The aim of the Master Programme on "Land and Water Resources Management: Irrigated agriculture" is to improve capacities of high ranking officials and professionals, both agronomists and engineers, in land and water resources management in the Mediterranean region.

The main objective of the Master Program in "Land and Water Resources Management: Irrigated agriculture" is to improve scientific knowledge and technological know-how of the candidates in water saving and land conservation issues through the completion of specific research themes and experimental works.

The course is structured in such a way as to promote integrated management of land and water resources in Mediterranean agriculture considering agronomic, engineering, environmental and socio-economic aspects on different scales.
The programme is organized in **8 Units (60 ECTS)**

Duration: **8 months from October 2016 to May 2017**

**3 Oct – 22 Oct 2016**

**UNIT 1 – INTRODUCTORY COURSES (6 ECTS)**

**Content:**
- Information and Communication Technologies (ICTs). Criteria for bibliographic research on specific topics in the country of origin.
- English language.
- Application of geographic information systems in land and water resources management.
- Pedology and soil survey investigation.

**Learning outcomes:**
Trainees should become capable of developing and implementing research protocols and conducting literature reviews. Enhancement of Language skills for application to field of studies. Acquiring advanced knowledge-base through the application of GIS in land and water resources management taking into account soil suitability on the basis of soil survey.

**Evaluation procedure: written examination**

**24 Oct – 19 Nov 2016**

**UNIT 2 – WATER AND LAND RESOURCES MANAGEMENT (8 ECTS)**

**Content:**
- Soil physics: water and solute movement.
- Surface Water Hydrology management.
- Groundwater hydraulics and pollution in agricultural settings.
- Soil erosion and desertification: monitoring, modelling and mitigation technologies.

**Learning outcomes:**
Learning how to manage land and water resources: from processing to interpretation on rainfall data and factors affecting infiltration and runoff, in
relation to soil physical characteristics, water movement in the soil and water availability, underground water flow, underground water quality and pollution, factors affecting soil erosion and desertification, monitoring, modelling and mitigation technologies, strategies of cultivated and bare land conservation.

**Evaluation procedure: written examination**

**21 Nov – 17 Dec 2016**

**UNIT 3 – IRRIGATION MANAGEMENT: SOIL-WATER-PLANT-ATMOSPHERE CONTINUUM (8 ECTS)**

**Content:**
- ✓ Agrometeorology + seminar on climate change
- ✓ Crop response to water and water use efficiency
- ✓ Crop water requirements and practical irrigation scheduling
- ✓ Crop growth modelling: Eco-physiological and Engineering aspects
- ✓ Agricultural aspects of irrigation methods "seminar"

**Learning outcomes:**
Learning how to manage irrigation in the soil-water-plant continuum starting from studying crop response to water and water use efficiency and its improvement for crop productivity with respect to growth stages and timing of stress occurrence, irrigation practice and management with related effects. Crop growth modelling through “Budget Aquacrop” in relation to climate factors and their effects on plant growth and farm production and climate change.

**Evaluation procedure: written examination**

**19 Dec 2016 – 14 Jan 2017**

**UNIT 4 – IRRIGATION MANAGEMENT AT FARM LEVEL (6 ECTS)**

**Content:**
- ✓ Design, operation, maintenance and performance evaluation of trickle irrigation systems.
- ✓ Design, operation, maintenance and performance evaluation of sprinkler irrigation systems.
- ✓ Design, operation, maintenance and performance evaluation of surface irrigation systems.

**Learning outcomes:**
Learning how to manage on-farm irrigation through design, operation, maintenance and performance evaluation, and methods to improve surface irrigation systems, by sprinkler and micro-irrigation, taking into account agricultural aspects.
Evaluation procedure: written examination and group work.

16 Jan – 4 Feb 2017

UNIT 5 – IRRIGATION MANAGEMENT AT DISTRIBUTION SYSTEMS LEVEL (6 ECTS)

Content:
✓ Design, operation, maintenance and performance evaluation of large scale open channel distribution systems.
✓ Design, operation, maintenance and performance evaluation of large scale pressurized irrigation systems.
✓ Determining soil hydraulic properties by field-measured infiltration rates “seminar”
✓ Water management optimization

Learning outcomes:
Learning how to manage irrigation of large-scale distribution systems through design, operation, maintenance and performance evaluation of open channels and pressurized irrigation systems; optimization of water management through planning and the application of dynamic management.

Evaluation procedure: written examination and group work.

6 Feb – 4 Mar 2017

UNIT 6 – USE OF NON-CONVENTIONAL WATER RESOURCES: TECHNICAL AND ENVIRONMENTAL ISSUES (8 ECTS)

Content:
✓ Salinity control in relation to irrigation.
✓ Drainage and drainage systems design and management
✓ Use of low quality waters: environmental and technical aspects
✓ Wastewater reuse in irrigation farming “seminar”
✓ Non-conventional water use “seminar”
✓ Urban wastewater treatment for agricultural reuse.

Learning outcomes:
Learning how to control salinity as related to water, climate and crop tolerance, leaching and reclamation techniques, management of unconventional waters for irrigation, study of water quality and pollution monitoring systems. Treatment of wastewater, wastewater reuse in irrigation farming. Management and design of drainage systems.

Evaluation procedure: written examination and group work.
UNIT 7 – IRRIGATION MANAGEMENT: INSTITUTIONAL, ECONOMIC AND ENVIRONMENTAL ASPECTS (8 ECTS)

Content:
- Principles of farm economics
- Optimal water allocation in irrigation sector
- Cost/Benefit Analysis
- Cost Recovery
- International economics and the role of agriculture in economic development
- Geopolitics of water in the Mediterranean and Middle east “seminar”

Learning outcomes:
Learning how to perform economic analysis and determine the economic benefits at the irrigated farm level, to perform optimal irrigation water allocation through environmental planning at farm scale, to perform cost/benefit analysis, to assess water cost recovery

Evaluation procedure: written examination and group work.

UNIT 8 – CASE STUDY – IRRIGATION PROJECT DESIGN (8 ECTS)

Content:

Learning outcomes:
The design of an irrigation project based on a case study of southern Italy will allow for applying the knowledge acquired in the previous seven sections and working in a team work. Such a work will enable to analyse and process data on climate, soil, crops, quality-oriented crop water requirements, to choose the optimal cropping system based on different simulation scenarios (water availability, quality, economic criteria, etc...). Hydraulic design of large scale distribution networks, environmental impact, cost/benefit analysis. Synthesis, conclusion.

Evaluation procedure: written examination and group work.
EXAMINATIONS

Participants take a written examination at the end of each Unit. Examinations are in the form of written exams in classroom, including problems, sets of questions, exercises or multiple choice questions.

Participants may retake failed exams once, and up to 8 ECTS credits (for full details, read the academic regulation).

For the elaboration of the irrigation project, the MAI scientific staff evaluates the group guided work as well as the individual contribution of each participant. The project is presented and defended orally during the final exam before the jury.

At the end of the course, participants take a comprehensive oral examination before an international jury.

Language of instruction: ENGLISH

ACADEMIC STAFF

In the “Master of MAIB” programme, instruction is given by MAIB internal staff and by 27 prestigious visiting professors from all over the world, coming from universities, higher institutions, international organizations and research centres.

In the Master of Science programme, student’s research theses are supervised by MAIB researchers or external professors in collaboration with MAIB staff.
Part 2 - The Master of Science Thesis

Project (60 ECTS)

The research activities of IAMB Dept. on Land and Water Resources Management cover different scales of application (from leaf - plant to watershed and region) and allow for a multilevel approach through the interaction of various aspects (agronomic, engineering and economic) at different levels of investigation: on the one hand, agricultural management practices are scaled up, from leaf to irrigation district level, which leads to the irrigation water demand of an entire district; on the other hand, this demand is translated into water released from the source and down-scaled through water management practices, from the source of water to farms and single plants.

The above activities are carried out both with L&W Dept staff and/or national-international expertise belonging to the L&W networking.

Actually, the research activities of Land and Water Division are going on through the Master of Science Program, PhD works and research projects as well.

Research activities: topics generally available for Master of Science theses:

- Water use efficiency and water productivity
- Deficit irrigation and supplemental irrigation
- Crop water requirements and irrigation scheduling
- Soil-plant-atmosphere relationships and crop growth modelling
- Saline irrigation practice and management
- Treated sewage water and its use in agriculture
- Climate variability and changes and their impacts on agriculture
- Land evaluation and Agro-ecological characterization
- Performance assessment of CIS: operational analysis and rehabilitation
- Management and design of CIS and optimization of on-farm/CIS interaction
- Water energy consumption: irrigation water supply and pumping station regulation
- Water resources management: reservoir operation and groundwater exploitation

Indicative master theses realized within the area

I.

- Title: “Optimization model for irrigation network sectoring: assessing the effect of flexibility reduction on farmers income”
✓ **Author:** Mezzane Soufiyan, rural engineering, Morocco (2015)  
✓ **Place of realization:** MAI-Bari, Italy  
✓ **Thesis directors:** R. Khadra, A. Scardigno & N. Lamaddalena

II.  
✓ **Title:** “Modeling the spatial distribution of evaptranspirantion of main crops in the Apulia region using dual crop coefficient approach”  
✓ **Author:** Assif El Mahdi, rural engineering, Morocco (2015)  
✓ **Place of realization:** MAI-Bari, Italy  
✓ **Thesis directors:** L. S. Pereira & D. D’Agostino

III.  
✓ **Title:** “Application of ground based remote sensing techniques to evaluate physiological and biometric variables of potato (*Solanum tuberosum* L.) grown under different water treatments”  
✓ **Author:** Imen Ben Charfi, Agricultural Engineer, Tunisia (2014)  
✓ **Place of realization:** MAI-Bari, Italy  
✓ **Thesis directors:** R. Albrizio & M. Todorovic

IV.  
✓ **Title:** “Interactive effects of nitrogen and calcium on growth and yield of sweet corn (*Zea mays sacharata*) under saline conditions”  
✓ **Author:** Mina Tissoudal, Agricultural Engineer, Morocco (2014)  
✓ **Place of realization:** IAV Agadir, Morocco  
✓ **Thesis directors:** R. Choukr Allah & A. Hamdy

V.  
✓ **Title:** “Performance analysis of looped pressurized irrigation distribution networks”  
✓ **Author:** Fouial Abdelouahid, Agricultural Engineer, Algeria (2013)  
✓ **Place of realization:** MAI-Bari, Italy  
✓ **Thesis director:** N. Lamaddalena

VI.  
✓ **Title:** “Low cost and sustainable green bean soilless production in greenhouse using closed cycle sub irrigation”  
✓ **Author:** Bouchaaba Zakaria, Agricultural Engineer, Morocco (2013)  
✓ **Place of realization:** MAI-Bari, Italy  
✓ **Thesis directors:** F. Montesano & R. Choukr Allah
VII.

✓ **Title:** “Application of proximate sensing techniques to evaluate physiological and biometric parameters of potato (*Solanum tuberosum* L.) under different water regimes”
✓ **Author:** Hammaoui Aicha, Agricultural Engineer, Morocco (2013)
✓ **Place of realization:** MAI-Bari, Italy
✓ **Thesis directors:** R. Albrizio & M. Todorovic

VIII.

✓ **Title:** “Assessing the impact of climate change on water productivity in the Mediterranean agriculture”
✓ **Author:** Saadi Sameh, Agricultural Engineer, Tunisia (2012)
✓ **Place of realization:** MAI-Bari, Italy
✓ **Thesis directors:** L. S. Pereira & M. Todorovic

IX.

✓ **Title:** “Quinoa and chickpea response to salinity stress”
✓ **Author:** Jelloul Ahmed, Agricultural Engineer, Morocco (2012)
✓ **Place of realization:** IAV Agadir, Morocco
✓ **Thesis directors:** R. Choukr Allah, & A. Hamdy

Further detailed information is available at http://www.iamb.it