



MSc in Natural Resources Management for Tropical Rural Development

academic years 2015 - 2017 | Cycle 2

www.iao.florence.it/landwater

www.tropicalruraldevelopment.unifi.it



Istituto
Agronomico
per l'Oltremare

Technical-scientific body of the Ministry of Foreign Affairs and International Cooperation



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DISPAA

Istituto Agronomico per l’Oltremare
Ministry of Foreign Affairs and International Cooperation

School of Agriculture
University of Florence

Master of Science in
“NATURAL RESOURCES MANAGEMENT
FOR TROPICAL RURAL DEVELOPMENT”

Academic Years 2015-2017

TABLE OF CONTENTS

1	ORIGINS AND GENERAL INFORMATION	4
2	MSc STRUCTURE	7
3	COURSES.....	10
4	ELECTIVE COURSES	18
5	TEACHING STAFF	19

MSc in Natural Resources Management for Tropical Rural Development

ORIGINS AND GENERAL INFORMATION

1.1 ISTITUTO AGRONOMICICO PER L'OLTREMARE

The *Istituto Agronomico per l'Oltremare* (IAO) is a technical-scientific body of the Ministry of Foreign Affairs and International Cooperation in the field of agricultural science and technology.

The Institute was established in 1904 in Florence by Italian agronomists. Originally known as the *Istituto Agricolo Coloniale Italiano* (Italian Colonial Institute), its aim was to promote the study and systematization of the tropical environment and agriculture and to implement education and training of technicians and migrants in the agricultural field.

The Institute was very active in the years between the two World Wars: the technicians used to study the agricultural and economic issues of Italian colonies and train agronomists in charge of the economic valorization of the colonies and other regions. In 1938 the Institute changed its name, becoming the *Istituto Agronomico per l'Africa Italiana*. After the Second World War, the Institute shifted its focus to the technical assistance to the Italians migrating to Latin America on agricultural topics. In 1959 the Institute adopted its current name and was assigned to the Ministry of Foreign Affairs.

1.2 UNIVERSITY OF FLORENCE

The University of Florence can trace its origins to the *Studium*, which was established in 1321. In 1472 the *Studium* was moved to Pisa. In 1859 the University re-emerged as Istituto di Studi Superiori (Institute of Higher Education). In 1923 it was established as a public university and started its activities as a fully-fledged university.

The University of Florence is one of the largest organizations for research and higher education in Italy, with over 1900 teaching staff and researchers, over 1600 permanent technical/administrative staff and language assistants and over 55 thousand students enrolled.

MSc in Natural Resources Management for Tropical Rural Development

The University comprises 10 Schools: Agriculture, Architecture, Economics, Education and Humanities, Engineering, Law, Human Health Sciences, Mathematics, Physics and Natural Sciences, Political Science, Psychology. Scientific research is carried out in the 24 Departments of the University, grouped into 5 major areas: Social Sciences, Humanities, Scientific, Technological and Biomedical areas.

1.3 MSc in “NATURAL RESOURCES MANAGEMENT FOR TROPICAL RURAL DEVELOPMENT”

The MSc in Natural Resources Management for Tropical Rural Development has been designed by the School of Agriculture of the University of Florence and IAO in order to harmonize the experiences of three previous training programs, and to develop them further.

These programs included the Professional Master courses in “Geomatics and Natural Resources Evaluation and in Irrigation Problems in Developing Countries” and the MSc in “Tropical Rural Development, offered by the School of Agriculture.

- The Professional Master in Geomatics and Natural Resources Evaluation, which reached its edition no. 33 in academic year 2013-2014, used to be organized by IAO in collaboration with the Department of Agronomic Food Production and Environment of the School of Agriculture (DISPAA). The first edition of the Master was held in 1974. The Master has always featured a strong focus on field research and hands-on experience, mainly thanks to intensive fieldwork sessions carried out in Italy and abroad (Eritrea, Bolivia, Tunisia, Morocco, Senegal, China and Ethiopia). In 2002, with the birth of Geographic Information Systems (GIS), the contents of the course were updated and the Master was called Geomatics and Natural Resources Evaluation.
- The Professional Master in Irrigation Problems in Developing Countries, organized by IAO in collaboration with the Department of Agricultural, Food and Forestry Systems of the School of Agriculture



MSc in Natural Resources Management for Tropical Rural Development

(GESAAF), saw the participation of students from several countries of sub-Saharan Africa since its very first edition in 2006. The aim of the program was to train technicians and operators from developing countries in the fields of irrigation and water management.

- The MSc in Tropical Rural Development, offered by the School of Agriculture, also thanks to the close partnership with IAO, has trained students for many years and it has been the only graduate program in tropical agriculture and engineering available in Italian universities. The collaboration between the two institutions intensified in the second half of the 1900s, and in 1972 the Faculty of Agriculture founded the School of Specialization in Tropical and Subtropical Agriculture. In 1980, this School was transformed into an undergraduate degree course (4 years, Italian old system). In academic year 2002-03 the course was reorganized in a Bachelor Degree (BSc, 3 years) and a Master's Degree (MSc, 2 years).

The MSc in Natural Resources Management for tropical Rural Development of the University of Florence, promotes research and professional training in the sectors of modern and sustainable agriculture, natural resources management and animal sciences, and identifies as preferential areas of intervention the little and medium farms of the less industrialized regions of the globe. The mission of the MSc is the education and training of experts in the technical and scientific areas of food production, environmental conservation and rural development, in order to improve food and water security, conservation of biological and cultural diversity and valorization of local tradition.

MSc in Natural Resources Management for Tropical Rural Development

2 MSc STRUCTURE

The MSc in Natural Resources Management for Tropical Rural Development is a 2-year program, which awards a Second Level Master Degree according to the Italian higher education system: www.miur.it/guida/capitolo3.htm.

Students must acquire a total of 120 academic credits (CFU), organized as follows:

Activity	CFU
Classwork (lectures and laboratoires)	93
Dissertation	27
Total CFU	120

The degree includes a first, common year and a second year with two different *curricula*: **Agricultural Production** and **Land and Water**.

Total number of courses: 11 + 2 elective courses and Laboratory.

Dissertation: experimental thesis with fieldwork.

MSc in Natural Resources Management for Tropical Rural Development

FIRST YEAR		
Course	CFU	Professor
First semester		
Crop protection	6	Antonio Belcari and Laura Mugnai
On farm irrigation	6	Graziano Ghinassi and Paolo Enrico Sertoli
Agroclimatology	6	Marco Bindi
Agricultural geomatics	9	Luca Ongaro
Second semester		
Farming system analysis	6	Caterina Contini
Tropical crops	9	Andrea Pardini, Enrico Palchetti and Edgardo Giordani
Tropical plant ecology [only for "Agricultural Production" <i>curriculum</i>]	6	Lorenzo Orioli
Irrigation with non conventional waters [only for "Land and Water" <i>curriculum</i>]		Elena Bresci
Elective Course	6	
Total	54	

MSc in Natural Resources Management for Tropical Rural Development

SECOND YEAR - "AGRICULTURAL PRODUCTION" CURRICULUM		
Course	CFU	Professor
First semester		
Rangeland management	6	Andrea Pardini
Livestock production systems	6	Andrea Martini and Riccardo Bozzi
Plant breeding	6	Stefano Benedettelli
Machinery systems in the tropical agri- food chain	6	Francesco Garbati Pegna
Second semester		
Laboratory (GIS applications)	9	Enrico Palchetti and Paolo Trucchi
Elective Course	6	
Dissertation	27	
Total	66	
SECOND YEAR - "LAND AND WATER" CURRICULUM		
First semester		
Information technology in irrigation	6	Ivan Solinas
Water resources evaluation and management	6	Elena Bresci
Land evaluation	6	Gaio Cesare Pacini and Roberto Ferrise
Agronomy and soil management	6	Simone Orlandini and Anna Dalla Marta
Second semester		
Laboratory (GIS applications)	9	Enrico Palchetti and Paolo Trucchi
Elective Course	6	
Dissertation	27	
Total	66	

MSc in Natural Resources Management for Tropical Rural Development

3 COURSES

3.1 FIRST YEAR

AGRICULTURAL GEOMATICS

Luca Ongaro

- Elements of ICT: Introduction, data types; operating systems. Open source software, history and background. Hardware and networks, CPU, disks, graphics. The Internet.
- Elements of geodesy and cartography: Ellipsoid and geoid, datums, projections. The GPS. Mapping: topographic and thematic maps. Map generalization and design.
- Elements of remote sensing: Principles, physics and technology. Characteristics and use of aerial photos. Satellite data, platforms and sensors, data providers. Image Processing.
- Elements of GIS: Vector and raster, file formats. Georeferencing, interpolation procedures. Digital Elevation Models. Attribute query and spatial query. Spatial analysis, overview of common geoprocessing tools. Map composition.
- Putting all together: Visual image interpretation, integration of data sources, natural resources evaluation.

AGROCLIMATOLOGY

Marco Bindi

- Climatology and Meteorology: mechanisms that determinate weather conditions and climate regimes.
- Agro-climatology: Agro-climatological parameters and their measurement, acquisition and transmission, availability and quality control.
- Description of the main relationships between climate and weather and agricultural crops and animals.



MSc in Natural Resources Management for Tropical Rural Development

Seminars on:

- Crop simulation models: Introduction to modelling in agriculture;
- Weather Forecasting: an instrument to monitor and predict crop yields;
- Climate change: impacts of climate change in agriculture, adaptation and mitigation strategies.

CROP PROTECTION

Antonio Belcari and Laura Mugnai

- General plant pathology: basic knowledge of plant pathology, of the biology and epidemiology of the main disease agents.
- Disease control methods for an integrated management of the tropical agrosystems.
- Clinical diagnosis of the diseased plant. Interpretation of the symptoms.
- Case studies in tropical plant pathology: main diseases caused by oomycetes, fungi, bacteria, viruses and viroids and phytoplasmas.
- Invasive species and mycotoxins.
- Ecology and diversity of insects in tropical areas.
- Ecology, biology and control of the most important Arthropods pests in tropical systems including mites.
- Main groups of Hemiptera, Coleoptera damageous to tropical crops.
- A detailed case study of ethological series of Lepidoptera: Cutworms, Stalk Borers, Bollworms, Armyworms. Studies on Fruit Flies (Diptera) and their control.

FARMING SYSTEMS ANALYSIS

Caterina Contini

- Aims and principles of the Farming System approach.
- Participatory approach (aims, principles and techniques).
- Household analysis.



MSc in Natural Resources Management for Tropical Rural Development

- An outline of multi-criteria decision analysis.
- Cost benefit analysis.
- Project cycle management (programming, identification, formulation, implementation, evaluation and audit).
The logical framework approach (overview, analysis and planning stage).

IRRIGATION WITH NON CONVENTIONAL WATERS

“Land and Water” curriculum

Elena Bresci

- Water availability for irrigation.
- Use of non-conventional water (saline water, wastewater, agricultural drainage water) for irrigation.
- Long term effects on soil, crops and livestock of using non-conventional water.
- Assessing the suitability of non-conventional water for irrigation.
- Changes in irrigation practices and management (irrigation scheduling, irrigation interval, irrigation method, leaching management for salinity control).
- Management of the multi-quality water resources using non-conventional water.

ON FARM IRRIGATION

Graziano Ghinassi and Paolo Enrico Sertoli

- Principles of irrigation: soils, water quality, crops, climate, crop water requirements, water balance.
- Basic hydraulics.
- Selection, design and operation of irrigation systems.
- Maintenance and evaluation; benchmarks and performance indicators.
- On-farm conveyance schemes.
- Analysis of case studies in different climatic conditions: problems and solutions.



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- After identification of main problems, formulation of a possible intervention using the PCM approach.

TROPICAL CROPS

Andrea Pardini, Enrico Palchetti and Edgardo Giordani

- Main tropical species including lost or minor crops: cereals, grain legumes, protein and oil species, tuber-root species, sugar cane, papaya, other industrial plants.
- Renewable energy from plants.
- Main tropical-subtropical species.
- The evolution of tropical tree crops; productive aspects, marketing and related problems.
- Origin, diffusion, morphology and physiology, genetic resources, cultivars, propagation and orchard management of some tropical fruit tree species.

TROPICAL PLANT ECOLOGY

“Agricultural Production” curriculum

Lorenzo Orioli

- Basic concepts of ecology (ecosystems, communities and populations, matter circulation, energy flow, information flow, primary and secondary productivity, competition for space and resources).
- Ecology of deserts
- Ecology of African and Neotropical Savannas
- Ecology of forests: evergreen rain forests, semi-deciduous forests and deciduous forests
- Ecology of successional dynamics in tropical forests.



MSc in Natural Resources Management for Tropical Rural Development

3.2 SECOND YEAR

"Agricultural Production" curriculum

LABORATORY

Enrico Palchetti and Paolo Trucchi (coordinators)

- GIS applications to land and water management.

LIVESTOCK PRODUCTION SYSTEMS

Andrea Martini and Riccardo Bozzi

- Tropical climates and environments.
- Animal bioclimatology. Animal nutrition and feeding. Hygiene and animal health and welfare. Management of animal genetic resources.
- General information, breeds, reproduction and production systems in the tropics of: dairy cattle, beef cattle, old world and new world camels, sheep, goats, swine and poultry.

MACHINERY SYSTEMS IN THE TROPICAL AGRI-FOOD CHAIN

Francesco Garbati Pegna

- Introduction to tropical agricultural mechanization.
- Energy and power in agriculture.
- Sources of power: human, animal, engines. Machinery for agricultural operations, post-harvest and processing.
- Examples of processing categories for tropical products (milling of grains, fermentation of juices, fruits or vegetables, heating, roasting or boiling of fruits and vegetables, oil extraction from fruits and nuts).
- Examples of mechanization of tropical agricultural chains: staple and cash products (rice, cassava, cocoa, dates, etc.).



MSc in Natural Resources Management for Tropical Rural Development

PLANT BREEDING

Stefano Benedettelli

- Population genetics and basic statistics. Genetic and environmental components of the phenotype. Variance of phenotype and different components.
- Crossing schemes to study genetic and environmental components. Calculation of the hereditary coefficients. Response to selection. The attainment of homogenous lines. Selection schemes. Varietal constitution. Assisted selection methods. Genetic markers.
- Evaluation of local genetic resources, plant breeding and local farmer participation in genetic improvement. Selection and choice of seeds. Methods and equipment for the cleaning and preparation of seeds.

RANGELAND MANAGEMENT

Andrea Pardini

- Distribution and productivity of rangeland and pastures in different climate areas.
- Rangeland analysis: productivity, botanical composition.
- Rangeland/Pasture carrying capacity and livestock stocking rate.
- Grazing effects on the vegetation, grazing methodologies.
- Improvements for rangelands and pastures.

MSc in Natural Resources Management for Tropical Rural Development

“Land and Water” curriculum

AGRONOMY AND SOIL MANAGEMENT

Simone Orlandini and Anna Dalla Marta

- Basic concepts of agronomy, agro-ecosystems, soil fertility, analysis and modelling tools.
- Soil physical, chemical and biological properties, agro-meteorological variables. Sensors and monitoring techniques for environmental characterisation.
- Water erosion, soil conservation, land setting and drainage.
- Water-soil-plant relationships, water balance and management.
- Soil tillage, zero and minimum tillage.
- Organic matter and mineral fertilization.
- Cropping systems and rotations, weeds and their control.

INFORMATION TECHNOLOGY IN IRRIGATION

Ivan Solinas

- Learn and practice some of the most important software in design and management of irrigation systems:
 - Drip irrigation system design (VeProLGs);
 - Sprinklers irrigation system design (Epanet);
 - Hydraulic Properties Calculator (Soil Water Characteristics);
 - Soil Map of the World (Harmonized World Soil Database);
 - Local climate estimator (Climwat);
 - Local climate estimator (NewLocClim);
 - Crop water requirements calculator (Cropwat);
 - Hydraulic analysis tool for surface irrigation systems (WinSRFR 4.1).



MSc in Natural Resources Management for Tropical Rural Development

LABORATORY

Enrico Palchetti and Paolo Trucchi (coordinators)

- GIS applications to land and water management.

LAND EVALUATION

Gaio Cesare Pacini and Roberto Ferrise

- The FAO Framework for Land Evaluation.
- Agro-Ecological Zoning.
- Applications to Agriculture.
- Basic concepts of sustainability science.
- Farming systems evaluation.
- Ecological and sustainable intensification approaches.
- Evaluation of land use options for world agriculture.

WATER RESOURCES EVALUATION AND MANAGEMENT

Elena Bresci

- Water resources evaluation and exploitation.
- Water supply from flowing water.
- Methods with direct intake and with reservoir.
- Types of reservoir.
- Water supply from subsurface water.
- Wells. Rainwater harvesting.
- Water quality management and influence on the potential exploitation.

MSc in Natural Resources Management for Tropical Rural Development

4 ELECTIVE COURSES

Students can choose 12 academic credits (6 in the first year and 6 in the second year) in order to complete the curriculum of studies. Academic credits can be awarded by the School of Agriculture or other Schools of the University of Florence.

Up to a maximum of 6 elective credits can be awarded also through an internship of 150 working hours with other institutions or organizations; in this case, a specific convention must be agreed and signed by the hosting organization and the University of Florence.

MSc in Natural Resources Management for Tropical Rural Development

5 TEACHING STAFF

Antonio
BELCARI



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 Current position
 Main activities and
 responsibilities
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University of Florence
 Full Professor
 Dipterans taxonomy and morphology, insect
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Stefano
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MSc in Natural Resources Management for Tropical Rural Development

Riccardo
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Caterina
CONTINI



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MSc in Natural Resources Management for Tropical Rural Development

Anna
DALLA MARTA



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Roberto
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Edgardo
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MSc in Natural Resources Management for Tropical Rural Development

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Laura
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MSc in Natural Resources Management for Tropical Rural Development

Luca
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Lorenzo
ORIOLO



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Istituto Agronomico per l'Oltremare, Florence
 Technical Officer
 Agronomist in development projects in Africa,
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Simone
ORLANDINI



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 Agrometeorology, climatology, agronomy, modelling
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MSc in Natural Resources Management for Tropical Rural Development

Gaio Cesare
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Enrico
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Research on tropical field crops, biofuels and
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Andrea
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MSc in Natural Resources Management for Tropical Rural Development

Paolo Enrico
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Istituto Agronomico per l'Oltremare
Technical Officer

Water resources management, irrigation methods and
water productivity, tropical agriculture production;
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Ivan
SOLINAS



Body or Institution
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Pienocampo (professional association)

Founding partner, professional agronomist

Irrigation systems design, irrigation software design

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Paolo
TRUCCHI



Body or Institution
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University of Florence

Associate Professor

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