policies Rural Development and the Water Framework Directive 2000/60/EC are taking greater importance.

In this context also the economic instruments of the WFD in relation to the principle of cost recovery of water services can be considered important tools: on the basis of economic analysis for different uses, and the "polluter pays" principle, the Member State shall identify water-pricing policies to encourage users to the efficient use and contributing to environmental objectives, and contribute to the recovery of costs of water services paid by the various water uses, including agriculture.

2.1 GOVERNANCE AND ADMINISTRATION SYSTEM IN ITALY

The current Italian water management system comes from a deep reform of the old framework which referred to 1933 Consolidation act. Such process started in 1989 with the Law 183 which introduce for the first time the concept of a new territorial entity, called river basin. The river basin becomes the territorial reference unit, which consider for a fare management of water bodies, not only its physical burdens, but also the areas in which it insists (Fig 1).

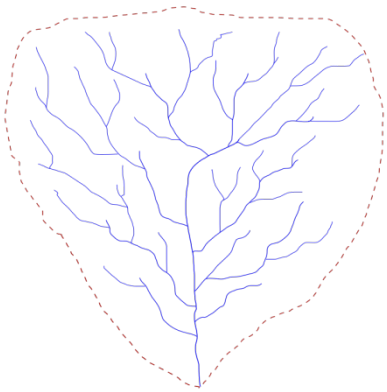


FIGURE 2 RIVER BASIN CONCEPT SCHEME.

From the law 183/89, throughout the law 36 of 1994 (concerning water pricing and cost recovery principles), in 2006, the reform of national water management system has been completed with the law 152 that, referring to principles and objectives of WFD 2000/60/EU, define current Italian framework concerning water resources. It considers the River Basin Management Plan (RBMP) as main tool to gain European environmental quality objectives, aimed at define and monitor the environmental status of water bodies (physical, chemical and biological) proposing measures and strategies to achieve “Good” quality status of all water bodies.

The innovative concept of river basin has thus been developed in District (currently 8) to better manage the complexity and variability arising from the high number of national river basins. So the river basin Authority has changed in District Authority and RBMP has moved to district level.

Concerning agriculture, the legal entities in charge of managing water for irrigation, as well as land reclamation and protection, is the Irrigation or Land Reclamation Consortia (also called Water User Association). It is an “economic public body”, where all people associated pay for its services and the benefit they receive, basing on a “Classification plan”. The plan concerns the supply of water per hectare, the way of distributing water (flow or in pressure) and another issues concerning the definition of individual benefits, and foresee a rate paid by users to cover Consortia operational costs. In Italy there are almost 90 consortia with different dimensions and characteristics due to different geographical conditions (North, Centre and South of Italy presents very various conditions).

In coordination with the District authorities the irrigation consortia have to plan agriculture needs in the irrigation seasons, and according priority to public uses, deliver water to farmers, from the source to the field, covering delivery, operation and maintenance costs of the irrigation network.

The origin of the consortium institution has a private and voluntary character. To better manage water resources, participatory management through the consortium has always favourably responded to problems, the individual would have not been able to solve autonomously.

The main functions of the consortium are:

- Design, execute, maintain and manage the land reclamation works, which guarantee the hydraulic safety of the territory;
- Participate in the formation of territorial plans and urban planning, as well as programs aimed at protecting the environment against 'pollution;
- Contribute to the implementation of the activities of soil conservation, use and management of water resources and environmental protection;
- Contribute to public action for the protection of agricultural water set for irrigation and of water down flowing in the land reclamation network;
- Contribute to the preparation and implementation of the District Basin Management Plans.

Now a day, it is clear the importance of Consortium in coordinating public actions and private activities providing wide and qualified competences, which includes the safety guard and the valorisation of the territory, the environmental protection, the hydraulic safety, the development of agriculture and the management of water.

2.2 WATER GOVERNMENT FRAMEWORK IN GREECE

Two ministries are basically in charge for water issues in Greece. The first is the Ministry of Environment Energy & Climate Change which operates a Special Secretariat for Water (http://wfd.ypeka.gr/). It is in charge for the implementation of the Water Framework Directive (European Commission, 2000) in Greece. In this framework they are setting managerial plans for the various regions of Greece (http://www.ypeka.gr/Default.aspx?tabid=248&language=en-US). These plans contain also information regarding the cost of irrigation water. The other is the Ministry of Agricultural Development and Foods (http://www.minagric.gr) which includes the Directives of Land Reclamation and Hydrology (Directive for Land Reclamations Projects Design and Soil Resources Efficient Use and Directive of Geology and Hydrology). Their main duties have to do with drillings management, public central irrigation networks design and supervision, irrigation water needs calculation etc. Both Ministries have relevant special branches in all regions of Greece.

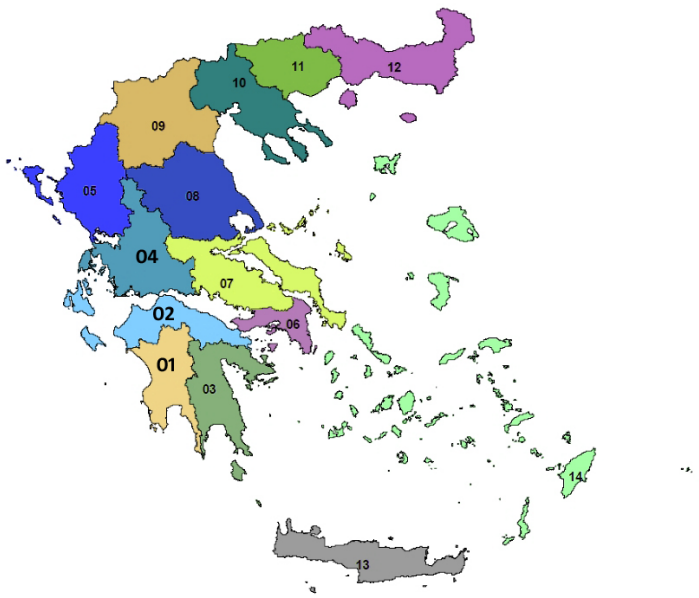


FIGURE 3HYDROLOGICAL APPORTIONMENT OF GREECE (THE 14 REGIONAL WATER DISTRICTS (RWDS)).

In Greece, the WFD has been transposed into the national legislation with Law 3199/2003 (GG A 280 9/12/2003). This law was amended by the Presidential Degree 51 (GG A 54 8/3/2007). The country is divided into 14 Regional Water Districts (RWD), 5 of which are transnational, sharing water routes with Albania, FYROM and Bulgaria to the north and Turkey to the east (Fig. 3). Furthermore the country is divided into 45 River Basins.

For each RWD, a Regional Water Management Plan (RWMP) has been planned to be developed. In 2015 most of these plans are completed (GSW, 2015). It worth to be noted at this point that according to WFD these plans are suggested to concern river basins than regions and should be updated every 6 years. For the area of IRMA project in the Region of Western Greece, the following plans are active:

- Western Peloponnesus (Fig. 4, GR01, http://wfd.ypeka.gr/index.php?option=com_content&task=category&sectionid=2&id=2&Itemid=12),
- Northern Peloponnesus (Fig. 5 and Fig. 6, GR02, http://wfd.ypeka.gr/index.php?option=com_content&task=category&sectionid=2&id=3&Itemid=12),
- Western Continental Greece (Fig. 7, GR04, http://wfd.ypeka.gr/index.php?option=com_content&task=category&sectionid=2&id=5&Itemid=12)

It has to be noted that administrative borders do not coincide with hydrological borders.

3 METHODOLOGY

The main objective of the Work Package 4 in IRMA project was to collect data about water management with emphasis on agricultural and landscape use. It was decided to conduct field surveys in 3 study area (Apulia, Epirus and Western Greece) using online questionnaires for data collection in order to:

- avoid errors in data entry: preventive controls have been implemented in SQL (routines, procedures) to validate data-entry;
- obtain continuous refreshments of the data in Relational Database (RDB);
- customize, integrate and standardize data in a common format;
- centralize all data.

Four types of questionnaires were developed. One for municipality and land reclamation organizations (Types 01 and 02), one for farmers (Type 03) and one for landscape irrigation (Type 04; end-users). The questionnaires were prepared in multi-languages, English, Italian and Greek to allow a more friendly use. The different types of questionnaires are available at: http://www.irrigation-management.eu/deliverables/Questionnaires.rar.

Data were collected from several sources: agro-environmental data, census data and, above all, data collected in the study area by some surveyor filling the questionnaires. To load the data into the RDB a Graphical User Interface (GUI) (Figure 5) was used to allow surveyor to insert data. The system is structured in three steps: data collection, data management and data analysis. In the first part (Figure 3) surveyors will fill out the questionnaires that are created on-line so as to be uniform and shared by all users, then data relating to the questionnaire are stored in a relational database.

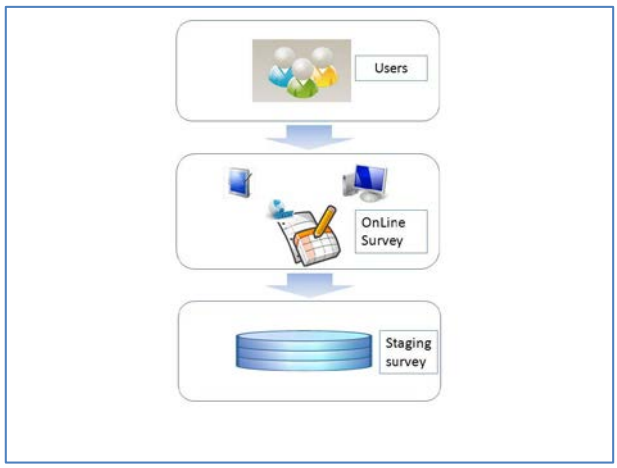


FIGURE 4 DATA COLLECTION STEPS.

FIGURE 5 GUI OF ONLINE QUESTIONNAIRE.

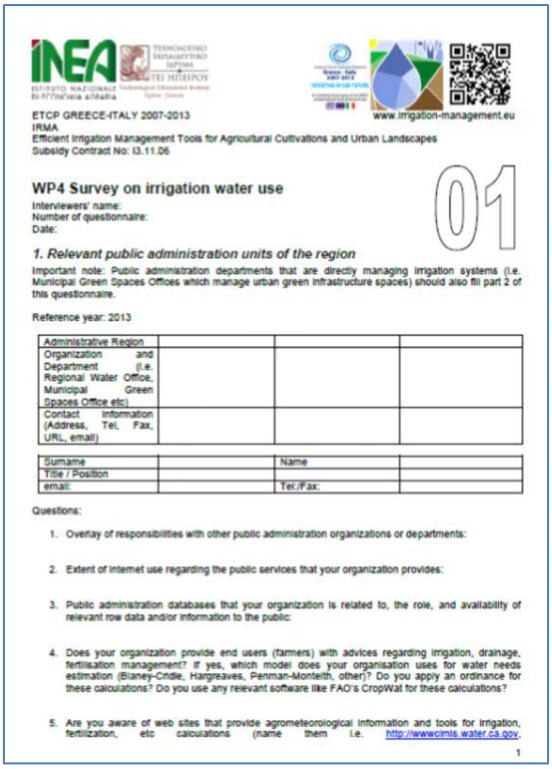
The 4 questionnaires are different each other depending on the user to whom it was addressed, but they have some characteristics in common; the questionnaires were divided in 6 sections, divided as follows:

- Section 1 - General information regarding organization/institution/farmer/Land Reclamation Consortium;
- Section 2 – Information about crops/green areas, irrigation systems and water sources;
- Section 3 – Irrigation management information;
- Section 4 – Economic information;
- Section 5 – Environmental issues;
- Section 6 – Other information.

The answers of the section 6 derived from the talk with the respondents and their availability.

Regarding the number of questionnaires (about 500 per region) and the sample, it was decided to set as goal 20 questionnaires of type 01 (10-15 of which will need filling of part 2); 30 questionnaires of type 02; 250 questionnaires of type 03 (for these we will take advantage of farmers concentration points (cooperatives, training sessions, seminars, fairs etc.) and 100-150 questionnaires of type 04.

The questionnaires were ready in English before the end of February 2014. All the involved partners were involved in their development. The questionnaires are available at: http://www.irrigation-management.eu/deliverables/Questionnaires.rar.



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Subsidy Contract No: I3.11.06

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WP4 Survey on irrigation water use

Interviewers' name:
Number of questionnaire:
Date:

01

1. Relevant public administration units of the region

Important note: Public administration departments that are directly managing irrigation systems (i.e. Municipal Green Spaces Offices which manage urban green infrastructure spaces) should also fill part 2 of this questionnaire.

Reference year: 2013

Administrative Region			
Organization and Department (i.e. Regional Water Office, Municipal Green Spaces Office etc)			
Contact Information (Address, Tel, Fax, URL, email)			

Surname		Name	
Title / Position			
email:		Tel./Fax:	

Questions:

1. Overlay of responsibilities with other public administration organizations or departments:
2. Extent of internet use regarding the public services that your organization provides:
3. Public administration databases that your organization is related to, the role, and availability of relevant row data and/or information to the public:
4. Does your organization provide end users (farmers) with advices regarding irrigation, drainage, fertilisation management? If yes, which model does your organisation uses for water needs estimation (Blaney-Criddle, Hargreaves, Penman-Monteith, other)? Do you apply an ordinance for these calculations? Do you use any relevant software like FAO's CropWat for these calculations?
5. Are you aware of web sites that provide agrometeorological information and tools for irrigation, fertilization, etc calculations (name them i.e. http://wwwcimis.water.ca.gov,

1

FIGURE 6 TYPICAL PAGE OF THE QUESTIONNAIRE

The number of questionnaires (about 400-500 per region) in every region they have been distributed in different ways, depending on the reality/structure of the area, as described in Table 1

The variability of the number of questionnaires within provinces depends on the availability of stakeholders.

TABLE 1SUMMARIZE OF DATA COLLECTED IN STUDY AREAS SUBDIVIDED BY REGION

Type of questionnaires	Theme of interest	Total number of interview	Apulia	Western Greece	Epirus
1. Public administration	Landscape	46	30	8	8
2. Local Organisations for Land Reclamation	Agriculture	61	20	24	17
3. Farm level	Agriculture	1037	270	329	438
4. Private landscape/Leisure irrigation system	Landscape	296	130	129	37
Total		1440	450	490	500

The majority of questionnaires, 72%, was made at farm level, followed by survey done at private landscape stakeholder (20.5%) and local organisations for Land Reclamation (4%).

FIGURE 7 TYPICAL SURVEY SESSION

4 RESULTS

In this section will be presented the results in a summarize form. Detailed results are described in Deliverable 4.2.1, Del.4.2.2 and Del. 4.2.4 and will be object of scientific publication.

4.1 REGION OF APULIA (ITALY)

In the Region of Apulia, irrigation is extensively used in agriculture and it's also gaining ground in landscape sector. The study area is one of the Italian region where it's mainly used irrigation systems with high efficiency and water saving, but other alternative water-saving source (i.e. re-use water, desalinization, etc.) are not widespread in the territory. The problem of water use from wells is deeply felt in all sectors, because it has environmental impacts both short and long term.

Even if stakeholders interviewed of different categories have a PC/Laptop/tablet or smartphone, they don't use very much IT technology in agriculture and landscape sector. In the opinion of stakeholder the irrigation IT are water and labour saving, but they have the disadvantage of high costs and that are difficult to manage.

For all stakeholder the most significant problem in Apulia region is drought, followed by salinization and desertification. For the stakeholder interviewed the main cause for water shortages in the area is climate change, followed by the lack of guidance and rules regarding water distribution and by the excess pumping for irrigation by private drillings. In general, stakeholders have a sensibility about environmental issues, they know that there is a closed relations between water management and environment and that environmental problems can be solve in the future trying to manage in a better way irrigation water, trying to use other water source and to modernize irrigation network.

4.2 REGION OF WESTERN GREECE (GREECE)

The Region of Western Greece is one of the largest agricultural regions in Greece, where a high percentage of residents is professionally engaged in land cultivation.

Local public authorities as municipalities and land reclamation consortia tackle with financial and administrative issues directly linked to inefficient irrigation water management. Municipalities vary in their organizational typology concerning urban landscape management. The land reclamation consortia face more significant financial problems putting at stake their sound operation. The recruitment of specialised staff, the maintenance and modernisation of the irrigation system, the implementation of IT technology, the monitoring of the water consumption and the provision of advisory support to end users are the main challenges they both face. The superior personnel is aware of the 2000/60/EC Directive (WFD) but they fail to participate in the development of any legislative act or local plan concerning the water management strategy.

Regarding farmers and landscape project managers, even if the majority of the interviewees own a PC/Laptop/tablet or smartphone, they rarely apply IT technology in agriculture in contrast to landscape sector. The majority of interviewees, although they find the irrigation water cost very high, fail to give an estimation of the annual cost for irrigation while the absence of water meters reveals the big ignorance of how much irrigation water is spent. Adequacy of water resources in their region is not considered as a problem and no particular method is applied for saving irrigation water. Stakeholders show a sensibility about environmental issues and they recognise the close relation between water management and environment. As a future trend, stakeholders think that a web based advice system for irrigation in agriculture and landscape sector would be helpful and could decrease the total irrigation cost while the majority embraces the idea of adopting and even paying for such a service.

Update of the legislative framework, augmentation of actions regarding networking of irrigation stakeholders, linkage of science with practice and reinforcement of training and consultation activities would provide the means for direct and quick improvement of irrigation practice in the Region of Western Greece.

4.3 REGION OF EPIRUS (GREECE)

For the Region of Epirus (Greece), according to the public authorities that are engaged with water and irrigation-drainage management, the most serious problems concerning water are the lack of water management strategy, insufficient training and ineffective water management at end-user level. Land Reclamation Consortia mainly suggest that modernization of irrigation and drainage systems is necessary, so as to improve water management and reduce energy cost.

In Epirus, irrigation is extensively used in agriculture, but unfortunately almost 70% of the farmers that were interviewed don't use any water saving practices nor have a water meter installed. This is probably because farmers don't face problems regarding water adequacy. Agricultural holdings are mainly operated by family members. This may indicate that farmers have a traditional approach to farm management, lacking a business point of approach for maximizing cultivations, increasing yield and adopting new methods and techniques. Because of the low presence of young people in the agricultural sector in Epirus, most farmers are not familiar with computers and electronic technology so they don't use ICT for irrigation management due to their complexity. The majority of farmers had not professional advice concerning irrigation so far, but a significant proportion of them would use an automatic service regarding irrigation scheduling.

At private level, landscape managers and homeowners are more familiar with computers and technology and have higher environmental awareness. The majority of them have irrigation and drainage systems designed by experts and they also ask for professional help regarding irrigation scheduling. About 60% apply the irrigation schedule using a controller and the same proportion uses a water meter.

Drought is considered as the most significant issue regarding water resources between stakeholders and it is also believed that modernization of irrigation and drainage systems is definitely needed. Nevertheless, stakeholders have sensibility about environmental issues and they know the relation between water management and environment.

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