One of the main questions in the future is whether there will be sufficient freshwater to satisfy the growing needs of agricultural and non-agricultural users.
Aqueduct Pont du Gard - Nîmes - France
Aqueduct Segovia - Spain

Aqueduct Neria - Spain
Aqueduct Tomar - Portugal
One of the most important Roman cities served by aqueducts at that time was certainly Pompeii.
THE BASILICA CISTERN IN ISTANBUL

IRRIGATION AND DRAINAGE IN THE MEDITERRANEAN

AVERAGE ANNUAL RAINFALL IN ITALY

AVERAGE ANNUAL EVAPOTRANSPIRATION IN ITALY
### Water Resources in Italy (10^9 m³)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Rainfall (A)</td>
<td>296</td>
</tr>
<tr>
<td>Potential water availability (B)</td>
<td>110</td>
</tr>
<tr>
<td>Exploitable water resources (C)</td>
<td>40</td>
</tr>
<tr>
<td>Available groundwater (D)</td>
<td>12</td>
</tr>
<tr>
<td>Total available resources (C+D)</td>
<td>52</td>
</tr>
</tbody>
</table>

### Geographical Distribution of Water Resources in Italy

<table>
<thead>
<tr>
<th>Area</th>
<th>10^9 m³</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Italy</td>
<td>65</td>
<td>59</td>
</tr>
<tr>
<td>Central Italy</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Southern Italy</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Islands</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>110</td>
<td>100</td>
</tr>
</tbody>
</table>

---

**IRRIGATION NETWORKS**

**IRRIGATION SYSTEMS**

**GEOGRAPHICAL DISTRIBUTION OF WATER RESOURCES IN ITALY**
### GEOGRAPHICAL DISTRIBUTION OF WATER RESOURCES IN ITALY

<table>
<thead>
<tr>
<th>Area</th>
<th>$10^9$ m$^3$</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>110</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

### WATER DEMAND IN ITALY

<table>
<thead>
<tr>
<th></th>
<th>Year 90's</th>
<th>Year 00's</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE</td>
<td>$10^9$ m$^3$</td>
<td>%</td>
</tr>
<tr>
<td>Families</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Industry</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Energy</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td>Agriculture</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Land reclamation and Irrigation Consortia realize integrated water management on catchment basis, protecting rural and urban land.

- 80% of Italian agricultural production comes from drained and irrigated areas.
- 145 Consortia are active all over Italy.
Land reclamation and Irrigation Consortia realize integrated water management on catchment basis, protecting rural and urban land.

- 85% of Italian agricultural production comes from drained and irrigated areas.
- 145 Consortia are active all over Italy.
- 17,672,565 hectares (59% of Italy’s area) are located in Consortia districts.
- 7,000,000 hectares under drainage (1,200,000 hectares depending on pumping stations).
- 3,300,000 hectares under irrigation.
  - 6% submersion irrigation (for rice cultivation)
  - 23% flooding irrigation (gravity)
  - 51% under pressure (sprinkler) irrigation
  - 20% drip irrigation

66% submersion irrigation
24% flooding irrigation
10% under pressure irrigation
POPULATION INCREASE AND WATER WITHDRAWAL

SOURCE: PLAN BLEU, 2005

POPULATION IN THE MEDITERRANEAN COUNTRIES

SOURCE: PLAN BLEU, 2005

WATER DEMAND PER SECTOR IN THE MEDITERRANEAN COUNTRIES

SOURCE: PLAN BLEU, 2005
Agriculture is the main consumer of freshwater in the Mediterranean Region. In order to save this precious resource, we need to reconsider Water Management and think of NEW innovative approaches.

Upgrade water use efficiency by means of:

- Improvement of the performance of Irrigation Networks - Systems
- Assessment of crop water requirements
- Irrigation Scheduling

Results of Research carried out in the last forty years have enabled the development of methodologies and technologies that allow sufficiently enough precise crop water requirements assessment for water scheduling, especially at the farm level.
### Water Scheduling Expert Systems operating in Italy

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>DEVELOPER</th>
<th>METHODOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRRIFRAME</td>
<td>ANBI</td>
<td>Hydrological balance ET&lt;sub&gt;0&lt;/sub&gt;: HG/PM</td>
</tr>
<tr>
<td>IRRISAT</td>
<td>Arlespace srl</td>
<td>Satellite Images ET&lt;sub&gt;0&lt;/sub&gt;: PM</td>
</tr>
<tr>
<td>IRRISIAMS</td>
<td>Regione Sicilia</td>
<td>Hydrological balance ET&lt;sub&gt;0&lt;/sub&gt;: PM</td>
</tr>
<tr>
<td>IRRITRE</td>
<td>Trentino</td>
<td>Hydrological balance ET&lt;sub&gt;0&lt;/sub&gt;: HG</td>
</tr>
<tr>
<td>IRRINET Sardegna</td>
<td>ARPAS</td>
<td>Hydrological balance ET&lt;sub&gt;0&lt;/sub&gt;: (?)</td>
</tr>
<tr>
<td>IRRI.T ASIA</td>
<td>Regione Toscana</td>
<td>Hydrological balance ET&lt;sub&gt;0&lt;/sub&gt;: HG</td>
</tr>
</tbody>
</table>

S.I.S. Smart Irrigation System is an ultimate monitoring system for the sustainable management of water resources and the planning of irrigation.

Validation and implementation of these innovations at field level (testing, scaling up, demonstration, training) are still going on.

### Smart Irrigation System

- **SMART IRRIGATION SYSTEM**
- Innovative technology applied for management, remote control and data acquisition of irrigation systems

**Higher Productivity & Control**
- Development & Elaboration of multidisciplinary information
- Data collection and availability
- Sustainable use of water resources

**Operating Costs**
- Water Losses
- Service Failures
- Crash of the system

- Follows the guidelines of MIPAAF approved by D.M. 31<sup>st</sup> July 2015
- Enables data transmission of volumes measured to GIS - SIDRAN
- Is eligible for financial support by PSRN 2014/20: Measure 4.3 - Irrigation Investments
Main goals are:
- Efficiency
- Productivity
- Competitiveness
- Quality
- Sustainable use of water resources
- Management costs

Very often problems in Irrigation Management are multidimensional. The Smart Irrigation System has been conceived in order to monitor and manage the huge amount of data passing through operating systems, as a consequence of water delivery in irrigation networks.

\[ 	ext{SIS can help stakeholders to take operative and strategic decisions} \]

Stakeholders’ expectations:
- **Water Manager**
  - Water Supply Management Costs
  - Energy Saving
  - Irrigation Scheduling
  - Territorial Planning

- **Farmer**
  - Crop Quality
  - Irrigation Advise
  - Control of irrigation
  - Higher Yields
  - Less subsidence

- **Community**
  - Sustainable use of water Resources
  - Protection of the Environment
  - Preservation of the Landscape
  - Economic and Social Development

**Decision Support System**

**Water saving**

**Environmental Sustainability**
How to irrigate, when and with how much water?

Smart Irrigation System

Primary Intake
Secondary Intake
Meteo Station
Remote Control Systems
Automated Delivery Groups
Environmental Sustainability
Decision Support System
GIS Data

Control Centre

Delivery

Flow Meters

Ø 1200-1000
Ø 200-250
Ø 1200-1000
Ø 1200-1000

Hydropass Groups

Primary Intake
Secondary Intake
Remote Control Systems
Automated Delivery Groups
Environmental Sustainability
Decision Support System
GIS Data

Control Centre

Delivery

Flow Meters

Ø 1200-1000
Ø 200-250
Ø 1200-1000
Ø 1200-1000

Hydropass Groups
**Ist and IInd Level – RTU «RTP» Apparatus**

**NETWORKS**
2/3 G, WLAN, VHF/UHF, ISM

**PROTOCOLS**
MODBUS RTU, MODBUS/TCP, IEC60870-5-104, …

**ARCHITECTURE**
MASTER/SLAVE
I/O > 4096 POINTS
I/O DISTRIBUTED

**WEB LOCAL SERVER**
Diagnostics
Parameters

**OPERATING PANEL**

**AUTOMATIONS & ADJUSTMENTS**

**CONTROL ACCESS TO TRASPONDERS**

**DIAGNOSTICS OF BUFFER BATTERIES**

**PROTECTION OF NETWORK POWER SUPPLY**

---

**IIIrd Level – µRTU «S642» Apparatus**

**IT IS:**
An equipment capable of remote monitoring and control, based upon 2.5G technology and supplied by photovoltaic energy.

**IT DOES:**
Bi-directional communication with the Control Centre, enabling precise data logging for I/O channels.
- Management of hydraulic valves command, by means of direct control of the solenoid;
- DI acquisition, counting and summarizations;
- AI acquisition.

---

**Smart Irrigation System**

**Ist & IInd Level**

**IIIrd Level**

**IVth Level**

**Primary Intake**

**Secondary Intake**

**Main Conduct**

**Secondary Conduct**

**Delivery**

**Control Centre**

**Flow Meters**

**Hydropass**
**IVth Level – Automated Water Delivery Groups**

**STAND ALONE CARD SYSTEMS:**
- **User Card**, by contact or wireless, to open and close water flow. Water accounting, control and planning of single irrigations.

**REMOTE READING CARD SYSTEMS:**
- **GSM/GPRS**: enables data acquisition periodically and with fixed timing.
- **RADIO**: network of repeaters covering the interested area, ultra low power, bidirectional, free frequencies.
  - Real time alarms acquisitions.
  - Continuous operating data acquisition.
  - Remote re-programming of delivery groups.
  - Command inputs transfer.

**IVth Level – Remote Reading equipment**

**Remote Reading Walk-by or Drive-by:**
- Data acquisition passing by delivery groups with tablet provided with receiver, max. distance (300/400 metres). Low energy consuming System batteries lasting >10 years.

**Radio**
- Network of receivers covering the area, ultra low power, free frequencies.
  - Technology LoRa Wan communicates at great distances (up to 15 Km)
  - Real time alarms acquisitions.
  - Continuous operating data acquisition.

**Management Software:**
- Enables integrated management of delivery groups and of counters provided with remote data reading, acquiring data directly through Gateway LoRa WAN.

**Smart Irrigation System**

- The engine of a SIS is the Control Centre:
  - Guarantees robustness of the remote control system
  - Handles the DSS and runs information/data
  - Enables Governance resolutions in water resources.
The S.I.S. System has been conceived and developed in order to fulfill the need of updated and real-time data. The communication network allows to have access to all the information regarding the user outline and his water consumption, along with the capability to communicate with the equipment in emergency or failure situations.

It can be coupled with the existing national databases, thus providing weather and soil information in order to support the most sustainable irrigation scheduling systems (IRRINET, IRRIFRAME etc). This leads to immediate and clear improvement of the irrigation operations with subsequent economic, management and environmental benefits.
What is a DSS?
It can help provide an exhaustive real-time picture of the Irrigation System

DSS is a middleware; technologies and software Internet oriented, web service in order to rely on communications among different devices.

Smart Irrigation System
At the heart of a Smart Irrigation System is the DSS = integration of information layers

A DSS is a smart information system useful for stakeholders in taking important decisions without replacing them.

DSS Irrigation Advise - IRRIFRAME

Feedback on meteo data & volumes
Optimization of Irrigation Advice based on info & data of water, soil and Metro

Mathematical Model developed by C.E.R.

Irrigation Advice

Effective Irrigation

Field Operation

DSS Irrigation Advise - IRRIFRAME
TECHNICAL ASSISTANCE ON IRRIGATION SCHEDULING

IRRIFRAME is an Expert System for Irrigation Consortia developed with the support of UE, providing each farmer information on the following irrigation scheduling parameters:

- Crop water requirements
- Irrigation interval and frequency

IRRIFRAME improved irrigation and increased quantity and quality of agricultural production.

- Crop data
- Irrigation system
- Meteo data
- Soil data
- Water table
- Consortium data

Crop water balance and irrigation scheduling according to intervals and water availability

Timing of irrigation intervals and frequency

Irrigation Volume

Economic convenience

After first time inputs are automatically assigned by the system

Internet access to IRRIFRAME server is achievable by entering ANBI website or directly from Consortia website. The farmer is provided with a password, in order to have the irrigation advice related to his farm.

- Provide geo referenced data on irrigated areas
- Provide information on irrigation intervals and conditions.
The user will access the service by introducing geo-referenced data of his farm on Google map. The system will automatically provide up-to-date information on the irrigated area, meteorological conditions, water table and soil characteristics.

Localization of the farm on Google map and acquisition of local data

<table>
<thead>
<tr>
<th>Consortium</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORSICA</td>
<td>detention</td>
</tr>
<tr>
<td>TOSCANA</td>
<td>Utri</td>
</tr>
<tr>
<td>LIGURIA</td>
<td>Genoa</td>
</tr>
<tr>
<td>ROMA</td>
<td>Tuscania</td>
</tr>
<tr>
<td>TRENTO CENTRALE</td>
<td>Padua</td>
</tr>
<tr>
<td>EMILIA CENTRALE</td>
<td>Reggio Emilia</td>
</tr>
<tr>
<td>BOLOGNA OCCIDENTALE</td>
<td>Bologna (BO)</td>
</tr>
<tr>
<td>BASILICATA</td>
<td>Foggia</td>
</tr>
<tr>
<td>AGENTO ETIO FOSSO</td>
<td>Pesci (MT)</td>
</tr>
<tr>
<td>MONO CREMONA</td>
<td>Cremona (MI)</td>
</tr>
<tr>
<td>MOTO CREMONA</td>
<td>Cremona</td>
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</tbody>
</table>
THANK YOU