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Efficient Irrigation Management
Tools for Agricultural
Cultivations and Urban
Landscapes

IRMA

WP4 Survey of irrigation practice

Report of the survey outcomes on irrigation practice in Apulia Region



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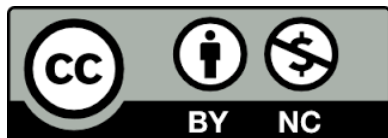
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WP4: Survey of irrigation practice

Report of the survey outcome on irrigation practice

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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 employes 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 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 in the specific study area (Apulia region), Section 2 gives information about the legislative framework concerning water management in Italy, Sections 3 describes the methodology and the preparatory

works for conducting survey, Section 4 presents the results of single types of questionnaires and section 5 discuss about the conclusions and the results obtained.

The questionnaires are given in Annexes I to IV.

1. Irrigation in Italy

In Italy, the total agricultural area is about 12.9 Mha (ISTAT,2010), with more than 1.6 million farms of a mean size of 7.9ha, with a 19% (2.4 Mha) of the total agricultural area irrigated (ISTAT, 2014). The region with the largest irrigated area is Lombardy, with more than 600,000 hectares irrigated, corresponding to 23.6% of the national irrigated area. Following the regions Piemonte, Emilia Romagna, Veneto and Puglia that have respectively the 14.8, 10.4, 9.9 and 9.8 percent of the national irrigated area. Agriculture uses almost 67% of the total amount of the available water (Massarutto, 2013). The most common irrigated crops are grain maize, rotational forages, vineyards, fruit and berry plantations (Lupia, 2013).

In Italian farms, irrigation water is managed from Land Reclamation Consortia (63%), this percentage is divided between the delivery based on turned (34.2% of the total volume used) and the one on demand (28.8%). The 17.9% of the water comes from groundwater withdrawn within or close to the farms, 11.0 per cent from surface water outside the farms, such as lakes, rivers or streams, and 4.7% from surface water internal to the farm. The supply of groundwater inside or near the farm is higher in small size companies, (less than 1 hectare), where the 38.3% of water come from wells.

Overall, 62% of irrigated water is distributed with a low efficiency irrigation system (27.2 % and 34.8% respectively for surface and lateral irrigation and flooding), mainly due to rice cultivation, the remaining by sprinkling (26.8%), micro irrigation (9.6%) and other system (1.5%) (Istat, 2014). However, in the southern regions of Italy like Puglia, where the weather conditions are dry, micro-irrigation covered more than 50% of the irrigated area (Lupia, 2013; Massarutto, 2013).

1.1 Irrigation in the Apulia region

The IRMA project regards the regions of Puglia in Italy and Western Greece and Epirus in Greece (Figure 1). The climate in Puglia and the Western coast of Greece is sub Mediterranean to xerothermomediterranean type.



Figure 1 Region of Apulia (Italy) and Region of Epirus and Western Greece (Greece) (source: Google Earth)

In Apulia region the irrigated area is around 238.542ha, managed by about 63.900 farms (ISTAT, 2014). The water is derived from different source: 61.4% of surface are irrigated with underground water (usually drilling), 4.5% of areas are irrigated using superficial water (river, lake, etc), 27.2% of surface are irrigated with water from Public Consortia. The most used irrigation system is micro-

irrigation (51.6% of irrigated areas), followed by sprinkler, 32.5% of irrigated area and 9.9% of area is irrigated with surface irrigation. The most common irrigated crops in Apulia region are olive trees, vineyards, orchards and fruit trees (ISTAT, 2014).

2 Legislative framework in water management in Italy

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

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).

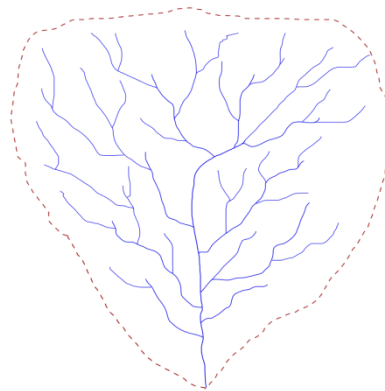


Figure 2 River basin concept scheme.

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.

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 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 4) 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.

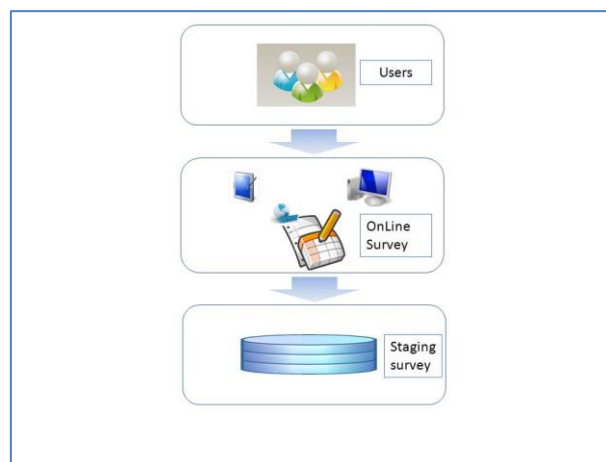


Figure 3 Data collection steps.



Figure 4 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 400-500 per region) in every region they have been distributed in different ways, depending on the reality/structure of the area. In Italy, Apulia region, 450 questionnaires have been collected as described in Table 1.

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

Type of questionnaires	Theme of interest	Number of interview	Lecce and Taranto	Foggia, Barletta-Andria-Trani, Bari	Bari and Brindisi
1. Public administration	Landscape	30	16	2	12
2. Local Organisations for Land Reclamation	Agriculture	20	3	5	12
3. Farm level	Agriculture	270	102	113	55
4. Private landscape/Leisure irrigation system	Landscape	130	29	30	71
Total		450	150	150	150

Table 1 Summarize of data collected in Apulia region subdivided by province.

4 Results

4.1 Questionnaire 1: Public urban green space

Survey 1 refers to public administration of Apulia region that manage the urban green space.

In Apulia region there are 258 municipality, 30 administration, 11,62% of the total, participate to the survey, the major distributed in the province of Lecce (Figure 5).

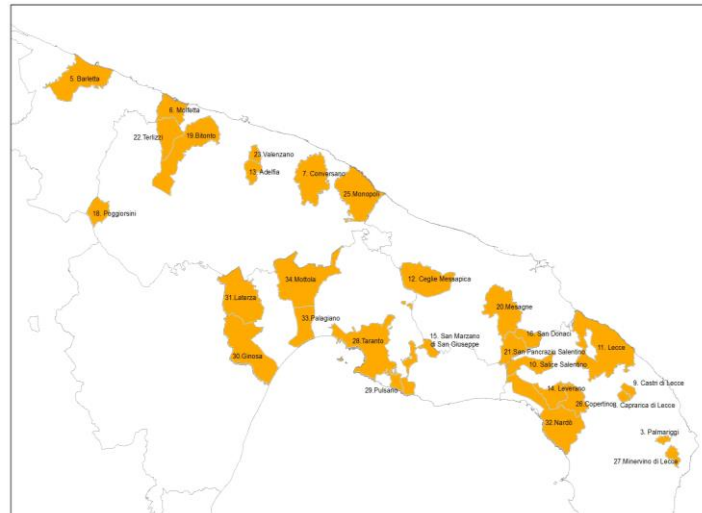


Figure 5 Public administration units that participate to survey

All the administrations don't offer to end users (farmers) with advices regarding irrigation, drainage, fertilisation management, the 20% of the total are aware of web sites that provide agrometeorological information and tools for irrigation. Most of them use the website "www.agrometeopuglia.it". The 23% of the municipality are directly responsible for public water sources (drillings, reservoirs etc) and the 6,6% are aware of the local water management plan which is applied in the framework of 2000/60/EC at the hydrological basin of their jurisdiction.

Urban green infrastructure, sources and irrigation system

Regarding water issues (Figure 6), the big part of the sample say that there is a lack of training and of straightforward strategy regarding water management. The most significant water issues, for the 50% of the administrations, is drought and the second is salinization (Figure 7).

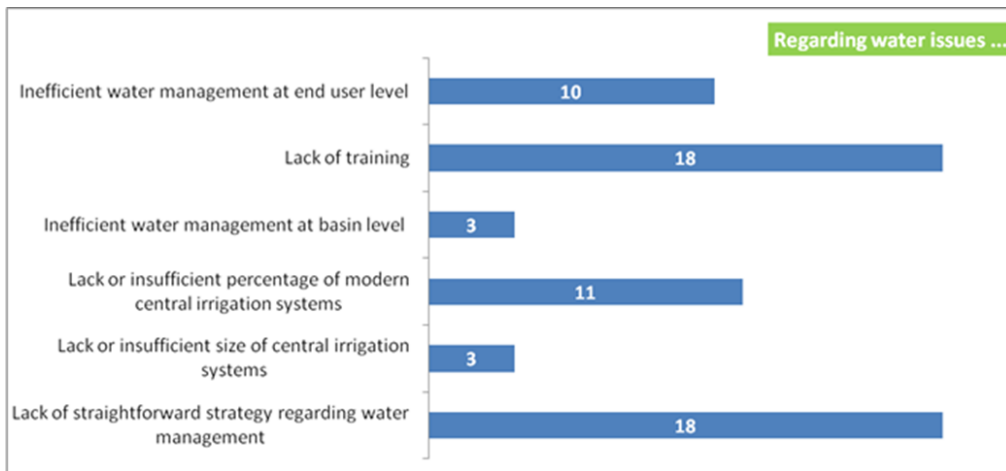


Figure 6 Opinion regarding water issues.

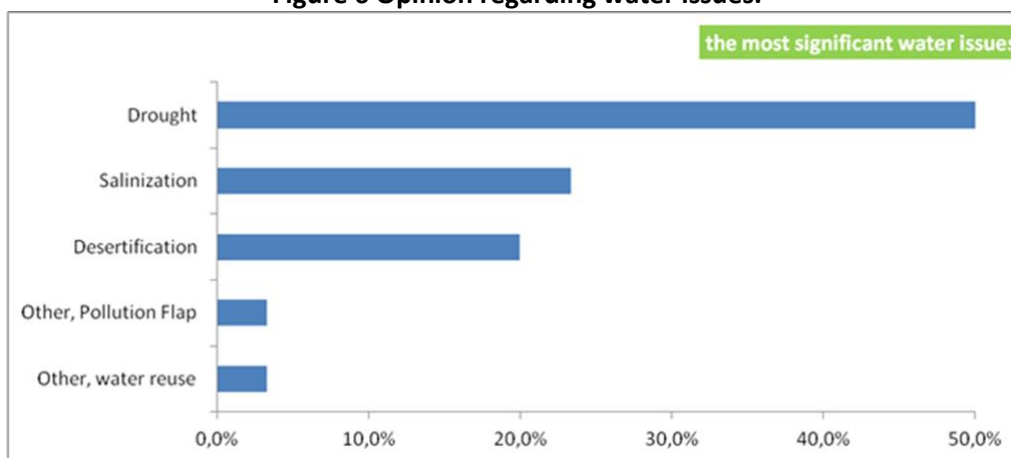


Figure 7 The most significant water issues for municipality.

The main cause for water shortages in the area is the lack of guidance and rules regarding water distribution for the 50% of the interviews, while for the 16.6% of interviews is the excess pumping for irrigation by private drillings and for the 13.3% the climate change (Figure 8).

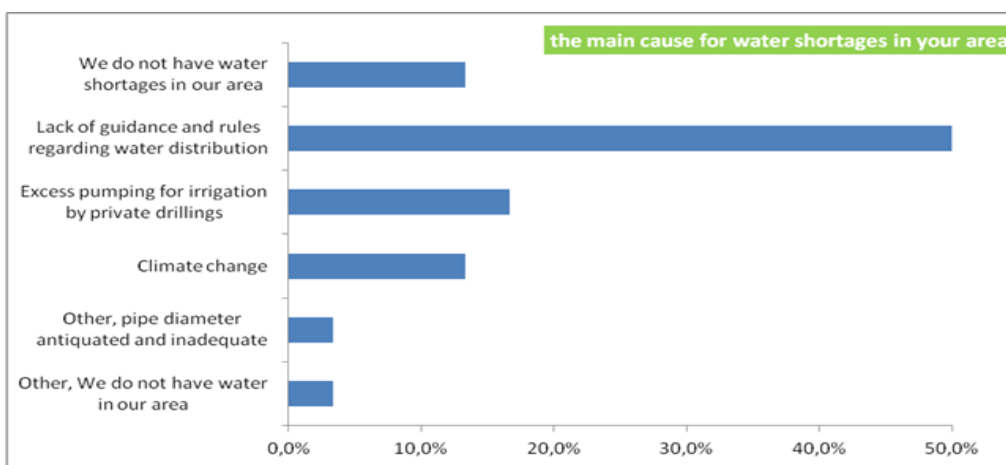


Figure 8 Main cause for water shortage.

The 53% of municipality interviewed have a department which directly manage urban green infrastructure spaces (Figure 9). These office manage more than 230 ha of green space area, about the 55% of these surface are irrigated with temporary (movable) irrigation systems and the 16,18% of the surface is equipped with fixed irrigation systems.

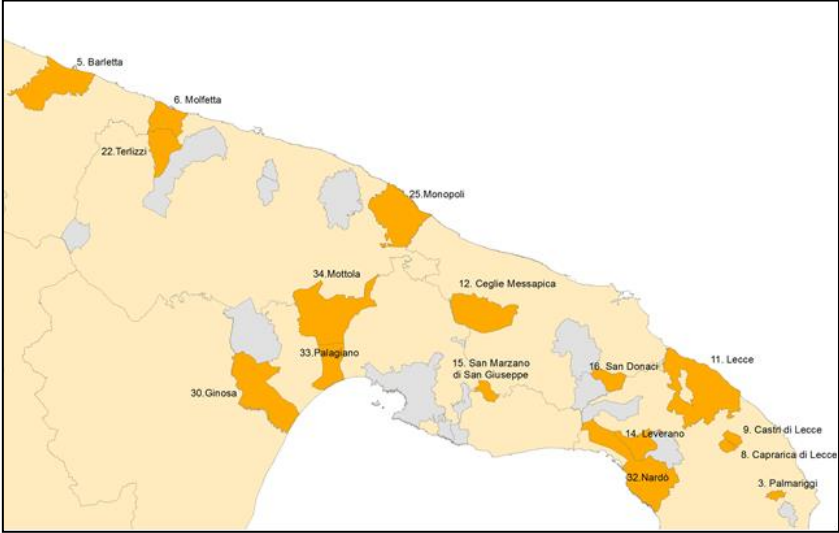


Figure 9 In yellow colour the municipality which manage green space.

The departments manage more than 540 urban green infrastructure, the 27% of the surface is represented by 17 cemeteries, the 17% of area are athletic fields, the 16% is vegetation on side of middle road verges, while the 15% is vegetation round about circuses squares (i.e. plazas) (Figure 10).

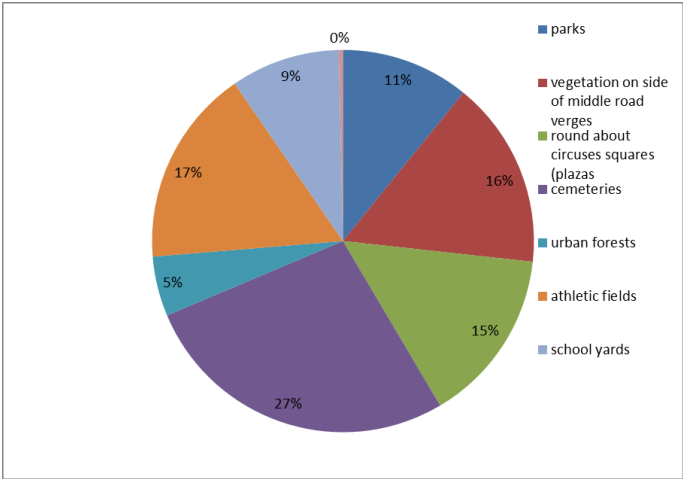


Figure 10 Surface of green infrastructures manage by department.



Figure 11 Example of urban green areas in Apulia region.

The pop-up sprinkler is the most widespread irrigation system (26,31%), trees or shrubs on turfgrass are irrigated with other types of irrigation as “drilled hose”, trees or shrubs on pavements and shrubs usually are not irrigated while turfgrass in over the 66% of the case is irrigated with pop-up sprinkler system (Table 2).

Type of landscape ²	Type of irrigation system ¹					Total
	(O) Other	(GS) Ground sprinkler system	(N) No irrigation	(PS) Pop-up sprinkler system	(GME) Ground microirrigation with individuals emitters	
(TG) Trees or shrubs on turfgrass	6	1	3	2	1	13
(TP) Trees or shrubs on pavements		1	3			4
(S) Shrubs	1		7		1	9
(G) Turfgrass	1	2		8	1	12
Total	8	4	13	10	3	38

Table 2 Type of irrigation system subdivided by landscape.

Water used to irrigate is fresh water in 54% of case, 39% of water derived from public or private drillings. Only one department use 100% of treated waste water and only one office use the 20% of their water from rain harvesting system (Figure 13). Fresh water is derived from “Acquedotto Pugliese” and from Land Reclamation Network. A 43% of departments use tank trucks in order to transport water for irrigation, in detail: the 77% of case they used to directly apply water to the plants though free surface distribution, 15,4% they use directly apply water to the plants though connection to an irrigation system and 7,7% they use to fill tanks.

¹ (N) no irrigation; (PS) Pop-up sprinkler system; (GS) Ground sprinkler system; (GME) Ground microirrigation system with individual emitters, micro-sprinklers etc; (GDL) Ground microirrigation system with drip lines; (SME) Subsurface microirrigation system with individual emitters; (SME) Subsurface microirrigation system drip lines; (O) Other, please specify

² (G) Turfgrass; (TG) Trees or shrubs on turfgrass; (TP) Trees or shrubs on pavements; (S) Shrubs

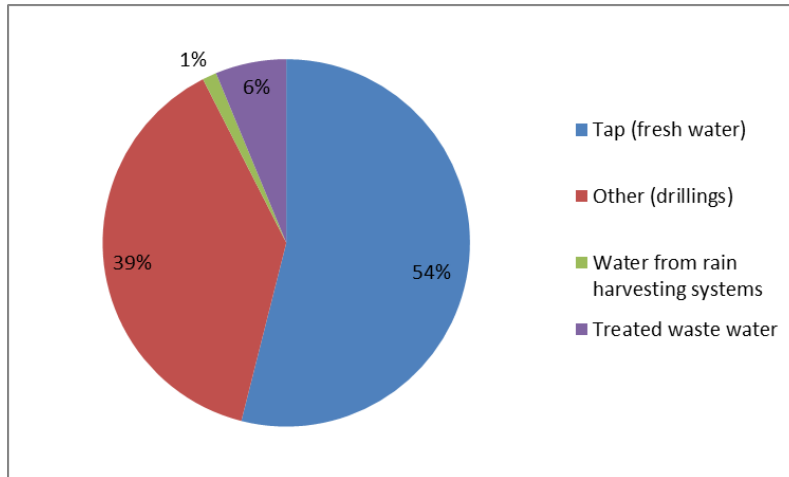


Figure 12 Water source for irrigation in urban green space in 2013.

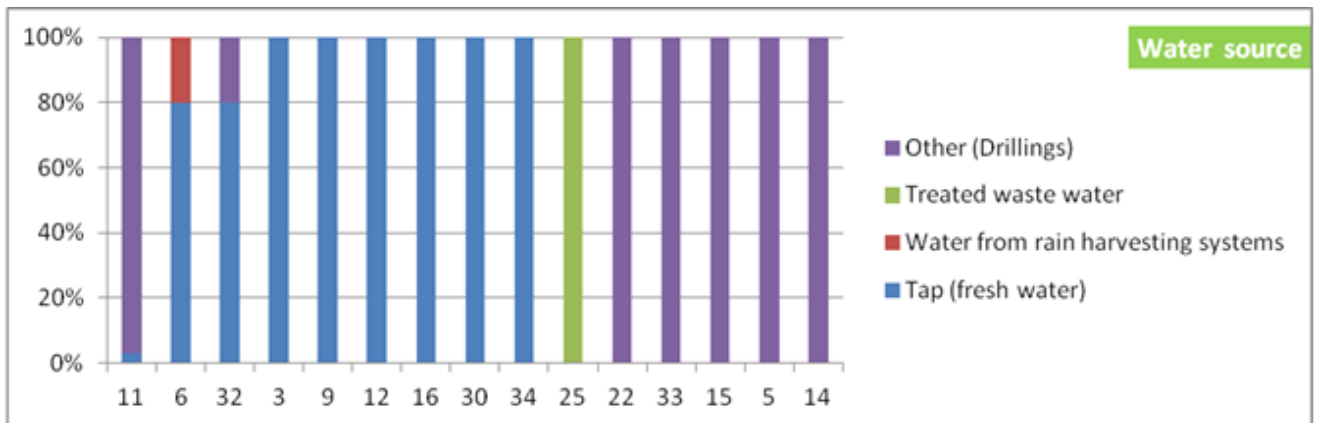


Figure 13 Detailed of water source x department.

Concerning public landscapes, the main reason why they are not irrigated is the high costs of irrigation (41.3%), the 31% don't irrigate due to the lack of distribution infrastructure, while the 10% don't need to irrigate, because they use local plants and xeriscaping techniques.

Irrigation management

None of departments develop and apply a guidelines regarding green space and none of offices apply some kind of quality system or irrigation ban. Six departments (37%) use water meters in order to monitor water consumption for irrigation. Only one units use some kind of electronics or IT technology for irrigation management (controllers, sensor. etc.). 75% of interviewee say that technology for irrigation management are useful because they save water and labor, but they are too expensive and complicated to use, also needing a specialized staff to repair them (Figure 14), while the irrigation system, that every department use, is easy to maintain in the 87,5% of case. None of municipality perform analysis on water and soil.

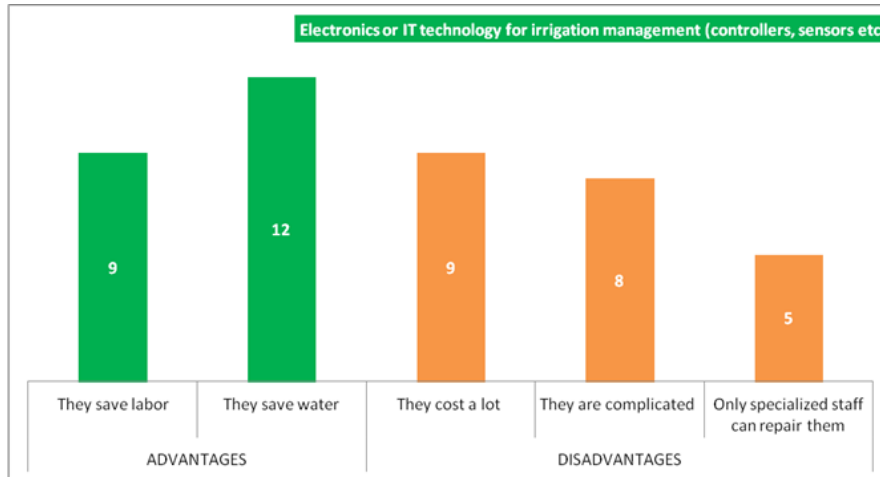


Figure 14 Opinions about advantages and disadvantages of technology in irrigation system.

The typical irrigation period in the study area is of 4 month (Figure 15), from June to the end of September (43.75%), usually the administration don't define it by ordinance, but by experience (93.75%) and they don't face problems regarding water supply in a particular time of year.

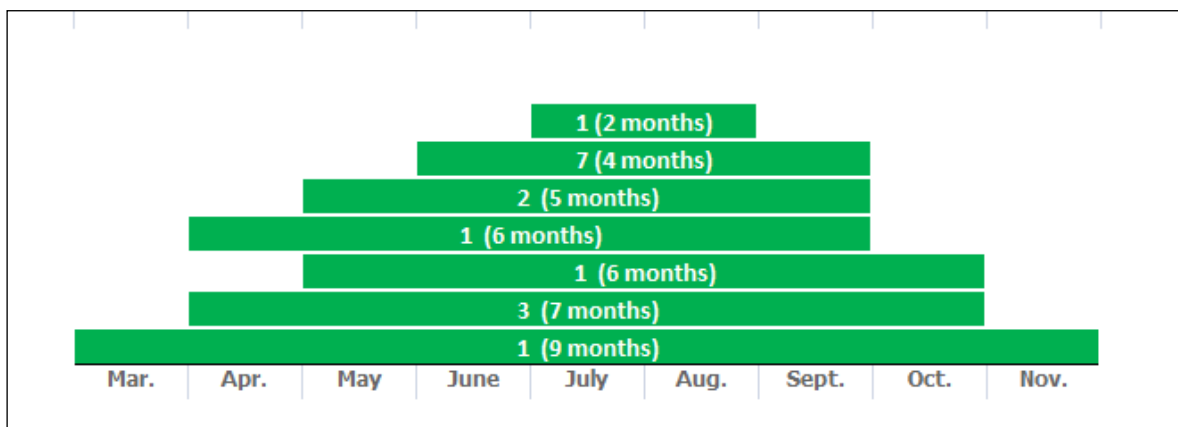


Figure 15 Irrigation period in study area during 2013.

The 81.25% of department don't use fertilizers during irrigation, none of units use plant protection substances with irrigation and don't have problems of run-off and drainage.

The major problems that every department face regarding irrigation are connected with the excessive need for labor in order to run the system, problems connected with the design and conditions of the system and with the training of staff and sub-contractors.

The costs of irrigation system management concern mainly the O&M of the infrastructures (40%), follow by the expense for labor (32%) and electric energy (14%) (Figure 16).

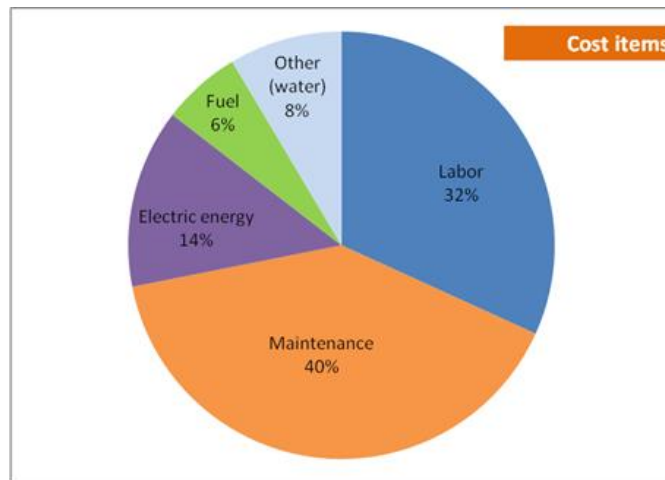


Figure 16 Costs for irrigation system.

The departments of urban green space don't link irrigation and drainage management choices with the protection of other water bodies (ground water, rivers, lakes, wetlands, sea etc). Even if Apulia region is a water scarcity area, during the 2013, the 65% of departments didn't use practices in order to save water or energy, in the 17% of case they elaborated irrigation schedules, the 11% use groundcover/mulching and the 6% make audit and more frequent maintenance.

4.2 Questionnaire 2: Local Organisations for Land Reclamation

Regarding land reclamation, 19 users respond to the “questionnaire 2” about Consortia or Farmer association that manage water for agriculture irrigation: 6 Public Land Reclamation Consortia, 1 Regional Agency called “ARIF” and 12 private associations of farmers. Collected data describe that, in Apulia region, water used in agriculture is managed by private consortium of farmer (58%) and public consortia (42%) that manage more than 99% of the total area investigated, more than 1.700.000 ha.

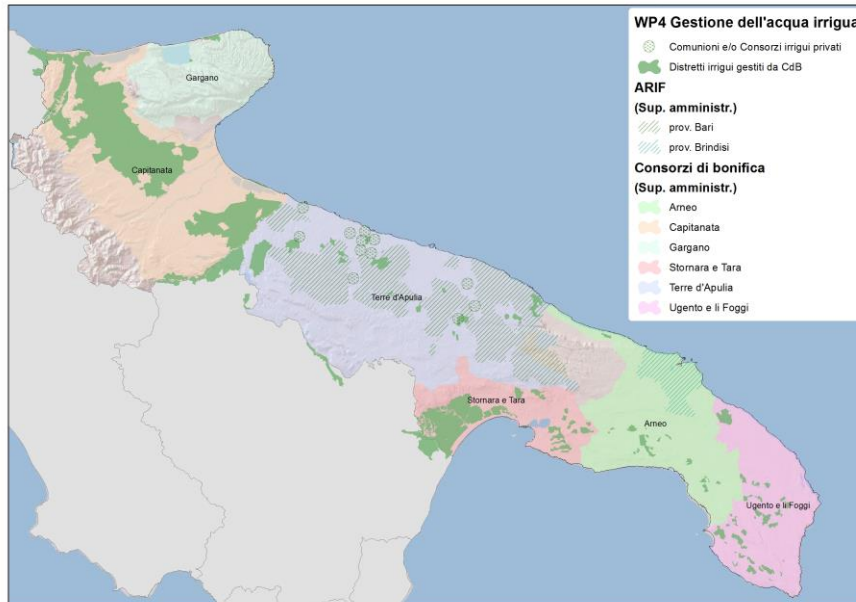


Figure 17 Distribution of Land reclamation Consortia in Apulia region.

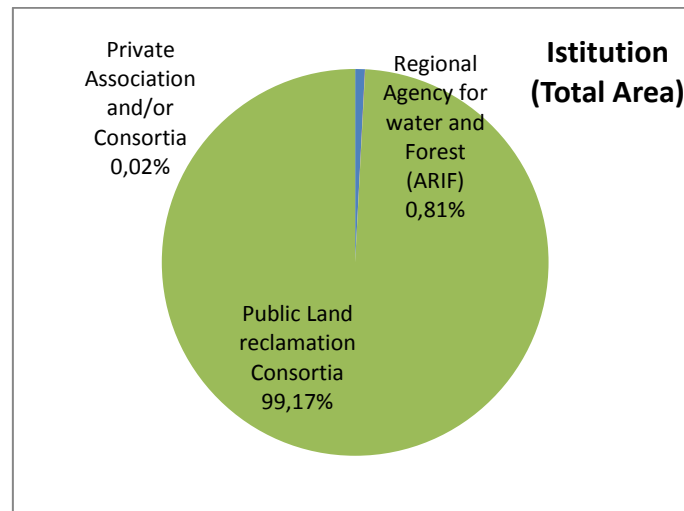


Figure 18 Total surface managed by local organization.

In Apulia there are 6 Public Consortia that manage more than 1.750.000ha, with almost 200.000ha of irrigable surface. Consortium “Terre d’Apulia” manage the larger area and it has the larger irrigated area, while the Consortium “Capitanata” has the greater irrigable area and it irrigates the 91% of the total area managed by Consortia (Figure 20).

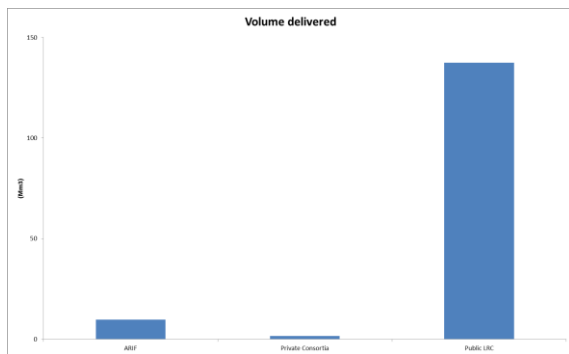


Figure 19 Volume delivered during 2013 by Consortia.

In 2013, small private consortia and Consortium “Gargano” irrigated almost all the area irrigable, the regional agency “ARIF” irrigated the 76% of the irrigable land and Consortium “Capitanata” the 53% of the irrigable area (Figure 21).

In Apulia region, the totality of water managed in agriculture is managed by Public Land Reclamation Consortia: in the season 2013 Public Consortia delivered more than 135 Mm³ of water (Figure 19).

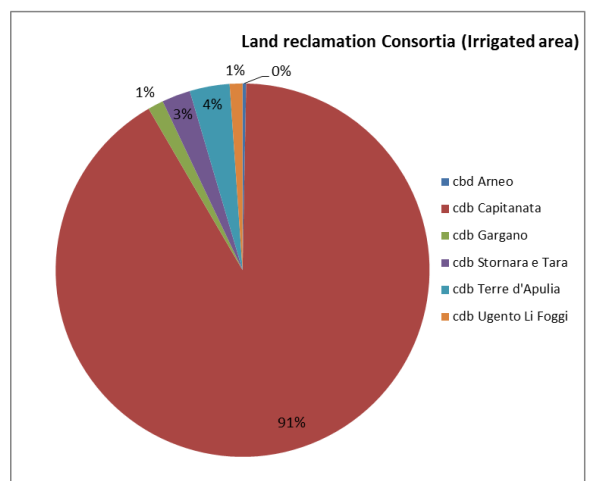
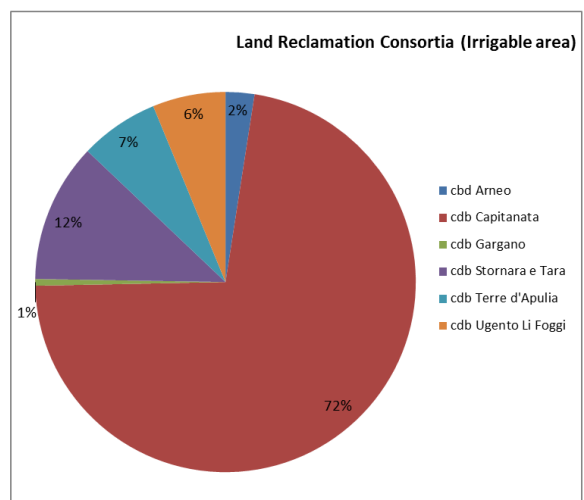
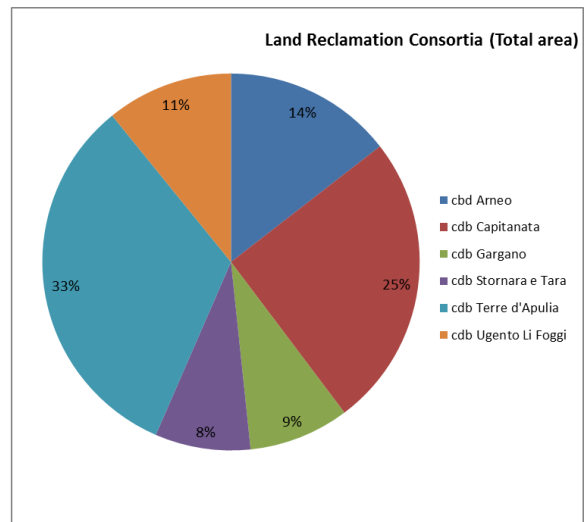


Figure 20 Surface inside Consortia in Apulia in 2013

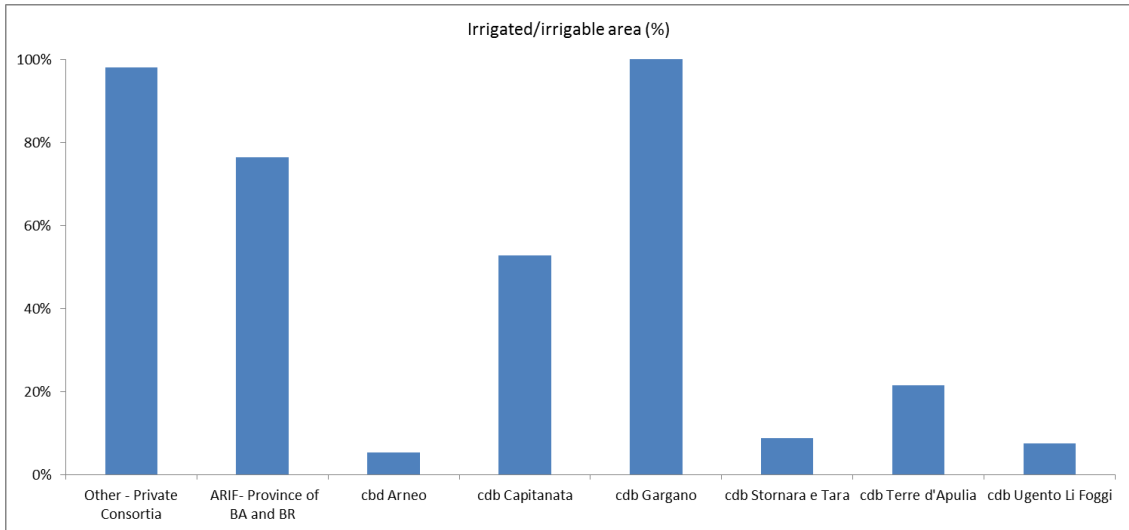


Figure 21 Indicator of ratio between irrigated and irrigable area in 2013.

During 2013, Consortia defined the period of irrigation by experience in the 79% of the case and by ordinances (10%); the period of irrigation varies, but in general it is between April and September/October (Figure 22).

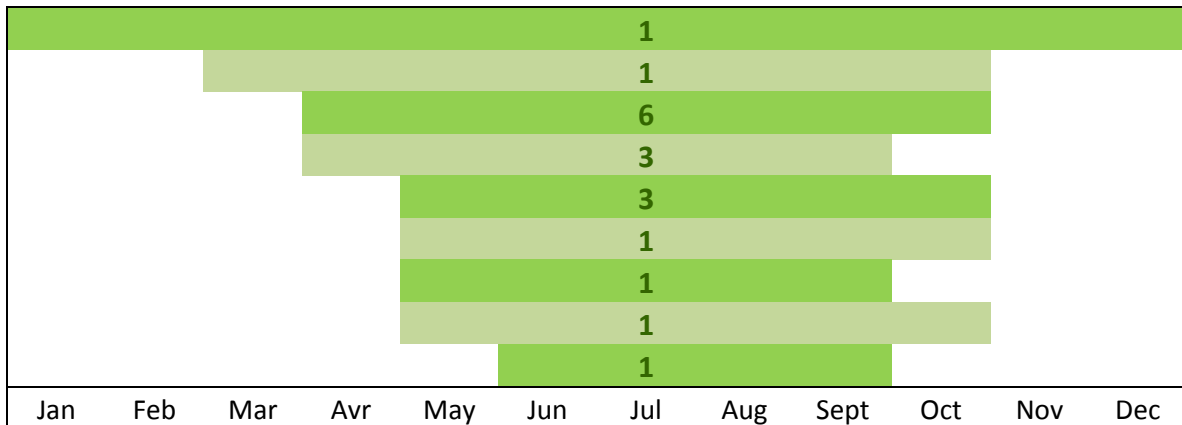


Figure 22 Period of water availability in 2013.

In the last 3 years, the average volume delivered is more than 185 Mm³, the 95% has been managed by public Consortia. More than the 89% of the total water was distributed by pressurized system and the 10.66% by gravity ones. Pressurized systems was addressed mainly to irrigate tomatoes (76%), vineyards (11%) and fruit trees (9%), while water delivered by gravity was used for olive trees (52%), fruit trees (31%) and orchards (9%). The quantity of water used to irrigate a specific crop changes among consortium according to the system of distribution of water and also to the type of crop. For instance, **Figure 23** shows the amount of water used by pressurized system to irrigate different types of fruit trees in several Consortium: it varies from 1.200 to 7.000 mc/ha during the season 2013.

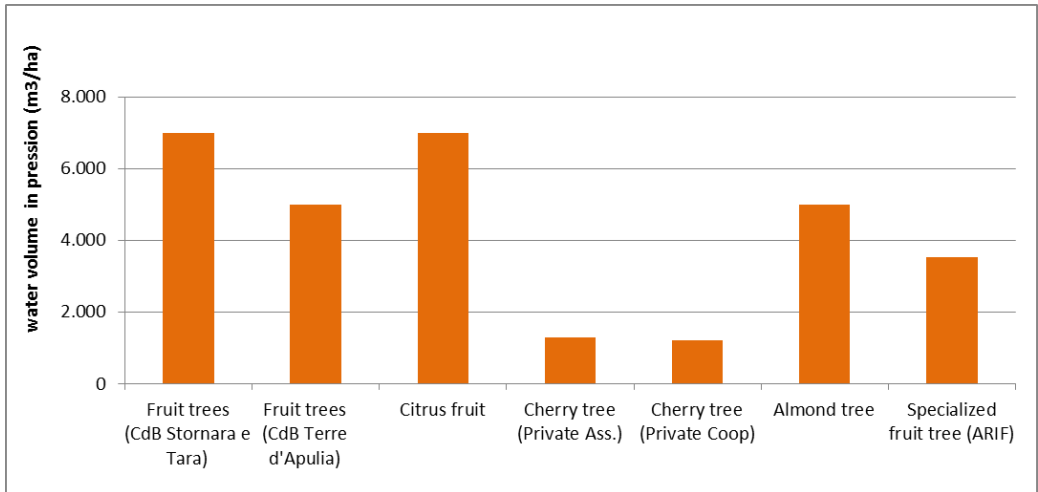


Figure 23 Example of different water volume for fruit trees in different Consortium in a pressure irrigation system.

Also within the same Consortium, the amount of water used to irrigate a crop can change according to the type of irrigation system applied: for instance in consortium Terre d'Apulia, water used to irrigate fruit trees, orchards and vineyard by gravity system is greater from 8% to 19% respect the pressure system (Figure 24).

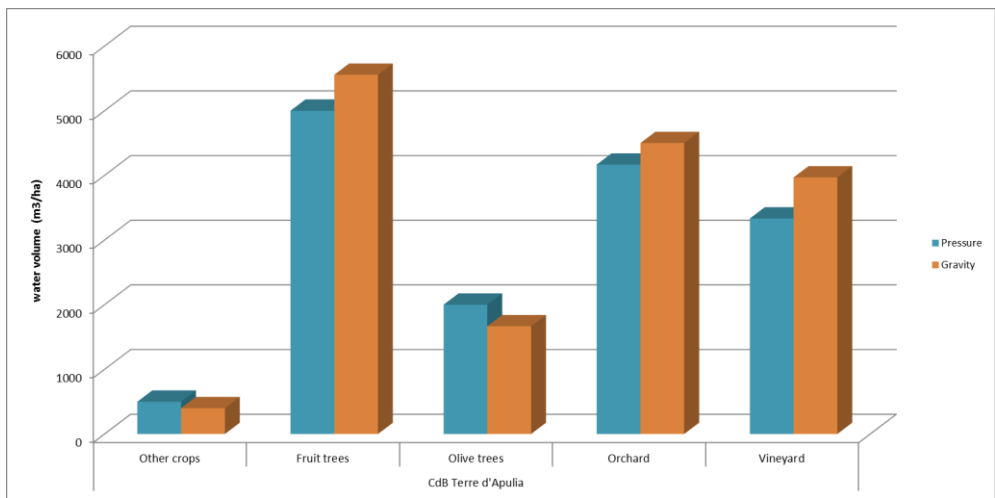


Figure 24 Differences between different irrigation system in Consortium Terre d'Apulia.

In Apulia region, the prevalent type of irrigation is micro-irrigation and/or drop irrigation (74%), followed by flowing (21.5%) and other types of micro-irrigation (3%) (Figure 25).

Private associations of farmers usually have a private well, while the public Consortium have different sources, according with the geomorphology of the area: natural and artificial lakes, wells or other sources.

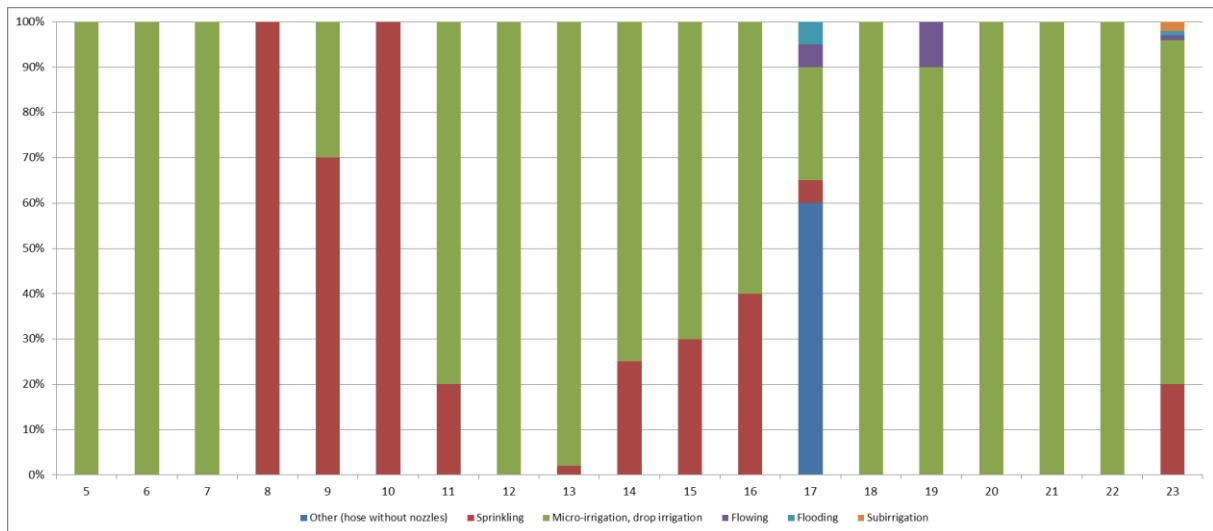


Figure 25 Different irrigation system per Consortium.

	Num of water sources for irrigation	Installed power (kW)	Electric energy consumption per year (kWh)	Water raised (mc)
Regional Agency (ARIF)	329	5.775	19.302.500	9.715.276
Private Consortia	11	390,95	445.651	587.141
Public Consortia	193	28.309	24.573.443	10.370.000

Table 3 Characteristics of irrigation water sources.

Almost all the interview say that farmers in the study area use in parallel private sources of water, especially wells, for irrigation purposes. The 47% say that according with their opinion these sources are legal, while the 42% don't know if they are legal or not.



Figure 26 Irrigation channel and Occhito's dam in study area.

The type of water pricing changes from different Consortium, but the majority use a mixed tariff usually based on surfaces- and other variables (i.e. water used, time, etc..). In over than 94% of cases the type of cultivation is not taken into account in setting the price. The cost of water to consumers vary according to the Consortium which can choose to base the irrigation fee can be on volume of water (€/m³)(Figure 27) or on irrigated surface (€/ha) (Figure 28). The water cost to consumers vary between 0,12 to 0.70 €/m³, while the price based on surface used almost by private consortia vary between 200 to 950 €/ha.

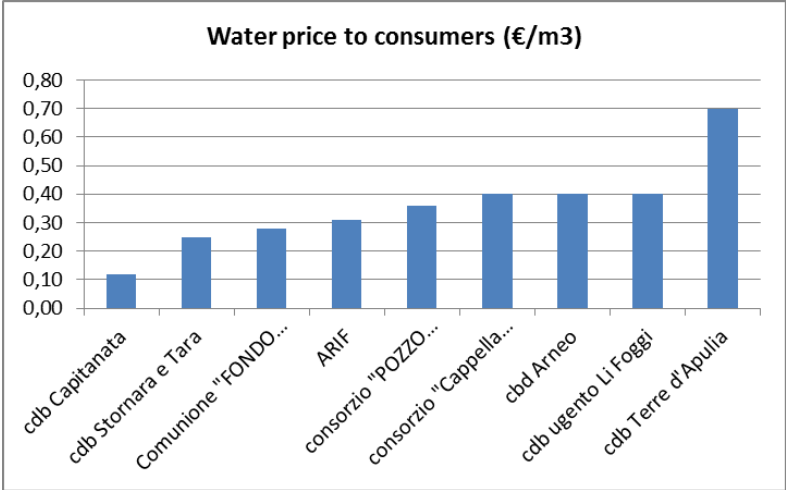


Figure 27 Water price to consumer based on water volume used.

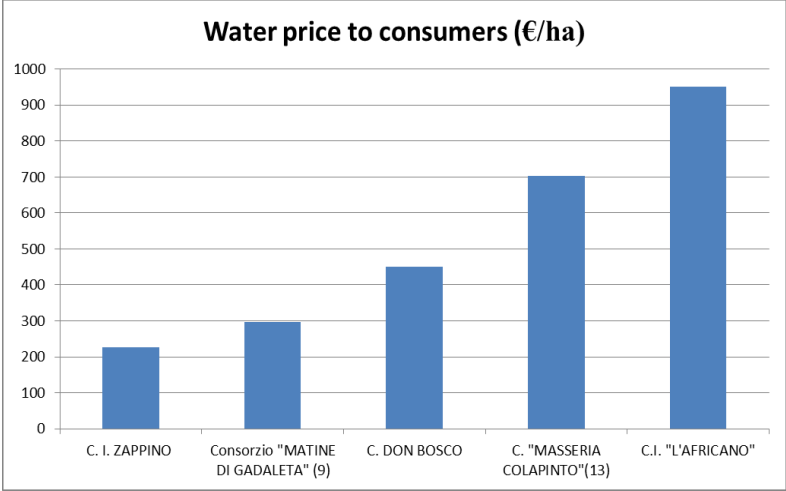


Figure 28 Water price to consumer based on irrigated surface (some examples of small private consortia).

The water price to consumers takes into account the cost related to energy, personnel involved in technical management, costs related to ordinary and extraordinary maintenance of distribution system, costs of vehicle and water supply. In the public consortia that manage the most amount of irrigated surface and water, the higher cost are due to the water supply, that cover between the 35-50% of the total costs (Figure 29). The cost of energy is the 15% of the total, while the technical personnel cost is around 20%. In the public consortia where the main water source are wells, the major cost are due to technical personnel and energy, 45.2% and 40% respectively. In small private consortia the higher cost are due to energy cost, for the pumping of water from wells. In small consortia the energy cost range between 60% to 90% of the total one. The second cost that affect

the price paid by consumers is the ordinary maintenance cost (O&M) that is around the 10% (Figure 30).

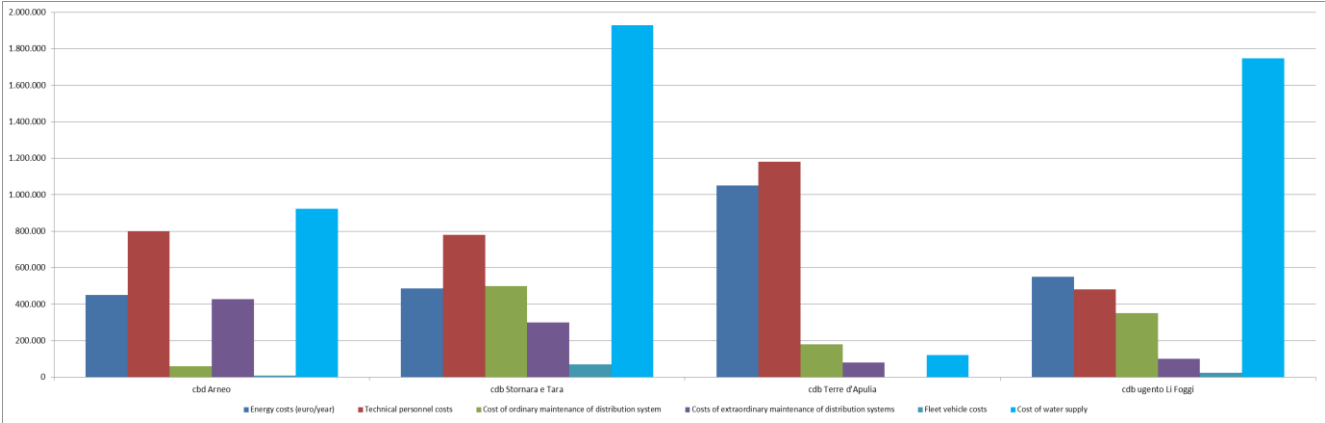


Figure 29 Costs related to water manage in Public Consortia in 2013.

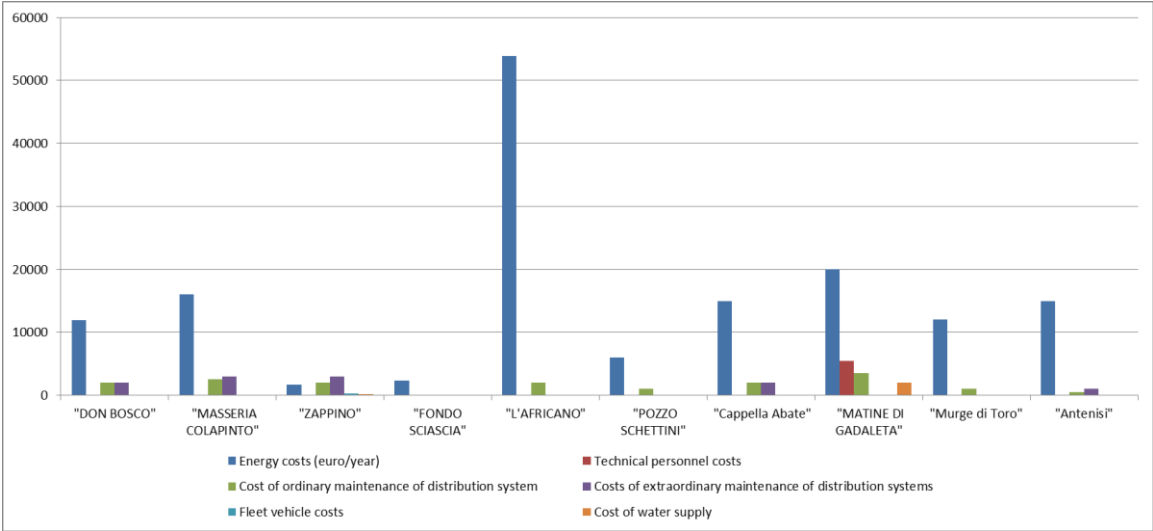


Figure 30 Costs related to water manage by private consortia in 2013.

Only one Public Consortium is equipped with a monitoring device to calculate the water consumption, represented by a sophisticated tool called AcquaCard. Besides this LRC estimate crop water needs using its meteorological station. Two public Consortia, do performance and environmental audits to the distribution system yearly.

Public Consortia have participated in planning activity regarding the implementation of the EU Water Framework Directive or national relevant activity. The majority of public Consortia adopt and integrated approach in planning irrigation and drainage, linking this activity with the protection of other water bodies. The 50% of public Consortia provide farmers with advices regarding irrigation, fertilization management, usually using the Penman-Monteith estimation formula. The 75% of total Consortia don't know web-site that provide agrometeorological information and tools for irrigation and fertilization, the other 25% know the web-site of Apulia region (www.agrometeopuglia.it).

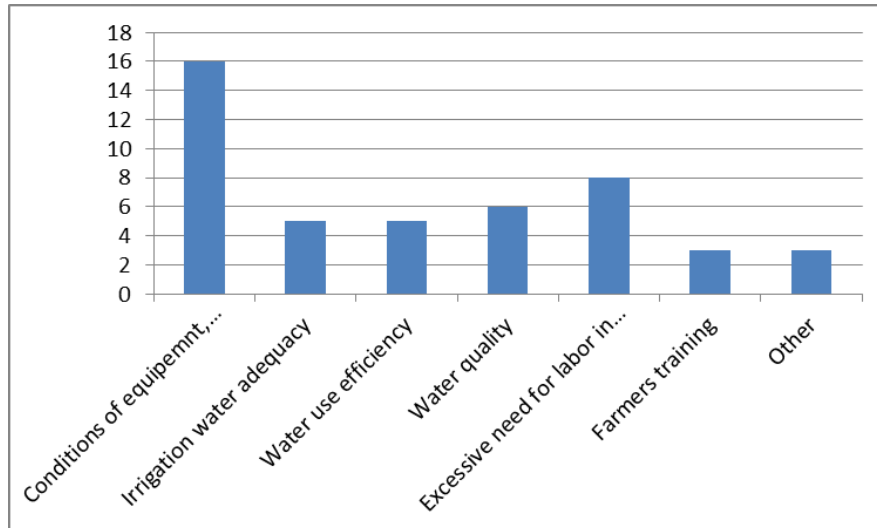


Figure 31 Major problems in Apulia irrigated area.

In the opinion of stakeholder that manage water in agriculture in Italian pilot area the main problem is due to the condition of equipment, channels, pipes and other structures. The excessive need for labour in order to run the system and the water quality are also critical issues. Other problems to which farmers give prominence are the increase of energy costs, theft and/or vandalism acts (Figure 31). In general, consortia put in evidence that now the water management is in difficulty due to the old and in bad conditions of the distribution system and the consequence is that there is a water waste in quantity and also in quality. Consortia managers hope that these problems will be solve in the future: some organization will try to manage in a better way irrigation water, trying to save water using also treated wastewater and also to modernize irrigation network.

4.3 Questionnaire 3: Farmers

“Questionnaire 3” concerns irrigation systems at farm level taking into account 271 agricultural companies that provided agro-environmental and economic information about their activity.

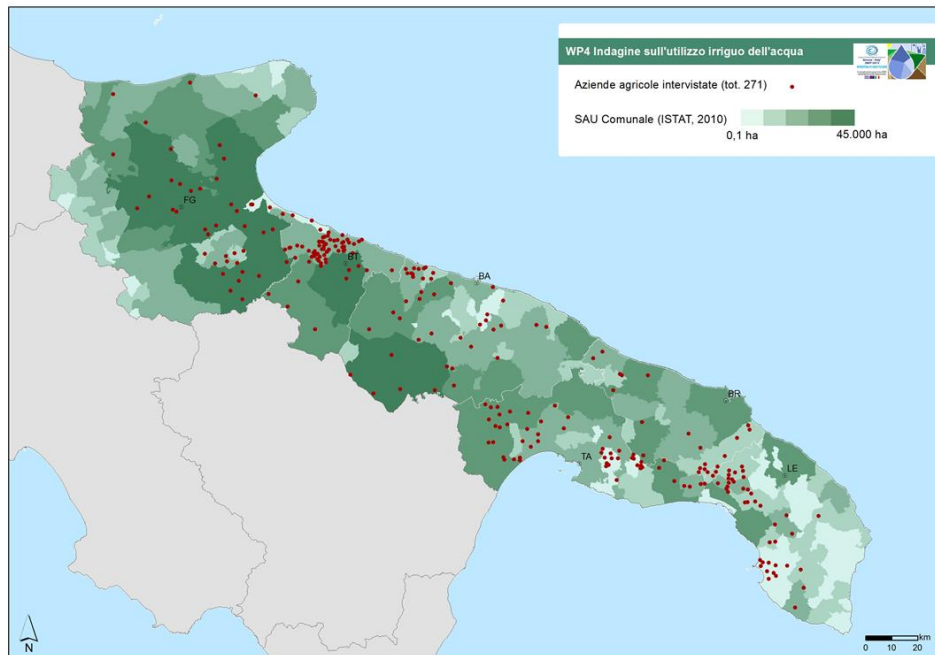


Figure 32 Distribution of farmers interviewed in study area.

The 84% of farmers interviewed are male, 51% with an age between 41-60 years (Figure 33). The 55% of farmers started to be occupied in agriculture when they had 16-20 years old, the 20% under 15 years (Figure 34). The 11% of them have an university degree, the 47 % attended the high school, the 37% a junior high school and the 6% the elementary school. The 52% of farmers carries out agriculture activity in exclusive way, the 10% predominant and the 38% in residual one.

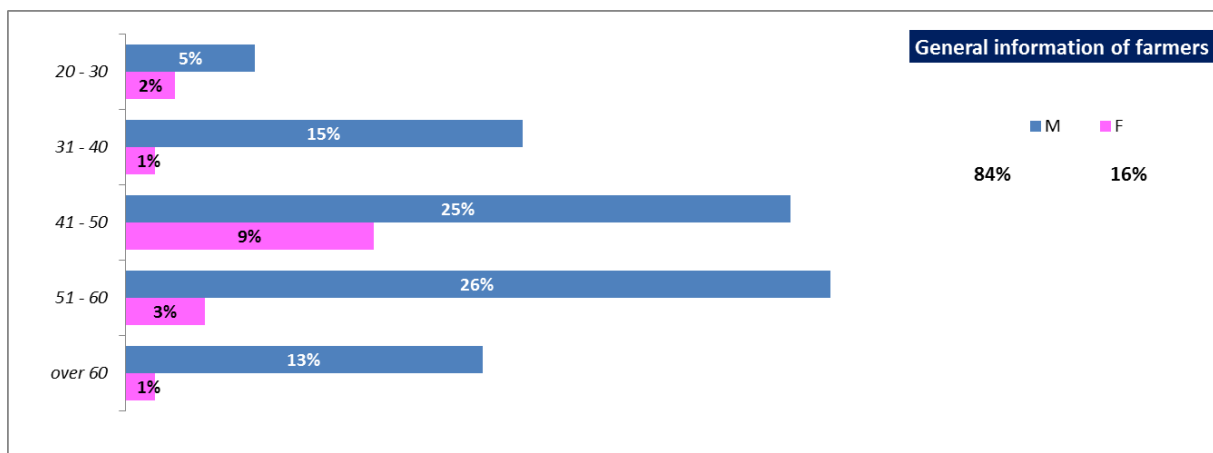


Figure 33 General information regarding the farmer interviewed.

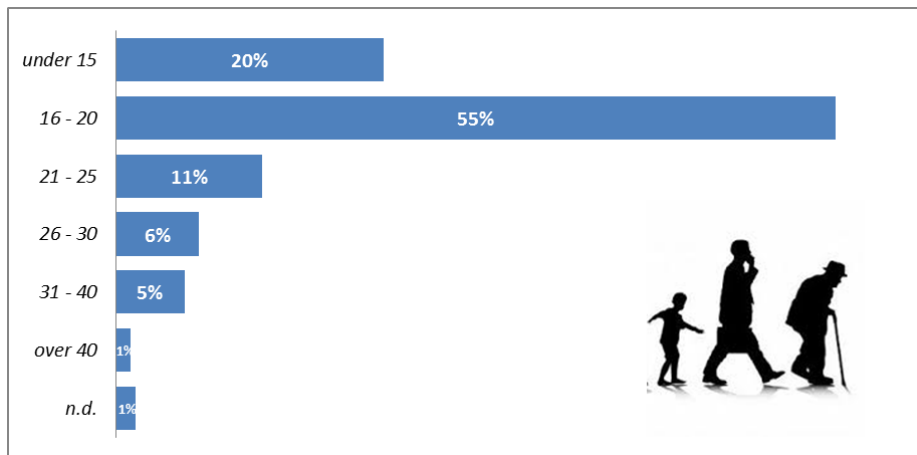


Figure 34 Age at which the farmer started to be occupied professionally in agriculture.

The 28% of interviewed are very familiar with the use of IT technology, the 32% have a medium familiarity, the 31% a fairly and the 8% not at all. IT technology is not very friendly with the farmer, even if the 72% have a PC/Laptop/Tablet or a smartphone and the 76% of farmers use internet. Only the 1% of farmers attend an education/training session specialized in irrigation (Figure 35). The main sources used by farmers to be informed on agricultural issues are the following: 47% private agronomic consultants, 46% consultants from relevant public organization, 9% Conferences/Symposia, 6% expositions/trade fairs, 5% specialized books. The 36% of farmers think that they need more training about new trends and new types of irrigation system, the 32% about irrigation management and scheduling and the 31% about irrigation system maintenance.

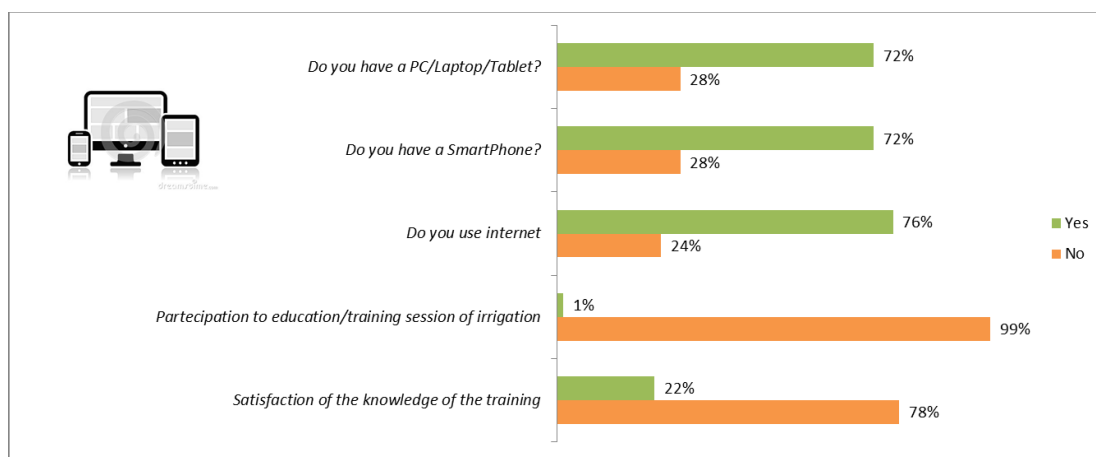


Figure 35 IT information of farmers.

The average size of the sample considered in our survey is 8.61 ha with a minimum of 0.25 ha and a maximum of 70 ha. The mean cultivated area of the farm is 8.26 ha. Irrigated area annually is almost 7 ha (mean value) and the surface equipped with irrigation fixed system is more than 6 ha (Figure 36).

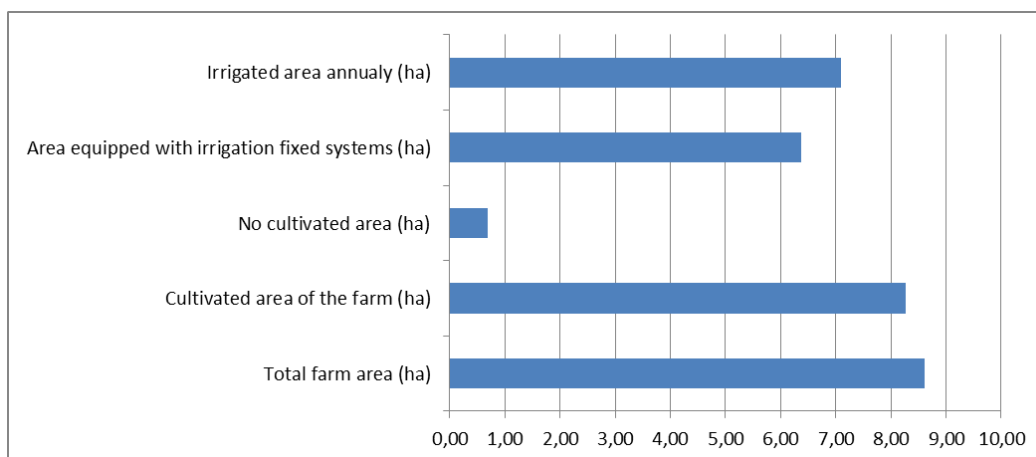


Figure 36 Average value of cultivations of the farm in 2013.

The 37.3% of farmer don't know the annual cost for irrigation for all the land parcels of the farm, between the remain 62.7%, the mean annual cost for irrigation is around 4.895 €, more than 2/3 of farmers spend less than 5.000/year, the remain 33% spends up to a maximum of 50.000 €/year (Figure 37). Considering the size of the farms, the annual cost for irrigation is around 340€/ha irrigated.

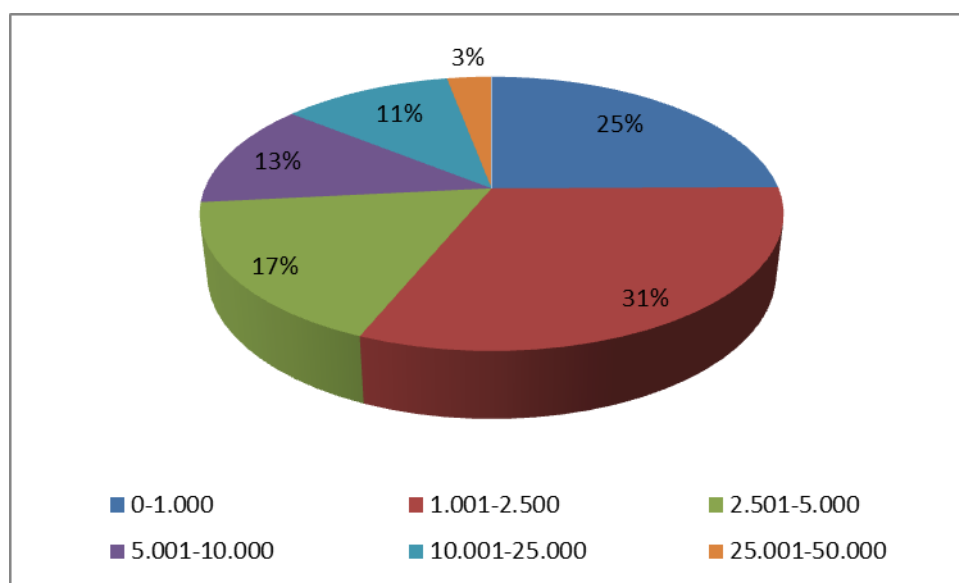


Figure 37 Percentage of farms divided in base of annual irrigation costs.

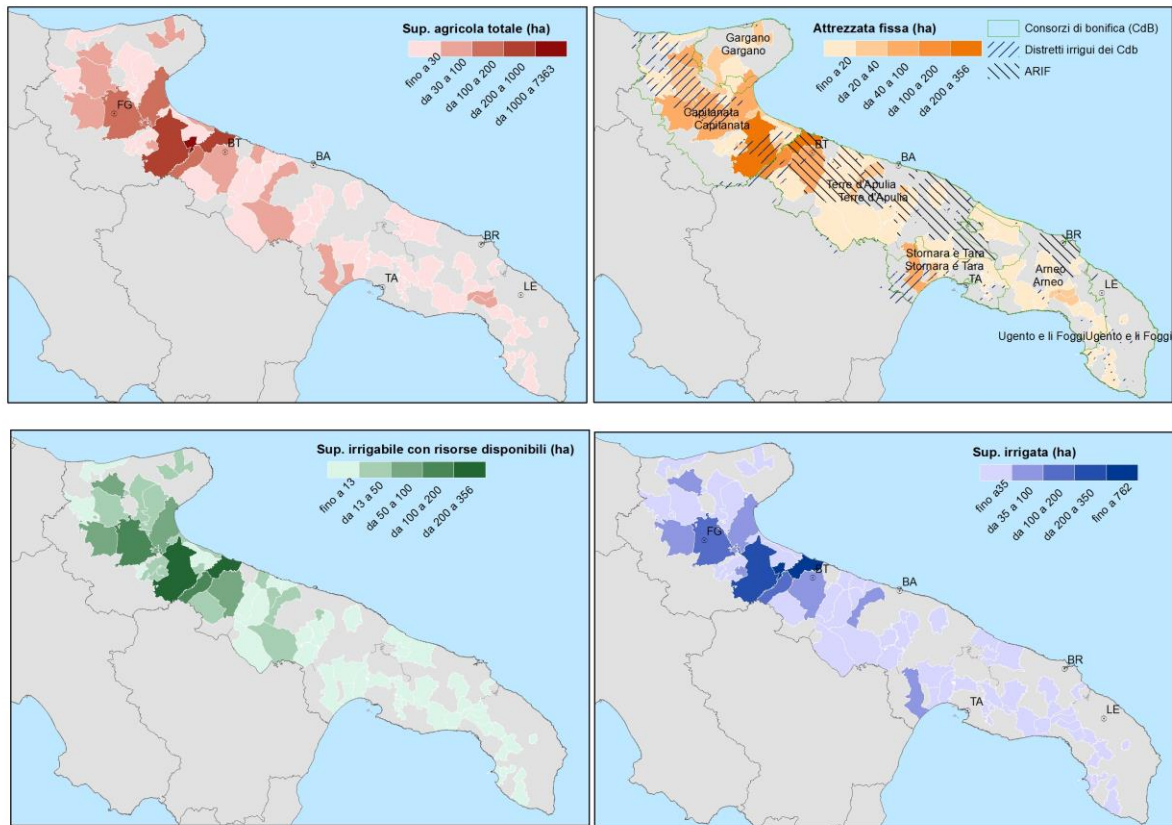


Figure 38 Farm's area aggregated by municipality.

As illustrated in Figure 38, farms with more total and irrigated area are located in the provinces of Foggia and Barletta-Andria-Trani (BAT), where land reclamation Consortia have more fixed irrigate systems.

In more than 73.6% of fields are of property of farmers, the 57,1% are tree crops that represent the 39,7% of total surface.

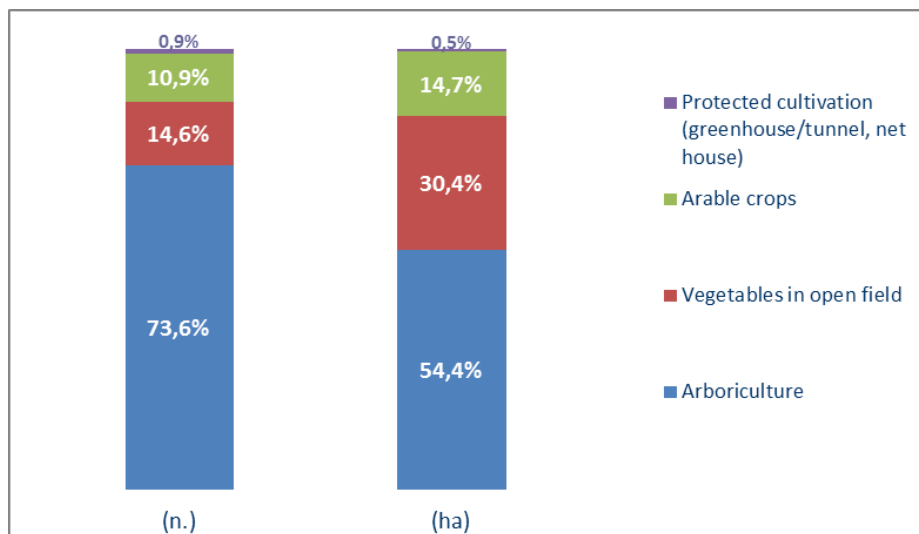


Figure 39 Cultivation types in study area.

From interviewed, in Apulia region the main crops are arboriculture (54.4% of surface), followed by vegetables in open field and arable crops, respectively with 30.4% and 14.7% of surface (Figure 39). In detail, the main tree crops are olive trees (31%), wine grapes (31%) and tables grapes (18%). Durum wheat is the main cereal cultivated in pilot area with 87%, while in the class vegetables in open field the following crops are the main cultivated: processing tomatoes (14%), potatoes (13%) and the family of Cabbage (cabbage, broccoli, etc..) with 11%.



Figure 40 Example of irrigated agriculture (lactuce, vineyard, peach) in Apulia region .

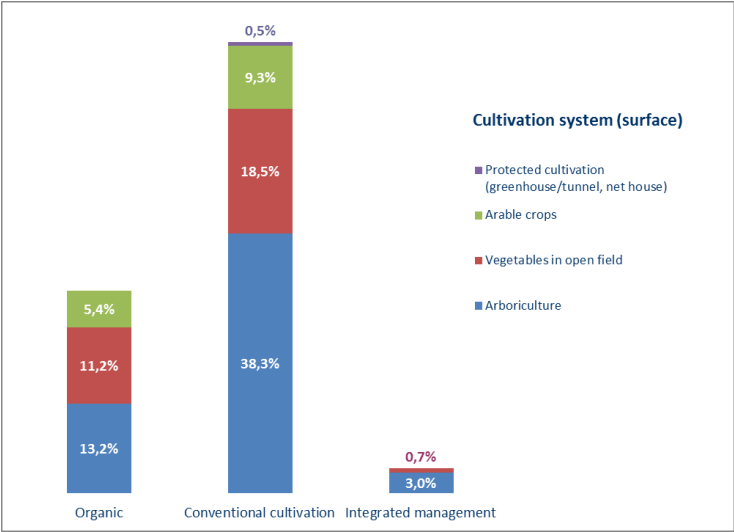


Figure 41 Crop cultivation subdivided by system.

The 66.5% of the agricultural area used by the companies surveyed is cultivated with traditional methods, 29.9% with organic methods and only 3.6% with the integrated system. All the protected cultivation interviewed are cultivated with traditional systems.

In the organic farm interviewed, the 44.2% of organic crops are trees (mostly vineyards and olive trees), followed by vegetables in the open field (37.6%): as potatoes, processing tomatoes and cabbage. In the organic arable crops the main crops are durum wheat and turnip tops (100% grown to organic farms surveyed). Durum wheat organic is 30% of the total areas of these crops. The integrated system is adopted mainly for trees (82%) as vineyards and olive and a small part for tomatoes (18%).

Irrigation management

In more than 93% of farms interviewed, water source is inside the farm: 53.8% are private source, 38.5% are LRC network. In the majority of case the way of transportation is in pipelines. In 62.7% of interviewed the distance of land parcel from the water source is 0 m. (near the parcel), 11.9% is less than 10m, 6% is between 11 and 30m, 16.4% is between 31-100m and 3% is more than 150m.

Water source	Place of irrigation water source		
	Off the land parcel	Inside the land parcel	Total
Other public or private (lakes, rivers, streams, ponds..)	0.0%	0.9%	0.9%
Land Reclamation Consortia	4.9%	38.5%	43.5%
Private source (drilling, well, open reservoir)	1.9%	53.8%	55.6%
Total	6.8%	93.2%	100.0%

Table 4 Information about water source in Apulia study area.

The total cost of water is different depending on the area, due to the presence or not of LRC system or of private sources. In some cases the cost of water is based on volume of water used, in other on area irrigated. In some case the cost of water is a mixed of the two. In farms where the irrigation system is under the Land Reclamation Consortium, the cost vary between 0.012€/mc (volume based) or between 13 and 350€/ha (area based).

More than 1 in 2 (53.6%) person interviewed has a private well in his farm. The mean water supplied by each well is about 86 m³/h, while water provided annually (2013) by all wells in a season was approximately 2Mm³. The big part of wells are in the province of Barletta-Andria-Trani (37%), followed by the province of Foggia and Taranto (Figure 42). It's interesting to notice from Figure 44 that the most of wells are nearness the equipped area of Land Reclamation Consortia. In some case the present of wells is inside the LRC territory, as in the province of Taranto and Foggia.

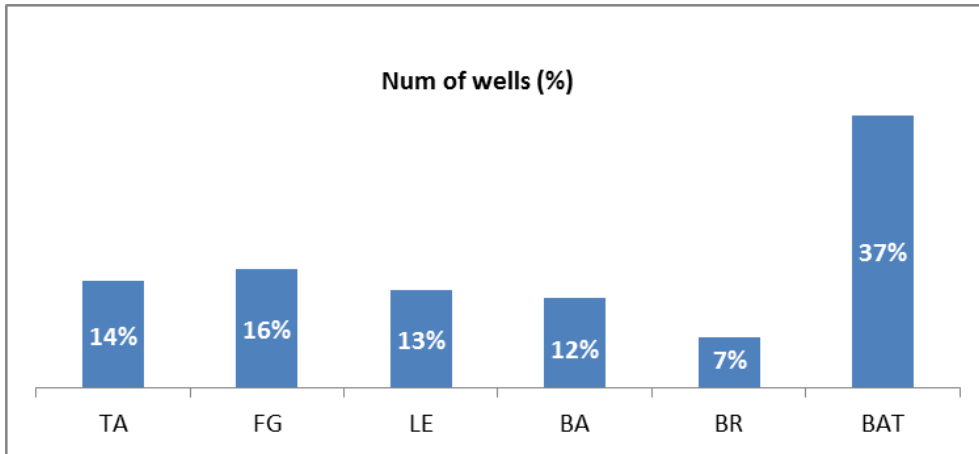


Figure 42 Distribution of wells in the Apulian province.

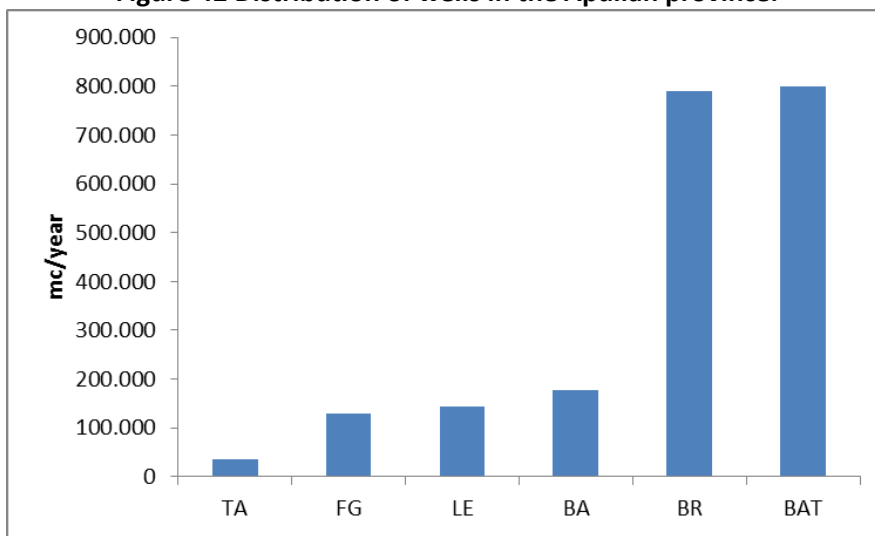


Figure 43 Total volume of water in 2013 from wells in the different province in Apulia.

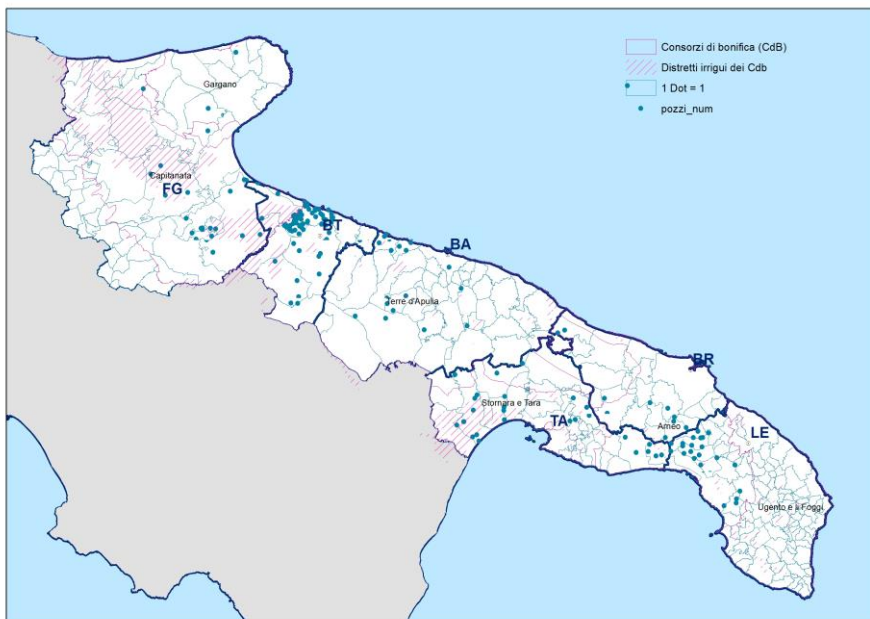


Figure 44 Distribution of investigated wells in Apulia region

The main type of energy source for pumping water from wells is electricity, followed by gasoline and in very few cases, solar energy. Most of the drill are old, installed before 2000. Farmers, that have wells in their parcels, have water supply problems during the summer due to a reduction of water availability and electricity problems. Whereas, farmers, that don't have wells in their farms, have problems with water supply in the period June-August, due to a bad water management. In particular they check problems due to a difficulty of booking water and to the fact that too much farmers use water at the same time.

Of all the off-farm water used for irrigation in 2013 in the majority of case (79%) came from LRC irrigation system, followed from other sources (20%). The reason of the need to obtain water from an off-farm source is that in the farm there are not water or not enough water available for irrigation. More than 50% of the interviewee say that there are not need to have other water. The reason why the fields of a farm are not completely irrigated is due mainly to a different crop management (64%), followed by crop rotation (14%) and water scarcity (7.8%).

The 97% of lands of farmers interviewed are irrigated with the system of micro-irrigation. The main crops irrigated with this system are vineyards (more than 30%), followed by olive trees and tomatoes (Figure 45).

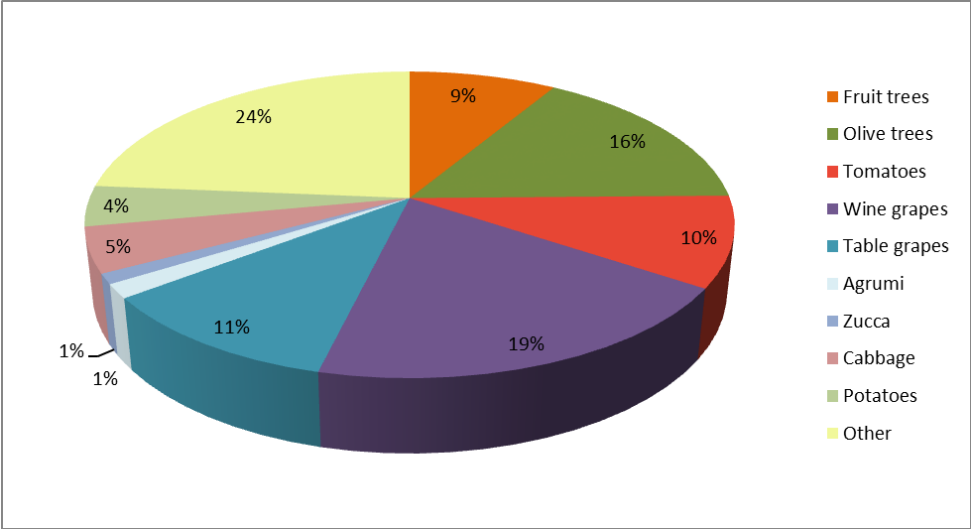


Figure 45 Main crops irrigated with micro-irrigation system.

More than 65% of farmer interviewed have a water meter, the 72% are obliged to have one and the 65% say that they have order to know the volume of water used. The 46% of famers find the cost of irrigation water reasonable and more than 60% repositioned manually the traveling guns.

During the 2013 the major of the farmers interviewed didn't use any types of practices to conserve water or energy. One of the most use practice (30%) is watering at night or early in the morning, followed by leaving stubble on fields (13%) (Figure 46).

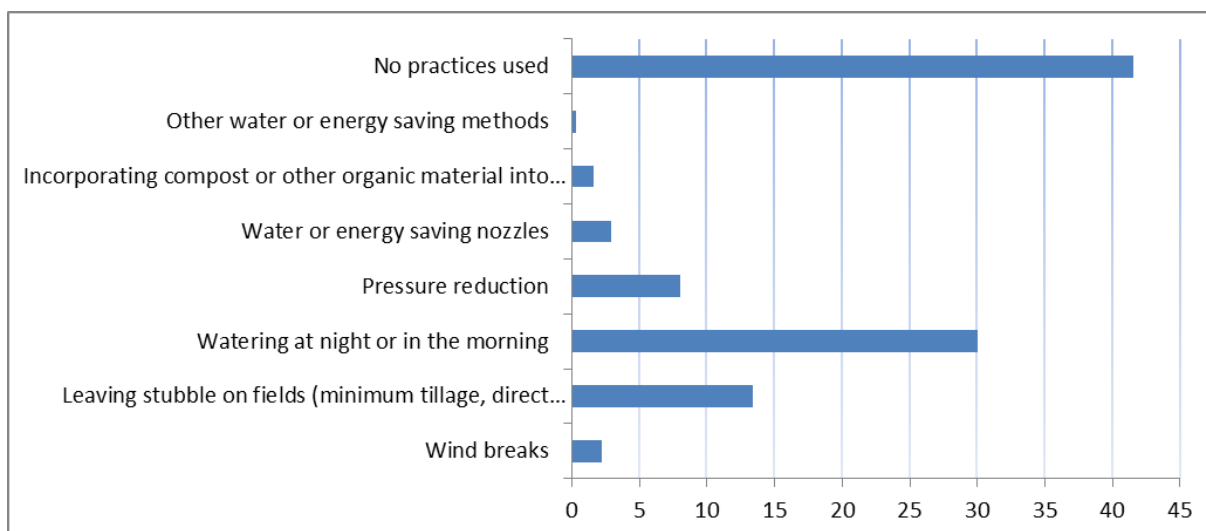


Figure 46 Main types of practices to conserve water or energy (percentage) applied in 2013.

The 31% of interviewee think that irrigation systems should be designed and constructed by specifically trained professionals and only the 17% would pay for such a service. All farmers say that their irrigation system is easy to manage. More than 50% of interviewee say that the advantages of using irrigation technologies in a farm is saving labour and for the 47.7% technology can save water. The disadvantages of using technology for irrigation are the following: high costs (64.4%), they are complicated to manage (27.7%), only specialized staff can repair it (6%) and they are expose to vandalism (1.5%).

Only 11% of farmers are award of web sites that provide agrometeorological information and tools for irrigation, fertilization etc. The 18% of interviewed asked for professional assistance regarding the set-up of the irrigation schedule that they use and the 16% regarding the fertilization that they apply. The 19% of farmers perform annually water analysis; the 62% of farmers apply plant protection substance using irrigation system. In the opinion of farmers interviewed, the quality of water is not bad: 50% say that quality is fair, for 47% water quality is good and only 3% say that water is poor. In study area nobody perform technical and/or environmental audit to their irrigation system and nobody utilize water for frost protection.

In the opinion of farmers the major problems of water are due to lack of support from relevant public administration services (28%), followed by lack or insufficient size of central irrigation systems (17%) and the lack or insufficient size of modern central irrigation systems (15%)(Figure 47).

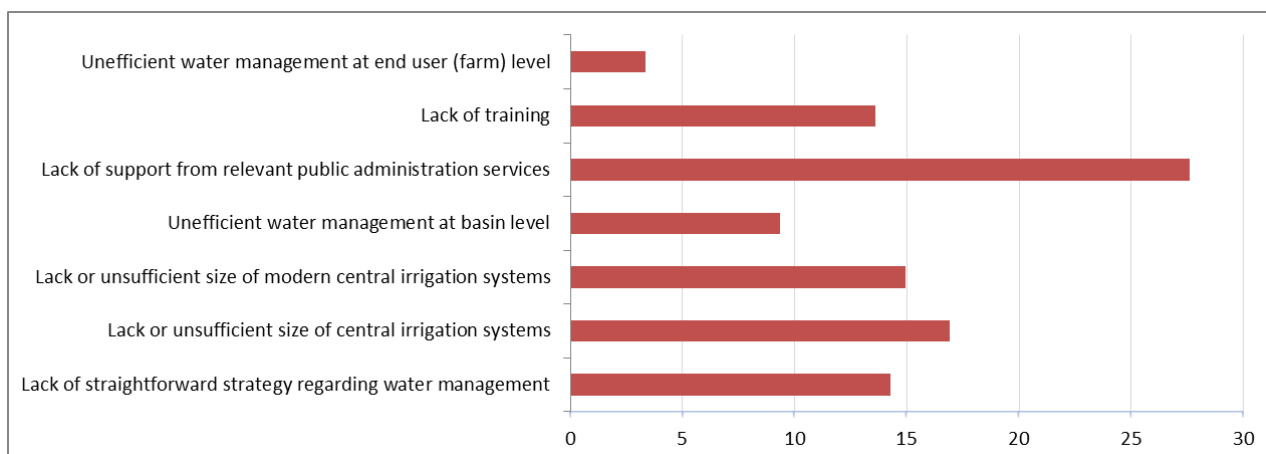


Figure 47 Farmers opinion regarding water issues in pilot area (percentage of responds).

About soil management, 89% of farmers interviewed didn't perform soil analysis in the last time, nobody use hydroponic cultivations; 94% of farmers apply fertilizer during a regularly scheduled irrigation application and nobody observe drainage problems in their fields.

Economic information

For interviewee, in Apulia region, agricultural activity are managed using family labour exclusively (51%), using family labour prevalent (24.4%) and managed by farmer (13.7%)Figure 48 .

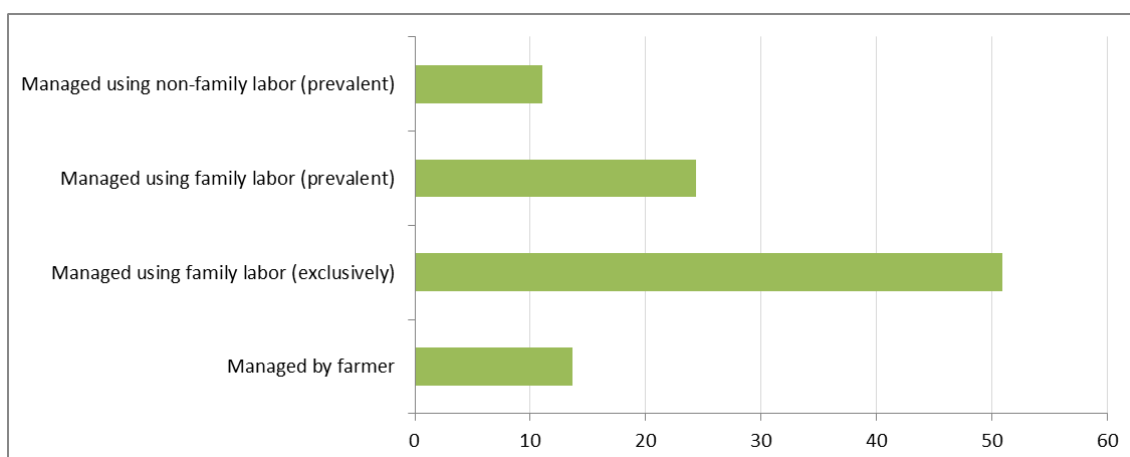


Figure 48 Agricultural labor information.

The costs incurred for the installation or modernization of irrigation system in the study area is around 6.600 € (mean value) in 2013, with a minimum cost of 150€ and a maximum of 50.000€. The Gross Saleable Yield from irrigated crops is around 47.900 € (mean value) with a minimum of 750€ and a maximum of 950.000€. The specific expenses incurred in 2013 for water are more than 1.100.000€ in total, due mainly to energy cost (39%), purchasing of water (34%) and maintenance (13.7%). The higher mean cost is for fuel, around 5.500€, followed by electric energy cost with 3.400€, detail in Figure 49.

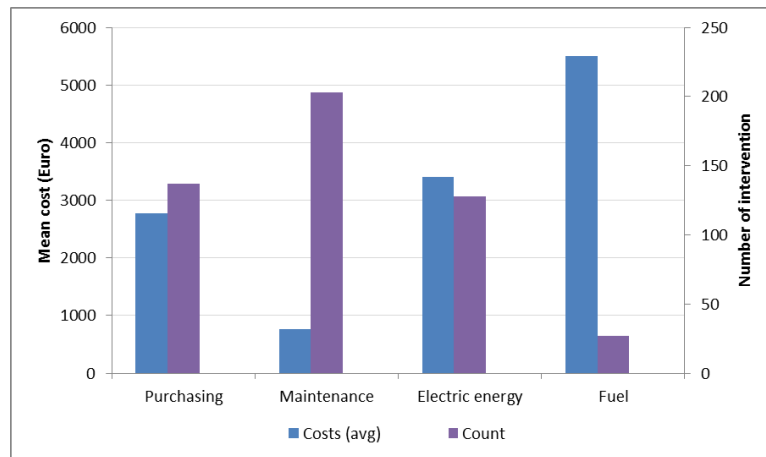


Figure 49 Specific expenses incurred in 2013 for water (mean value).

The public organisation that farmers interviewed visit to settle irrigation issues are the following: 36% Land Reclamation Consortia, 18% Civil Engineering, 3% Municipality/province, 3% they ask to the consultant, 35% they don't know. In general the issues are related to the renewal of permissions of drilling, problems connect with irrigation systems, etc.

Only 7.7% of farmer interviewed received a subsidies for the installation or modernization of irrigation system. All the farmers used the "Rural Development Programme" funds: 90% of farmers use the money to modernize irrigation system, the other to change the typology of crops. In all case the percentage of investment financed is around 50%. Farmers that already use these type of subsidies are propensy to new investments in agriculture, in particular to modernize irrigation system or other part of farms.

Environmental information

In Apulia region, according to interviewed, nobody harvest rain water and there are not problems of erosion. During 2013, the majority of interviewed didn't have problems with pests and diseases, the other have problems of fungus disease (like "oidio" and "peronospera").

Regarding water issues the most significant water problem in Apulia region is drought (54.6%), followed by salinization (26%) and desertification (19%). Almost 21% of farmers say that don't have water shortage in their area, 35% says that the main cause for water shortage in their area is due to climate change, 30% says that there is an excess pumping for irrigation by private drilling and 14.3% that there is a lack of guidance and rules regarding water distribution. The 68% of people interviewed know that water ends to aquifer, 22% don't know where water ends and 9.6% it's not interested.

4.4 Questionnaire 4:Private landscape

“Survey 4” concerns irrigation systems at private user level; 130 private users give agro-environmental and economic information about the use of water in their gardens.



Figure 50 Fruit trees in urban garden.

The 71% of interviewed stakeholders are male, the 38.2% of the total are 41-50 years old, followed by 21.4% of 51-60 years old and 19.1% of 31-40 years old (Figure 52). More than 53% of interviewee has an university degree and more than 34% have an high school degree.

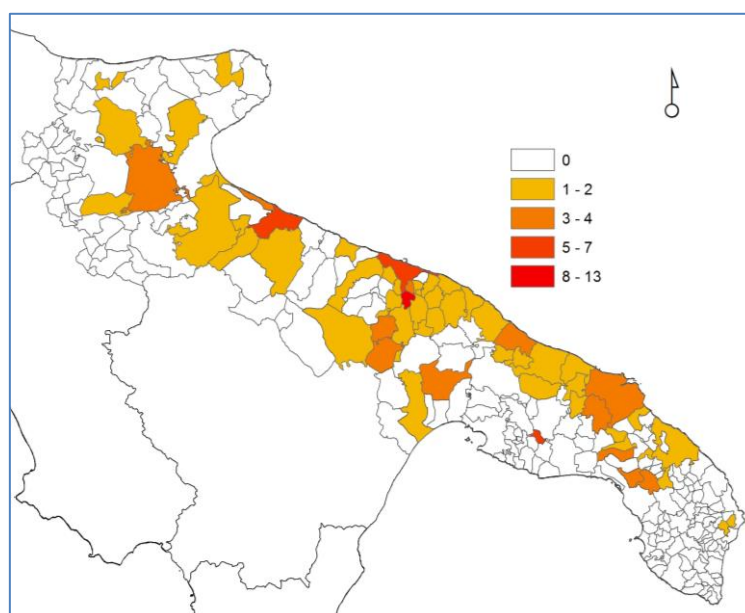


Figure 51 Distribution of water users interviewed in study area.

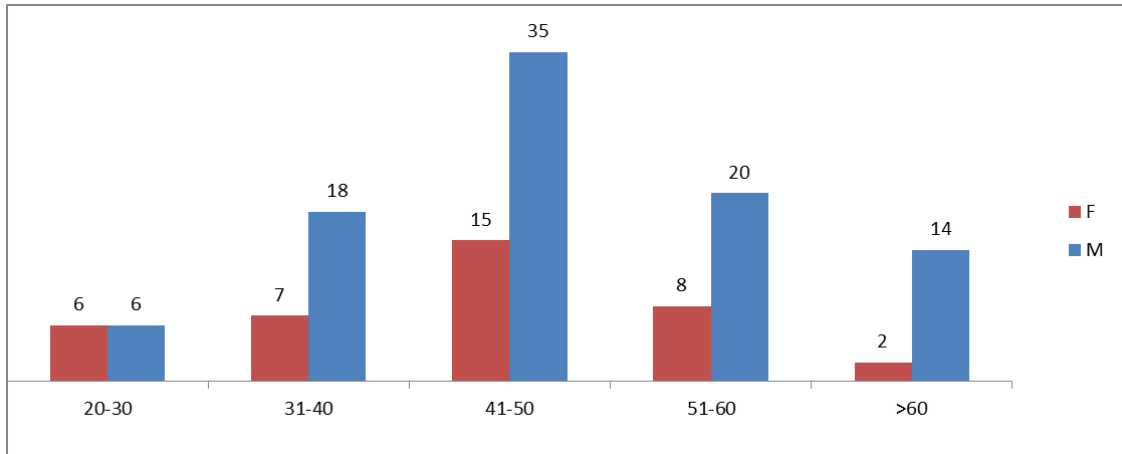


Figure 52 Distribution of interviewed by gender and age.

The 62% of interviewee are very familiar with the use of IT technology, the 27% have a medium familiarity, the 10.68% a fairly and the 0.7% not at all. IT technology is very friendly with the interviewee, almost all have a PC/Laptop/Tablet or a smartphone, the 97% of stakeholders use internet. More than the 46% are informed of basic concept regarding gardening issues and 45,8% are not informed or trained.

All the stakeholders interviewed managed more than 34.600 m² of green surface, with a mean value of 264m², the turf grass area is of more 12.900m² and the shrub area is more than 14.600 m². The principle type of irrigation system is sprinkler (76.5%), followed by gravity system (11.2%) and micro-irrigation system (10%). The water used to irrigate gardens and kitchen gardens derived from tap water (73%), wells (24.6%) and rain water harvesting (2%); the mean amount of water used for irrigation from these sources in one year (2013, reference year) is of more than 56 m³/year, 160 m³/year and 93 m³/year respectively for tap water, wells and rain water harvesting. These data are all estimated from stakeholder interviewed, because they don't measure with counter the water used. Water users don't have a great sensibility about water costs, as a matter of fact the 54% know the cost of tap water, while only the 8% of users that use water from drills know the cost of energy to pump water.

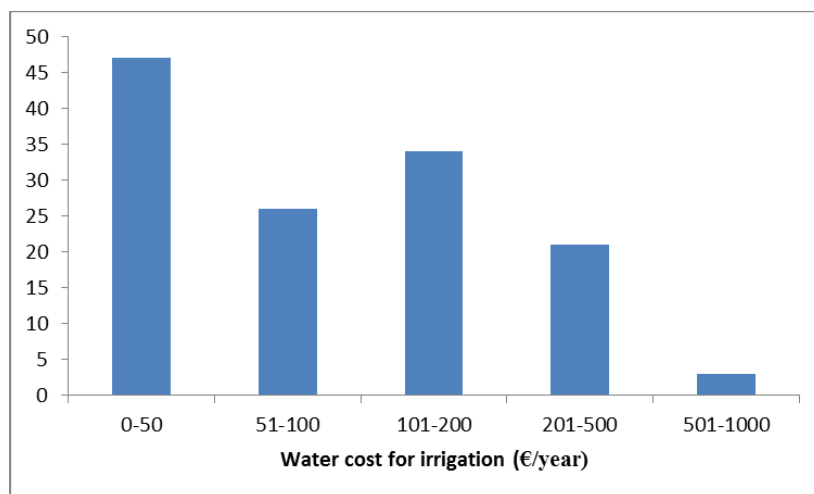


Figure 53 Water cost for irrigation of gardens, subdivide by numbers of users.

The mean cost for irrigation of private garden in the study area is about 140 €/year, almost the 36% of interviewee pay less than 50 €/year, near the 46% between 51 and 200 €/year, and the 2% more than 500 €/year (Figure 53). Users that pay less than 100 €/year to irrigate use more than 70% of cost to pay water cost and the rest of money to pay the system maintenance, while people that spend more than 100 €/year, pay also for energy costs.

The 73% of interviewed users don't perform water analysis and only 27% rarely, while the 88% don't perform soil analysis. The 73.3% of users think that irrigation and drainage systems should be designed and constructed by specifically trained professionals, the 82.3% of these are favourably disposed to pay for this service. The 48% of stakeholders interviewed system was done by a professional that also provided with a study, design, irrigation scheduling proposal (37%). All the interviewed say that irrigation equipment is easy to manage. The 49% of interviewee use a controller to apply the irrigation schedule, of these the 60% rarely change the schedule, the 20% don't made changes and 20% always.

The 57% of interviewee are not interested to change the garden to a more water conservation one, nobody have never hear the term xeriscaping. If people were obliged by the state to change turgrass by another kind of ground cover, the interviewed prefer to use a full cover meadow or a passing through meadow, they will use synthetic grass only as last change (Figure 54).

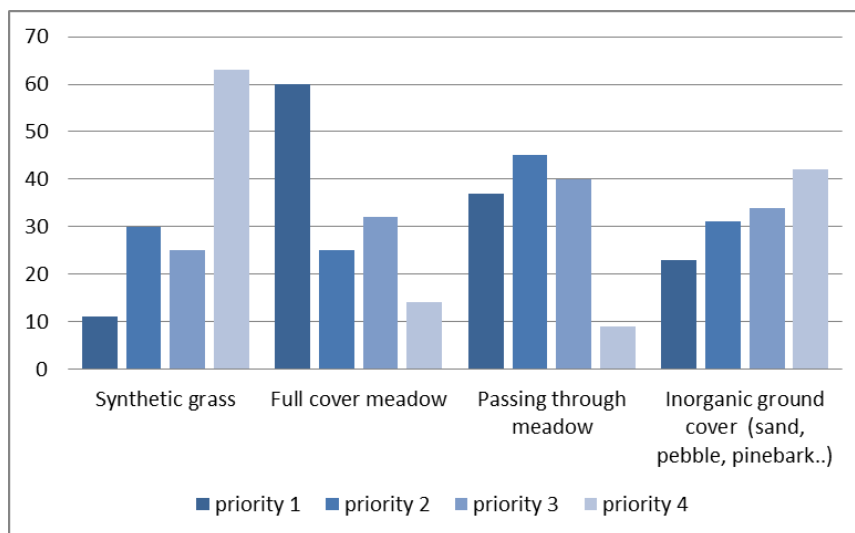


Figure 54 Users preferences for another type of ground cover.

Regarding water issues (Figure 55), the majority say that there is lack of straightforward strategy regarding water management and a lack of training, 46% and 40% respectively. The most significant water issues for more than 47% of the interviewed is desertification, the second is drought with more than 40% followed by salinization (Figure 56).

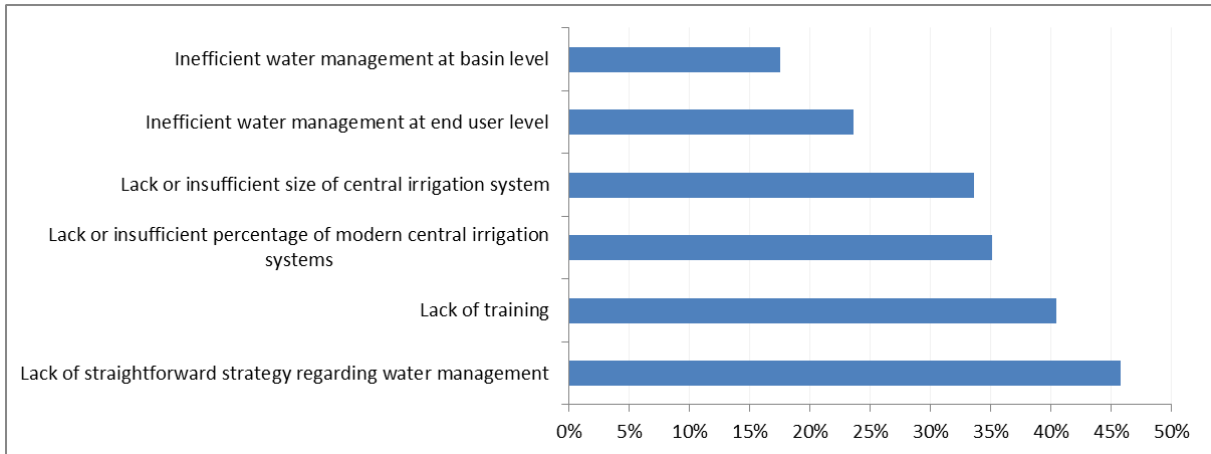


Figure 55 Opinion regarding water issues (multiple response).

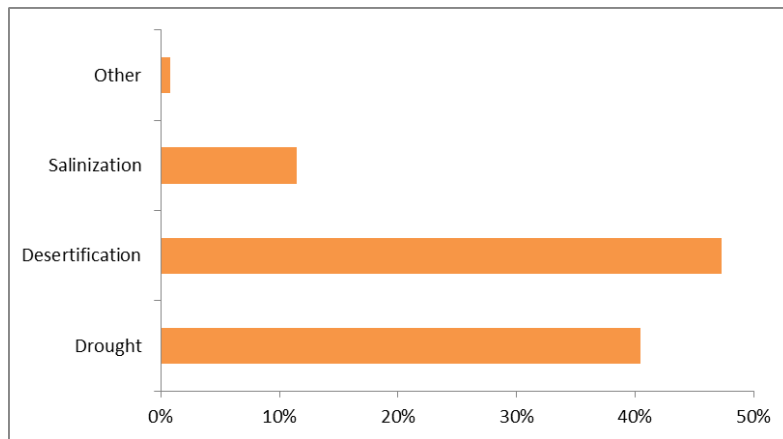


Figure 56 The most significant water issues for private citizen (multiple response).

In the opinion of stakeholder the main cause for water shortages in the area is climate change (45%), follow by the lack of guidance and rules regarding water distribution (24.4%) and the excess pumping for irrigation by private drillings (16%) (Figure 57).

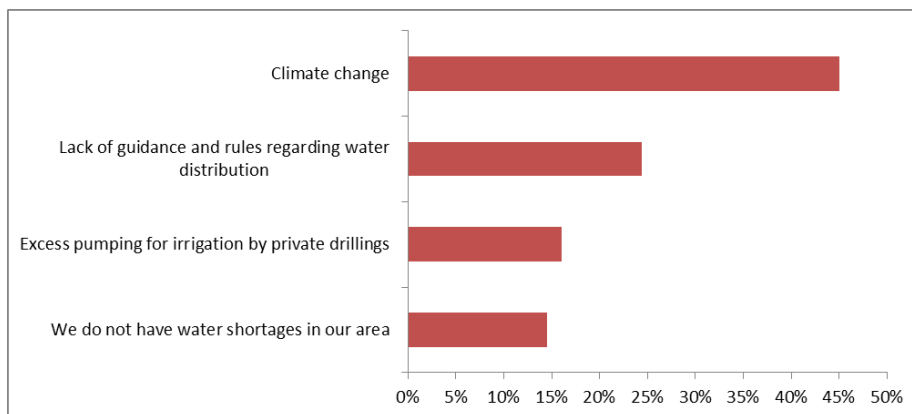


Figure 57 Main causes for water shortages in study area (multiple response).

5 Conclusions

Findings from above shows that in Apulia region 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.

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Annex I Scheme of questionnaire 1



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Efficient Irrigation Management Tools for Agricultural Cultivations and Urban Landscapes
Subsidy Contract No: I3.11.06

01

WP4 Survey on irrigation water use

Interviewers' name:
Number of questionnaire:
Date:

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	Puglia	Region of Epirus	Region of Western Greece
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. Means and extend of distance services the your organisation provides to public and/or members:
Telephone (0-1-2-3-4-5-6-7-8-9-10)

Fax (0-1-2-3-4-5-6-7-8-9-10)
Internet (0-1-2-3-4-5-6-7-8-9-10)
Other, specify

3. Public administration databases that your organization is related to, the role, and availability of relevant row data and/or information to the public ? yes/no
 - a. if yes, it's available to public? yes/no
 - b. If yes, how?

4. Does your organization provide end users (farmers) with advices regarding irrigation, drainage, fertilisation management?
 - a. If yes, which model does your organisation uses for water needs estimation (Blaney-Cridle, Hargreaves, Penman-Monteith, other)?
 - b. Do you apply an ordinance for these calculations? yes/no
 - c. 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>, <http://www.agrometeopuglia.it>, <http://probiosis.teiep.gr>, <http://www.hnms.gr>, <http://www.meteo.gr> etc)

6. Is your organization directly responsible for public water sources (drillings, reservoirs etc)? yes/no

7. Have your organization participated, or participate this period, by any means, in any planning activity regarding the implementation of the EU Water Framework Directive - integrated river basin management for Europe (2000/60/EC)³ or other EU or national relevant activity?
 - Yes
 - No

8. Are you aware of the local water management plan which is applied in the framework of 2000/60/EC at the hydrological basin of your jurisdiction?
 - Yes
 - No

9. Regarding water issues, which is in your opinion the most significant of the following:
 - Lack of straightforward strategy regarding water management
 - Lack or insufficient size of central irrigation systems
 - Lack or insufficient percentage of modern central irrigation systems
 - Inefficient water management at basin level
 - Lack of training
 - Inefficient water management at end user level

10. Regarding water issues, which is in your opinion the most significant of the following:
 - Drought

³ <http://ec.europa.eu/environment/water/water-framework/>

- Desertification
- Salinization
- Other, please define it

11. According to your opinion which is the main cause for water shortages in your area?

- We do not have water shortages in our area
- Excess pumping for irrigation by private drillings
- Lack of guidance and rules regarding water distribution
- Climate change
- Other, define

Optional questions of part 1

1. Characteristic photos from the organization:
2. Place of organization/department in the organizational structure of public administration (mention all relevant levels above and bellow):
3. Area of responsibility:
4. Internal organizational structure:
5. Infrastructure (offices, laboratories, IT systems and software, etc):
6. Number of employees (general)
7. Employees that are related directly or not with irrigation and drainage issues:

Specializations	Educational level	F	M

8. Basic relevant legislation that your organization applies:
9. Administrative responsibilities regarding irrigation and drainage (list):
10. Have your organization participated, or participate this period, by any means, in any implementation or planning activity regarding R&D projects regarding irrigation and drainage? Yes/No
 - a. if yes, please refer the most significant:
11. Which are your views regarding the future in water management and relevant irrigation and drainage issues?
12. Do you think that problems maybe faced regarding water supply in the future? yes/no
 - a. How does your dept. plan to overcome them?

2. Special part for public administration departments that are directly managing irrigation systems (i.e. Municipal Green Spaces Offices which manage urban green infrastructure spaces)

Reference year: 2013

A. Verde urbano, fonti e sistemi di irrigazione

1. Water basin:
2. Total green spaces area (ha):
3. Surface equipped with fixed irrigation systems (ha):
4. Surface irrigated with temporary (movable) irrigation systems (ha):

5. What kind of urban green infrastructure does your dept. manage (parks, vegetation on side of middle road verges, round about circuses squares (plazas), cemeteries, urban forests, athletic fields, allotment gardens, school yards, etc)? Please name them and try to quantify them (if possible):

green infrastructure	Number	Surface (ha)
parks		
vegetation on side of middle road verges		
round about circuses squares (plazas)		
cemeteries		
urban forests		
athletic fields		
allotment gardens		
school yards		
other (specify)		

6. Please refer the kind of irrigation system that is typically used for the various types of landscapes (if you use more than one systems for the same type of landscape, use all the relevant indications separated by comma and provide the relevant percentage if possible)

Type of landscape ^(a)	Type of irrigation system ^(b)	Comments

a) (G) Turfgrass; (TG) Trees or shrubs on turfgrass; (TP) Trees or shrubs on pavements; (S) Shrubs

b) (N) no irrigation; (PS) Pop-up sprinkler system; (GS) Ground sprinkler system; (GME) Ground microirrigation system with individual emitters, micro-sprinklers etc; (GDL) Ground microirrigation system with drip lines; (SME) Subsurface microirrigation system with individual emitters; (SME) Subsurface microirrigation system drip lines; (O) Other, please specify

7. How much water is applied for irrigation every year by your dept.?

Water source	Percentage (%)	Comments
Tap (fresh water)		
Water from rain harvesting systems		
Treated waste water		
Gray water		
Desalinated water		
Saline water		
Other (please specify)		

8. Please indicate the reasons why public landscape settings in your area are not completely irrigated:

- water scarcity
- lack of distribution infrastructure
- poor quality of water
- soil properties
- costs
- no need for irrigation (use of local plants and xeriscaping techniques)
- no need for irrigation (use of synthetic turf)
- no need for irrigation (use of bare soil or other ground cover material)
- other (please specify):

9. From what kind of sources does your dept. obtains water? Please indicate their percentage if possible.

- Land Reclamation Organization Network (specify which) (%)
- Public or private (please indicate) drillings/wells (%)
- Public or private (please indicate) open or closed tanks/reservoirs (%)
- Other like lakes, rivers, streams, ponds, dugouts etc) (%)

10. Does your dept. uses tank trucks in order to transport water for irrigation? yes/no

If yes, are they used to:

- Directly apply water to the plants though free surface distribution?
- Directly apply water to the plants though connection to an irrigation system?
- Fill tanks

B. Irrigation management information

11. Does your dept. develop and apply a guideline regarding green spaces?

- If yes:
 - Does it contain specific information regarding irrigation and drainage (plants that need less water, irrigation scheduling advices etc)?
 - How do you disseminate it to any interested party (department staff, landscape subcontractors, citizens, pupils, etc)?
 - Can you provide us with a copy?

12. Does your dept. apply some kind of resources management system regarding landscape (i.e. Differentiated Management Plan)?

13. Does your dept. apply some kind of quality system like integrated management, organic cultivation etc?

14. Has your dept. ever applied or involved in an irrigation ban?

15. Does your dept. uses water meters in order to monitor water consumption for irrigation? Are you obliged to?
16. Are the irrigation systems that your dept. administrates easy to manage? If No, please explain why
17. Does your dept. use some kind of electronics or IT technology for irrigation management (controllers, sensors etc)?
18. Could you mention your opinion regarding the advantages and the disadvantages of using such technology?
- Advantages: () They save labor () They save water () Other, specify
 - Disadvantages: () They cost a lot () They are complicated () Only specialized staff can repair them () Other, specify
19. Are the irrigation systems that your dept. administrates easy to maintain? Yes/No If No, please explain why
20. Does your dept. perform technical and/or environmental auditing to you irrigation system? Yes/No
21. Irrigation at field is usually applied by your depts. employees or by landscape subcontractors?
22. Are periodic analysis are performed on water and/or soil that is used for irrigation?
- i. If Yes, how often and which parameters are detected for water?
 - ii. If Yes, how often and which parameters are detected for soil?
23. Which is the typical irrigation period (from-to) in your area? from month to month
- Is it defined by an ordinance? yes/no
24. How does your dept. typically decide about this period?
- () by experience () by following information provided by relevant services which monitor ET, soil moisture etc () by monitoring directly ET, soil moisture etc () following an ordinance that comes from higher level of administration () Other, specify
25. Does your dept. faces problems regarding water supply in a particular time of year? If Yes, which period (month) and for what reason?
26. Does your dept. use irrigation schedules which are updated when necessary? If yes,
- Which model does your organization uses for water needs estimation?
 - Do you apply an ordinance for these calculations?
 - From where do you get relevant data and information?
 - Do you use any relevant software or internet sites which provide agrometeorological information for these calculations?

27. Are fertilizers applied using the irrigation system? Yes No

28. Are plant protection substances applied using the irrigation system? Yes No

29. Are run-off, waterlogging and drainage problems exist at your dept's area of jurisdiction?
Yes No

30. Do you know where the drainage water ends to?
() I do not care () I do not know () to the aquifer () to the river and then to the sea () Other,
specify

31. Which are the major problems that your dept. faces regarding irrigation:

- Design of irrigation and drainage systems (low-efficiency systems because of age, inappropriate design, etc)
- Condition of the systems and relevant equipment
- Excessive need for labor in order to run the system
- Dept. staff and subcontractors training
- Water quality (salinity, etc)
- Other (please specify)

C. Economic information

32. Costs incurred for the installation or upgrade/modernization of irrigation and / or storage system:

33. Specific expenses incurred during last year for water. Specify items and amount

Cost items	€
Labor	
Maintenance	
Electric energy	
Fuel	
Other (please specify)	

34. Has your dept. receives any subsidies for the installation or modernization of irrigation systems? If Yes, specify the type, year of disbursement, money lender, type of intervention, % of investment financed, disbursed amount.

D. Environmental issues

35. Which of the following practices does your dept. applied in 2013 in order conserve water or energy?

- Installation of central and/or local electronic control systems and sensors
- Elaborated irrigation schedules (best possible estimation of water needs, use of soil characteristics, frequency, duration, time of application etc)
- Replacement of less by more efficient systems (modern sprinklers, microirrigation systems, subsurface systems etc)
- Auditing and more frequent maintenance
- Groundcover / mulching
- Using soil amendments in order to ameliorate it's water retention ability
- Replacement of plants that have great water needs by local plants or in general plants with less water needs
- Use of alternative water for irrigation (rain harvest, saline, treated, gray etc)

- Information dissemination and training regarding these issues
- Other water or energy saving methods or devices
- No practices used

36. Does your dept. links irrigation and drainage management decisions with the protection of other water bodies (ground water, rivers, lakes, wetlands, sea etc) directly or indirectly affected?

Optional questions of part 2

1. Characteristic photos from urban infrastructure projects that are managed by the department:

1.
2.
3.
4. add lines if more

2. Please provide information regarding the drillings/wells that you dept. uses:

X,Y ^(a)	Year of installation	Depth of the drilling	Diameter of drilling suction pipe	Type of pump	pump power	year of purchase of pump	Average discharge flow rate (m ³ /hour) at head (bar of m H ₂ O)	Type of energy source	Filters and filtering problems ^(b)

- a) Specify coordinates if possible
- b) Sand, centrifugal, disk, screen etc

3. Has your dept. ever created/distributed or just distributed some kind of informative material (leaflet, special web page etc) regarding irrigation and drainage? yes/no
 a. If yes could you provide us with copies? yes/no

4. Has your dept. ever organized or cooperated in the organization of any kind off training / educational event for department staff, landscape subcontractors, citizens, pupils etc? yes/no

5. Does you dept. has an easy to reach way (i.e. help desk, call center, web page form etc) for citizens to report problems regarding irrigation and drainage (water run-off on pavements or roads, leakages, waterlogging) and propose solutions? yes7no

- If yes, which are the most common problems, comment, proposals that your dept. receives?
 - If no, why your dept. have not done this?
6. Which is your opinion regarding xeriscaping, urban meadows and synthetic grass?
 7. By whom irrigation and drainage systems for public spaces of your dept.'s area of jurisdiction are designed?
 8. Which projects regarding irrigation and drainage does you dept. runs or are ready to begin this period?
 9. Which projects regarding irrigation and drainage are running or are ready to begin this period by other public authorities in your dept's area of jurisdiction?
 10. Have relevant proposals been submitted by your dept. or other public authorities which are waiting for evaluation? yes/no
 11. Do you think that problems maybe faced regarding water supply in the future? yes/no
 - a. How does your dept. plan to overcome them?
 12. Area for general comments:

Annex II Scheme of questionnaire 2



ISTITUTO NAZIONALE
DI ECONOMIA AGRARIA
ETCP GREECE-ITALY 2007-2013

IRMA

Efficient Irrigation Management Tools for Agricultural Cultivations and Urban Landscapes

Subsidy Contract No: I3.11.06



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WP4 Survey on irrigation water use

Interviewers' name

Number of questionnaire:

Date:

02

2. Local Organisations for Land Reclamation

Reference year: 2013

1.

Surname		Name	
Title / Position			
Mail:		Tel:	

2.

Administrative Region	Puglia/ Region of Epirus/ Region of Western Greece		
Water district			
Watersheds included			
Name of irrigation scheme / organisation			
Contact information (Address, Tel, Fax, URL, email)			
Staff of Land reclamation Organisation (number)		Personnel involved in technical management	
Foundation year			
Total area (ha)			
Irrigable surface (ha)			
Irrigated surface (ha)			

3.

	Total	Male	Female
Members (end-users)			

4.

Period of water availability (irrigation period):	From month to month
---	---------------------

How do you define it each year?	() by experience () by following information provided by relevant services which monitor ET, soil moisture etc () by monitoring directly ET, soil moisture etc () following an ordinance that comes from higher level of administration () other, specify
Do you use an ordinance?	Yes/no

5.

Volume delivered (mean of last 3 years) Mm3	
Percentage of the above volume delivered by gravity system:	
Percentage of the above volume delivered by pressurized system:	

6. Irrigated area for the 5 major crops (reference year 2013):

Crop	Surface Pressure (ha)	Surface Gravity (ha)	Volume delivered pressure	Volume delivered gravity

7. Could you provide us with an estimation regarding the percentage of type of systems in your area:

Type of systems	percentage
flooding	
flowing	
sprinkling	
Micro-irrigation, drop irrigation	
Subirrigation	
Other, specify	

8. Type and number of irrigation water sources:

System	Irrigation	Reclamation	Both	Total
Number of water sources in general (drillings, etc)				
Installed power (kW)				
Electric energy consumption per year (KWh)				
Use of alternative energy sources or production of energy (from water, wind, sun etc)				

System	Irrigation	Reclamation	Both	Total
Water raised (m3):				
Average pressure at the hydrants (bar or m H ₂ O):				

9. Do farmers in your area use in parallel private sources of water (wells, drillings, reclaimed water etc) for irrigation purposes? Yes/No

10. Do you know if there is a process to register those? Yes/No

11. Do you have access to the relevant database? Yes/No

12. Which percentage of those are legal according to your estimation? _____%

13. Type of pricing and cost	
Type of pricing (per area, per m3, etc)	Per area Per m3 Fixed Variable Mixed (explaine) Other (explaine)
How do you calculate the water price?	
Does the type of cultivation is taken into account when the price is set?	Yes/No
Water price to consumers:	€/ha or €/m3
Energy costs (€/year):	
Personnel costs involved in technical management:	
Costs related to the ordinary maintenance of distribution systems:	
Costs related to the extraordinary maintenance of distribution systems:	
Number of extraordinary maintenance in last 3 years:	
Fleet vehicle costs (fuel/maintenance/rental):	
Cost of water supply:	

14. Is the distribution system equipped with monitoring devices (water meters etc)?	yes	no
15. Do you use more sophisticated methods to monitor the water consumption by the system (special satellite images etc)?if yes, what	yes	no
16. Do you use more sophisticated methods to estimate cultivation's water needs (meteorological stations and calculation of evapotranspiration etc)? if yes, what	yes	no
17. Is the distribution system subjected to performance and environmental audits?	yes	no
• and how often?	Num/year	

18. Subsidies for the construction/expansion or modernization of the distribution system?	(Yes/No)
---	----------

If Yes, specify: Type of subsidies, year of disbursement, money lender (financing source), type of intervention, % of investment financed, disbursement amount (€)	
--	--

19. Have you participated, or participate this period, by any means, in any planning activity regarding the implementation of the EU Water Framework Directive - integrated river basin management for Europe (2000/60/EC)⁴ or other EU or national relevant activity? yes/no
20. Are you aware of the local water management plan which is applied in the framework of 2000/60/EC at the hydrological basin of your jurisdiction? yes/no
21. Does your organisation links irrigation and drainage with the protection of other water bodies (ground water, rivers, lakes, wetlands, sea etc) directly or indirectly affected? yes/no

Extent of internet use regarding the public services that your organization provides:

22. Does your organization provide end-users (farmers) with advices regarding irrigation, drainage, fertilisation management? yes/no
23. If yes, which model does your organisation uses for water needs estimation (Blaney-Cridle, Hargreaves, Penman-Monteith, other)?
24. Do you apply an ordinance for these calculations? yes/no
25. Do you use any relevant software like FAO's CropWat for these calculations? yes/no
 - if yes, what
26. Are you aware of web sites that provide agrometeorological information and tools for irrigation, fertilization, etc calculations (name them i.e. <http://www.cimis.water.ca.gov>, <http://www.agrometeopuglia.it>, <http://probiosis.teiep.gr>, <http://www.hnms.gr>, <http://www.meteo.gr> etc)
27. Major problems in the irrigated area (max 5 responses)
 - Condition of equipment, canals, pipers, reservoirs and other structures
 - Irrigation water availability
 - Water use efficiency (leaching, leakages, old application systems etc)
 - Water quality (salinity, etc)
 - Excessive need for labor in order to run the system
 - Soil erosion / desertification
 - Soil quality (pH, nitrates, etc)
 - Drainage problems (waterlogging, system maintenance needs, eutrophication etc)
 - Farmers training
 - Other (specify)
28. Which are your views regarding the future in water management and relevant irrigation and drainage issues?

⁴ <http://ec.europa.eu/environment/water/water-framework/>

29. Do you think that problems maybe faced regarding water supply in the future? How does your organisation plan to overcome them?

Optional questions

1. Characteristic photos from the organization:
2. Could you provide a copy of the constitution and scheme by-laws as it is today? yes/no

3.

Brief description of the irrigation and drainage network and the infrastructure of the organization (pumping stations, canals or pipe length and relevant material, laboratories for soil and water analysis etc)	<i>If you have a ready relevant text you can just provide us with it</i>
Could you provide us the most recent top view plan of the system	<i>The copy will be scanned and returned</i>

4. Please refer any extra services provided to members (i.e. relevant training, irrigation scheduling advices, irrigation system auditing, etc)
5. Does you dept. has an easy to reach way (i.e. help desk, call center, web page form etc) for citizens to report problems regarding irrigation and drainage (water run-off on pavements or roads, leakages, waterlogging) and propose solutions?
 - i. If yes, which are the most common problems, comment, proposals that your dept. receives?
 - ii. If no, why your dept. have not done this?
6. Are analyses of water performed (and how many in space (different points) and time per year) in irrigation and drainage system or your organisation and what problems have occurred?
7. By whom irrigation and drainage systems in your area are designed and installed?
8. With which means are these adjustments made in your system (manually, centrally using electrically operated gates, other)?
9. Which projects regarding irrigation and drainage does you organization runs or are ready to start this period?
10. Which projects regarding irrigation and drainage are running or are ready to begin this period by other public authorities in your organisation's area of jurisdiction?
11. Have relevant proposals been submitted by your organisation or other public authorities which are waiting for evaluation?
12. Area for general comments:

Annex III Scheme of questionnaire 3



ISTITUTO NAZIONALE
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IRMA

Efficient Irrigation Management Tools for Agricultural Cultivations and Urban Landscapes

Subsidy Contract No: I3.11.06



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WP4 Survey on irrigation water use

Interviewers' name:

Number of questionnaire:

Date:

03

3. Irrigation systems at farm level (Farm level questionnaire)

Reference year: 2013

A. General information regarding the farmer (agricultural enterprise leader)

1. Full name:		
2. Sex:	Male	Female
3. Age:	20-30 31-40 41-50 51-60 Oltre 60	
4. Address:		
5. Municipality		
6. Telephone numbers:		
7. email etc		
8. Age at which started to be occupied professionally with agriculture?		
<ul style="list-style-type: none"> Educational level / qualifications 	<ul style="list-style-type: none"> Elementary school Junior High school High school University degree Post degree 	
9. The farmer carries out the activities in agriculture	-Exclusive (>50% agricultural income) -Predominant -residual	
10. Other than agricultural income comes from:		
11. How familiar are you with the use of IT technology?	<ul style="list-style-type: none"> High 	

	<ul style="list-style-type: none"> • Medium • Low • Nothing
12. Do you have a PC/Laptop/Tablet etc?	Yes No
13. Do you have a SmartPhone?	Yes No
14. Do you use the internet:	Yes No
15. Which are the main means you use in order to be informed regarding agricultural issues: <input type="checkbox"/>	<input type="checkbox"/> Councilor from relevant public organisation <input type="checkbox"/> Private agronomic councilor <input type="checkbox"/> Specialised books <input type="checkbox"/> Specialised newspapers, magazines (name some) <input type="checkbox"/> Specialised TV series (name some) <input type="checkbox"/> Specialised web sites (name some) <input type="checkbox"/> Expositions, Trade fairs <input type="checkbox"/> Professional education workshops <input type="checkbox"/> Conferences, symposia Other (specify)
Did you ever attended an educational/training session specialised in irrigation and/or drainage (organiser, title, hours)?	Yes/no
Are you satisfied with the knowledge you got from that training?	Yes/no
On which issue do you think you need more training:	<ul style="list-style-type: none"> • irrigation system maintenance, • irrigation management/scheduling, • new trends and new types of irrigation systems? • other (please specify)

B. Land parcels and cultivations of the farm

Reference year: 2013

1. Total farm area (ha)⁵:
2. Cultivated area of the farm (ha):
3. No cultivated area of the farm (ha):

⁵ There is the possibility that the total farm area is not equal with the sum of the cultivated land parcels area as some of the farm area could be unutilised.

4. Surface equipped with irrigation fixed systems (ha):
5. Irrigable area with available water resources (ha):
6. Irrigated area annually (ha):
7. Total yearly cost for irrigation and drainage for all the land parcels of the farm:

Table 1: Cultivated land parcels registration:

If possible for each land parcel the cartographic coordinates (polygon or central point) will be defined (with the Id as description (attribute))⁶

Id	Region	Province	Municipality	Possession of the land ^(e)	Area (ha)	Crop type ^(b)	Cultivation (and variety)	Age of plants ^(c)	Number of plants	Cultivation system ^(d)

- c) (O) Own property; (R) Rent; Other (please specify)
d) (1) Arable crops; (2) Protected cultivation (greenhouse/tunnel, net house); (3) Arboriculture; (4) Vegetables in open field; (5) Other (please specify)
e) Where applicable
f) (O) Organic or (IM) Integrated Management or (CC) Conventional cultivation

Table2:

Id	Special cultivation type ^(e)	Cultivation layout ^(f)	Groundcover ^(g)	Mean yield per year	Soil type ^(h)	Slope ⁽ⁱ⁾	Distance from residence (km)	Electricity (Y/N) ^(j)

- g) Tall or short olive trees, palm shape etc
h) Co-cultivation (specify crops)
i) In case of trees specify the percentage of ground covered by other crops (0%, bare soil)
j) (S) Sandy; (C) Clay; (L) Loamy
k) (I) Inclined; (H) Horizontal; (C) Combination
l) Probably in order to get permission to use electricity for pumping water you submitted a plan contained the irrigation system layout, the irrigation period, the cultivation water needs and the relevant scheduling. Could you provide us with a copy of it?

⁶ Digitize the most representative plots on Google Earth (See technical specifications).

Table3.

Id	Water district	Water basin (river)	Special microclimatic conditions ^(k)	Irrigated (Y/N)

m) i.e. high relative humidity in comparison with the mean of the area

C. Irrigation (only for irrigated land parcels)

Table4:

Id	Place of irrigation water source ^(a)	Irrigation water source ^(b)	Way of transportation in case of off-farm water source ^(c)	Distance of land parcel from the water source	Cost of water ^(d)

b) Specify if the water source is on or off the land parcel

c) Land Reclamation Organization Network (specify which), Private source (drilling, well, open reservoir etc), other public or private (lakes, rivers, streams, ponds, dugouts etc)

d) Off-farm water transported to the farm e.g., via pipeline, canal system or vehicle, including municipal water and any surface water located off-farm

e) From land recalamtion organisation or estimation in case of private source (if possible)

Table 5: Drillings

Id ^(a)	Year of installation	Depth of the drilling	Diameter of drilling suction pipe	Type of pump, pump power, year of purchase	Average discharge flow rate (m ³ /hour) at head (bar of m H ₂ O)	Type of energy source	Filters and filtering problems ^(b)

Id ^(a)	Year of installation	Depth of the drilling	Diameter of drilling suction pipe	Type of pump, pump power, year of purchase	Average discharge flow rate (m ³ /hour) at head (bar of m H ₂ O)	Type of energy source	Filters and filtering problems ^(b)

- c) In case of more than one drilling in a land parcel use a different line to register it
d) Sand, centrifugal, disk, screen etc

1. Have you got drilling in your farm? yes/no
 - if yes, how much?

2. Did you have problems with water supply in a particular time of year (you can use the Land parcel id in order to refer to specific land parcels)?
 - If Yes, what period (month) and for what reason?

3. Of all the off-farm water used for irrigation in 2013, what percentage (%) came from each of the following?

Tap water	<input type="text"/>
Treated wastewater	<input type="text"/>
Provincial water sources (irrigation district, irrigation project)	<input type="text"/>
Private sources	<input type="text"/>
Other sources, please specify:	<input type="text"/>

4. Why did you need to obtain water from an off-farm source in 2013?

No water or not enough water available on the farm for irrigation	<input type="text"/>
Poor quality of on-farm water for irrigation	<input type="text"/>
Other reasons (please specify):	<input type="text"/>

5. Please indicate the reasons why your farm is not completely irrigated (you can use the Land parcel id in order to refer to specific land parcels)

management	<input type="text"/>
crop rotation	<input type="text"/>
lack of distribution infrastructure	<input type="text"/>
lack of agrarian settlements	<input type="text"/>
water scarcity	<input type="text"/>
fragmentation of the farm	<input type="text"/>
soil properties	<input type="text"/>
ownership and/or distance of water source	<input type="text"/>
costs	<input type="text"/>
poor quality of water	<input type="text"/>
other (please specify):	<input type="text"/>

Table 6

Id	Irrigation method - Specify ^(e)	Start of irrigation season	End of irrigation season	Number of irrigation events ^(f) (A)	Water volume (liters, m ³ or mm) or run time (min or h) per irrigation event (B)	Total water volume (mm) ^(g) (C)

- f) Sprinkler irrigation (solid set, center pivot irrigation system, linear move irrigation system, traveling guns (either cable tow or hard hose traveling sprinkler system)); Micro-irrigation (drip lines, tapes, emitters/dripers, bubblers, micro-sprinklers etc); Flood (surface) irrigation
- g) Number of irrigation events performed during a typical irrigation season
- h) Total volume of applied water per season (mm is the same as 10m³/ha).

Special questions:

1. Do you have a water meter?yes/no
 - are you obliged to? yes/no
 - Do you have it order to know the volume of water you use?
2. Do you find the cost of irrigation water reasonable?
3. Does the trunk or the foliage of the cultivation is getting wet during irrigation events?
4. Are the traveling guns manually repositioned?
5. Which of the following practices were used in 2013 to conserve water or energy? (you can use the Land parcel id in order to refer to specific land parcels)

Wind breaks	
Leaving stubble on fields (e.g., minimum tillage, direct seeding)	
Watering at night or in the morning	
Pressure reduction	
Water or energy saving nozzles	
Incorporating compost or other organic material into soil to increase soil water retention	
Other water or energy saving methods or devices	
No practices used	
6. When (year) did you installed and when was the last upgrade/modernization of the irrigation system (you can use the Land parcel id in order to refer to specific land parcels), can you mention the cost?
7. Do you think that irrigation and drainage systems should be designed and constructed by specifically trained professionals? Would you pay for such a service?
8. In case that your system has been done by a professional did she/he provided you with a study, designs, irrigation scheduling proposal?
9. How much (and when) did you pay for this service?
10. Is your irrigation equipment easy to manage? If No, please explain why
11. Do you use some kind of electronics or IT technology for irrigation management (controllers, sensors etc)?
12. What are the advantages and the disadvantages of using irrigation technologies in your farm?
13. 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>, <http://www.agrometeopuglia.it>, <http://probiosis.teiep.gr>, <http://www.hnms.gr>, <http://www.meteo.gr> etc)?

14. Do you ask for professional assistance regarding the set up of the irrigation schedule you apply?
15. Would you use an automatic advice service regarding irrigation scheduling? Would you prefer that your agronomist/councilor use that service and review the advice before you are suggested to apply it? Would you pay for this service?
16. Do you ask for professional assistance regarding the amount of fertilizers you apply?
17. Do you perform periodic analysis on water?
 - i. If Yes, how often and what parameters are detected?
18. Do you apply plant protection substances using the irrigation system?
 - i. The quality of water is poor, fair or good?
19. Is your irrigation equipment easy to maintain? If No, please explain why
20. Do you perform technical and/or environmental auditing to you irrigation system? Could you provide us with a copy of the most recent one?
21. Do you utilize water for frost protection? Do you use the irrigation system for these or do you have a special system. Describe in detail how you decide when to turn the irrigation system on and off for freeze protection.
22. Do you think that you may face more problems regarding water supply in the future? How do you plan to overcome this?
23. Regarding water issues, which is in your opinion the most significant of the following:
 - Lack of straightforward strategy regarding water management
 - Lack or insufficient size of central irrigation systems
 - Lack or insufficient size of modern central irrigation systems
 - Unefficient water management at basin level
 - Lack of or support from relevant public administration services
 - Lack of training
 - Unefficient water management at end user (farm) level
 - Other, please specify

D. Soil/Substrate and Drainage

Id	Last time you performed soil analysis	Fertilisation (elements, quantities, months)	Fertigation (elements, quantities, months)	Hydroponic cultivation ^(a)	Do you apply fertilizer during a regularly scheduled irrigation application?	Waterlogging/drainage problems (area affected)

a) Please mention which kind of substrate do you use?

E. Economic information

- 1) Labor:
 - managed by farmer
 - managed using family labor (exclusively)
 - managed using family labor (prevalent)
 - managed using non-family labor (prevalent)
 - management using salaried field workers
 - other (please specify)
- 1) Costs incurred for the installation or upgrade/modernization of irrigation and / or storage system
- 2) Gross Saleable Yield derived from irrigated crops
% on total Gross Saleable Production
amount €
- 3) Specific expenses incurred in the last year for water. Specify items and amount
Cost items €
 - Purchasing
 - Maintenance
 - Electric energy
 - Fuel
 - Other (please specify)
- 4) Have you noticed changes in yield after irrigation was applied?yes/no

F. Environmental issues

- 1) Do you harvest rain water?
- 2) Do you face erosion problems?
- 3) Refer the pests and diseases that occurred during the year and how much damage had been done?
- 4) Regarding water issues, which is in your opinion the most significant of the following:
 - a. Drought
 - b. Desertification
 - c. Salinisation
 - d. Other, please define it
- 5) According to your opinion which is the main cause for water shortages in your area?
 - a. We do not have water shortages in our area
 - b. Excess pumping for irrigation by private drillings
 - c. Lack of guidance and rules regarding water distribution
 - d. Climate change
 - e. Other, define
- 6) Are you aware of the special environment legislation concerning water and programs that provide funds for environmental friendly practices: i.e. Natura 2000, 2000/60/EC, De-nitrification initiative, etc
- 7) Do you know where the drainage water ends to?

G. Other information

1. Which public administration organisation/department have you visited in order to settle irrigation/drainage related issues?
2. Which were these issues (i.e. permission for or registration of drilling, permission to use electric supply for pump, etc)
3. How satisfied are you from the relevant transactions?
4. Have you received any subsidies for the installation or modernization of irrigation systems?

- a. If Yes, specify the type, year of disbursement, money lender, type of intervention, % of investment financed, disbursed amount.
- b. Propensity to new investments in agriculture, particularly in the irrigation sector
- c. In case of propensity, specify the type of new investments and the amount that you intend to invest on them.

Optional questions

Characteristic photos from the farm:

5.
6.
7.
8.
9. add lines if more

Which are your views regarding the future in water management and relevant irrigation and drainage issues?

Do you think that problems maybe faced regarding water supply in the future? How does you plan to overcome them?

Area for general comments:

Technical data regarding selected land parcels

If you have a relevant study/design, could you provide us with a copy of it?

- 1) Land parcel Id
- 2) Sketch of the system (water supply, layout: mainlines, typical zone pipes and laterals, height differences indication with characteristic dimensions):
- 3) Type of system
- 4) Who designed the system?
- 5) Who installed the system?
- 6) Number of zones and flow need per zone?
- 7) Materials, depth of height (in case of tree hanging) of installation
- 8) Type and characteristic of sprinklers, micro-sprinklers or emittters (flow, pressure)
- 9) Number of water distribution points⁷ per tree
- 10) Filters, control valves, pressure regulators, air relief valves and othe components
- 11) Control components and sensors
- 12) Characteristic photos

⁷ Water distribution point: is used as a generic term for every irrigation system components (channel exit points, sprinklers (of any size), emitters (drippers), bubblers, micro-sprinklers etc.

Annex IV Scheme of questionnaire 4



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IRMA

Efficient Irrigation Management Tools for Agricultural Cultivations and Urban Landscapes

Subsidy Contract No: I3.11.06



www.irrigation-management.eu

WP4 Survey on irrigation water use

Interviewers' name:

Number of questionnaire:

Date:

04

4. Private Landscape /Leisure irrigation Systems⁸

Reference year: 2013

A. General information regarding the organization/institution/company (when applicable)

Name:		
Region	Municipality	
Telephone numbers:		
Other contact information (website, email etc)		

B. General information regarding the irrigation manager

Full name:		
Sex:	Male	Female
Age:		
Region	Municipality	
Telephone numbers:		
Other contact information (email etc)		
Educational level / qualifications		
How familiar are you with the use of IT technology?	A lot Fairly Just a bit Not at all	
Do you have a PC/Laptop/Tablet ?	Yes	No
Do you have a SmartPhone?	Yes	No
Do you use the internet:	Yes	No
Are you informed/trained systematically or not by any means regarding gardening issues (including irrigation)?	Yes, deeply Yes, basic concept No	

⁸ Academic campus, Institutional park, sport's establishments (golf, football, tennis etc), touristic and leisure set ups, individuals owning private garden etc.

C. Landscape, irrigation system and irrigation management information

Green surface managed (m ²)			
Green surface irrigated (m ²)			
Turf grass area (m ² and type or irrigation system)		type or irrigation system)	
Shrub area (m ² and kind or irrigation system)		type or irrigation system)	
Other areas i.e. synthetic turf, meadows, alternative groundcovers etc (m ² and type or irrigation system)		type or irrigation system)	
Water supply source	Tap water, well, drilling, rain water harvest, treated waste water other		
How much water is consumed for irrigation on average per year? (m ³ /year)			
Is this an estimation or do you have special water meter to measure it?	Estimated measured		
In case you use tap water, do you know the cost of water?	Yes/no		
Are volume consumption levels applied to cost per m ³ in your area?	Yes/no		
In case you use water from drilling, do you know the cost of energy to pump water?	Yes/no		
Are energy consumption levels applied to cost per kWh in your area?	Yes/no		
Total cost of irrigation water (€/year),	(€/year		
please specify the percentage of total for water, system maintenance, energy	%		

Other questions:

12. If you use a drilling could you provide the following data:

- a. Year of installation
- b. Depth of the drilling
- c. Diameter of drilling suction pipe
- d. Type of pump, pump power, year of purchase
- e. Average discharge flow rate (m³/ hour) at head (bar of m H₂O)
- f. Type of energy source
- g. Filters and filtering problems

13. How often do you perform soil analysis? frequently/rarely/ never

14. and water analysis? frequently/rarely/ never

15. 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>,

<http://www.agrometeopuglia.it>, <http://probiosis.teiep.gr>, <http://www.hnms.gr>,
<http://www.meteo.gr> etc) yes/no,

16. Do you think that irrigation and drainage systems should be designed and constructed by specifically trained professionals? yes/no
 - a. Would you pay for such a service? yes/no
17. In case that your system has been done by a professional did she/he provided you with a study, designs, irrigation scheduling proposal? yes/no
18. Is your irrigation equipment easy to manage? yes/no
 - a. If No, please explain why
19. Do you ask for professional assistance regarding the set up of the irrigation schedule you apply? yes/no
20. How do you apply the irrigation schedule? manually/ using a controller/other, specify
21. If you use a controller how often do you make changes (schedule change, water budget figure change, rain delay change etc) to it? frequently/rarely/never
22. Does your control system use any kind of sensor? (rain sensor/soil moisture sensor/other, specify
23. Do you think that this kind of technology (sophisticated controller, sensors etc) would lead to significant lowering of water consumption? yes/no
 - a. Would you expect great cost gains from this? yes/no
24. Do you perform technical and/or environmental auditing to you irrigation system? yes/no
25. Do you ask for professional assistance regarding the amount of fertilizers you apply? yes/no
26. Are run-off, waterlogging and drainage problems exist at your garden? yes/no

27. Do you know where run-off or drainage water from your garden ends to?
() I do not care () I do not know () to the aquifer () to the river and then to the sea ()Other, specify

28. Would you interested to change your garden to a more water conservation one? yes/no
 - a. have you heard the term xeriscaping? yes/no
 - b. if yes, in what context?
29. How frequent do you check you system for leakages, adequate distribution uniformity etc? frequently/sometimes/rarely/never
30. If you where obliged by the state to change turfgrass by an other kind of ground cover, which of the following would you prefer (put a priority number next to each alternative):
 - Synthetic grass
 - Full cover meadow
 - Passing through meadow
 - Inorganic groundcover (sand, pebble, pine bark etc)
31. Regarding water issues, which is in your opinion the most significant of the following:
 - Lack of straightforward strategy regarding water management
 - Lack or insufficient size of central irrigation systems
 - Lack or insufficient percentage of modern central irrigation systems
 - Inefficient water management at basin level
 - Lack of training
 - Inefficient water management at end user level
32. Regarding water issues, which is in your opinion the most significant of the following:
 - Drought
 - Desertification
 - Salinization
 - Other, please define it
33. According to your opinion which is the main cause for water shortages in your area?

- We do not have water shortages in our area
- Excess pumping for irrigation by private drillings
- Lack of guidance and rules regarding water distribution
- Climate change
- Other, define

Optional questions

Characteristic photos from the landscape project:

- 10.
- 11.
- 12.
- 13.
- 14. add lines if more

Technical data

If you have a relevant study/design, could you provide us with a copy of it?

- 13) Sketch of the system (water supply, layout: mainlines, typical zone pipes and laterals, height differences indication with characteristic dimensions):
- 14) Type of system
- 15) Who designed the system?
- 16) Who installed the system?
- 17) Number of zones and flow need per zone?
- 18) Materials, depth of height (in case of tree hanging) of installation
- 19) Type and characteristic of sprinklers, micro-sprinklers or emitters (flow, pressure)
- 20) Number of water distribution points⁹ per tree
- 21) Filters, control valves, pressure regulators, air relief valves and other components
- 22) Control components and sensors
- 23) Characteristic photos
- 24) Could you provide us with the relevant bill(s) of last irrigation period (2013)?

⁹ Water distribution point: is used as a generic term for every irrigation system components (channel exit points, sprinklers (of any size), emitters (drippers), bubblers, micro-sprinklers etc.

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